

Running title: SELF-EFFICACY & SMOKING CESSATION

Indicators of Cessation Outcome for Treatment-Seeking Smokers With and Without a Lifetime
Diagnosis of Mental illness: The Impact of Cessation Self-Efficacy

Matthew Clyde, MSc

A thesis submitted in partial fulfillment of the requirements for the PhD program in Clinical
Psychology at the University of Ottawa

© Matthew Clyde, Ottawa, Canada, 2019

Acknowledgements

I am indebted to a great number of people who have supported me throughout my academic career. First and foremost, I am deeply grateful to my supervisor Dr. Heather Tulloch for her willingness to take a chance on me as her first graduate student. Throughout my PhD, Heather has been a constant source of support and encouragement, helping me by providing so many wonderful opportunities which has allowed me to fully develop as a science-practitioner in Clinical Psychology. I would also like to express my gratitude for the co-investigators of the *FLEX trial*, including Dr. Bob Reid, Dr. Andrew Pipe and Dr. Charl Els. All were incredibly helpful in offering their insights and suggestions for the articles which form the basis of this dissertation, and I am thankful for their support and encouragement to continue writing and publishing over the years. A special thanks to Bob Reid who also graciously offered to serve on my dissertation committee, and to my other committee members, including Dr. Elizabeth Kristjansson and Dr. Tim Aubry for their thoughtful comments and support throughout . A very special mention to Dwayne Schindler at the University of Ottawa for his support and expertise in statistical methods and the countless meetings and consulting over the past several years! I would also like to briefly mention Dr. Norbert Schmitz, my thesis supervisor for my masters, who gave me a chance to become involved in research and academia and helped mentor me in my early career. A big thank you goes to my fiancé and partner Shuo, who has supported me throughout my PhD and the 300 odd kilometers that separated us each week. Finally, I would not be at this point without my family, who have always believed in me to achieve whatever it is I set out to do since day one. Thank you for your love and support, I would not have made it this far without it!

Abstract

Smoking remains a leading cause of disability and mortality worldwide. Despite declining rates of smoking in developed countries, smoking prevalence remains high, and there is evidence that it has plateaued in recent years. Individuals with a comorbid psychiatric diagnosis represent a disproportionate percentage of those who continue to smoke and are particularly at-risk given they smoke at higher rates and consume more cigarettes compared to those with no diagnosis. Moreover, these individuals are often excluded from clinical trials of smoking cessation, making it difficult to generalize results of previous intervention studies. In the general literature of smoking cessation, smoking cessation self-efficacy, or one's confidence in their ability to abstain from smoking, is a consistent predictor of positive abstinence outcomes. The overall purpose of this dissertation was to investigate smoking cessation self-efficacy as a predictor of abstinence outcomes in a population of treatment-seeking smokers with and without a history of psychiatric illness. To accomplish this, articles 1 and 2 investigated the psychometric properties of a multi-item measure of cessation self-efficacy. This entailed comparing the measure to other indices of smoking, and conducting a confirmatory factor analysis to ensure factor invariance and equivalence of the measure regardless of psychiatric status. We found a moderate correlation between our multi-item scale to a single-item measure of confidence to quit, as well as support for both the original two-factor model as well as a three-factor model, which explained 79.3% of the variance. Our results also supported the measure as being factor invariant across psychiatric diagnoses. Next, articles 3 and 4 investigated how this measure of cessation self-efficacy predicted several smoking outcomes (10-, 22- and 52-weeks following target-quit date), and whether this relationship was mediated by concurrent smoking and other interpersonal-indices of smoking cessation (nicotine withdrawal, negative affect). In article 3, we

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

found support for a bidirectional and reciprocal relationship between smoking cessation self-efficacy and smoking status. While changes in concurrent behavior (smoking or abstinent) did impact subsequent evaluations of self-efficacy, the inverse was also true. Moreover, both concurrent smoking and cessation self-efficacy predicted outcomes at week 10. Article 4 built on this framework and investigated this relationship at 22- and 52-weeks post-target quit-date. Our results highlight the robust association between cessation self-efficacy and abstinence. Higher cessation self-efficacy was positively associated with better abstinence outcomes, even after controlling for concurrent smoking, withdrawal, and negative affect. Further, there was evidence that cessation self-efficacy partially mediated the impact of withdrawal and negative affect. In our fully adjusted model (adjusting for demographic characteristics, baseline smoking levels, withdrawal and negative affect), cessation self-efficacy along among the interpersonal-determinants predicted abstinence outcomes (Odds ratio = 1.078, 95% confidence interval (1.068 - 1.089)). This was true for those with either a current, past, or no lifetime psychiatric diagnosis, and despite the finding that individuals in the lifetime (current or past diagnosis) category experienced overall lower self-efficacy. Overall, our results support the value of cessation self-efficacy as an important indicator of abstinence outcomes, and particularly highlight its potential utility for at-risk populations of comorbid psychiatric smokers.

Table of Contents

Acknowledgements ii

Abstract iii

 Introduction 1

 Interventions for Smoking Cessation 1

 Limitations in smoking cessation literature: Disadvantaged populations 3

 Association between smoking and mental illness 4

 General determinants of smoking cessation 5

 Self-efficacy: A brief primer and definition 7

 Sources of self-efficacy 9

 Measurement considerations for self-efficacy 11

 Self-efficacy and health behaviour change 12

 Smoking Cessation Self-Efficacy: Definition and Limitations 14

 Cessation Self-Efficacy and Mental Illness 17

 Measurement limitations for cessation self-efficacy in psychiatric smokers 19

 Study design and Purpose 21

 Specific Research Aims and Hypotheses 24

 References 26

Dissertation Article 1: Task and barrier self-efficacy amongst treatment-seeking smokers with current, past or no psychiatric diagnosis 42

 Title page 43

 Abstract 44

 Introduction 45

 Methods 48

 Measures 49

 Statistical Analyses 50

 Results 51

 Discussion 52

 References 58

 Table 1 – Demographic variables by psychiatric categories 65

 Table 2 - Smoking variables by psychiatric categories 66

 Table 3 Percentage responding ‘Not confident’ for SEQ-12 items by Psychiatric Diagnosis 67

 Table 4 - Correlations by psychiatric diagnosis 68

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

Dissertation Article 2: Factor structure of the Smoking Cessation Self-Efficacy Questionnaire among smokers with and without a psychiatric diagnosis.....	69
Title page.....	70
Abstract.....	71
Introduction	72
Methods.....	74
Participants	75
Measures.....	76
Statistical Analyses.....	77
Results.....	78
Discussion.....	82
REFERENCES.....	88
Table 1 - Demographic and smoking related variables by psychiatric status.....	93
Table 2 - Factor loading from EFA.....	94
Table 3 - Fit indices for 3 CFA models	95
Table 4 - SEQ-12 scores and week 10 abstinence.....	96
Figure 1 – Path model of CFA.....	97
Dissertation Article 3: A Bidirectional Path Analysis Model of Smoking Cessation Self-efficacy and Concurrent Smoking Status: Impact on Abstinence Outcomes	98
Title page.....	99
Abstract.....	100
Introduction	102
Methods.....	105
Participants	105
Procedure.....	106
Measures.....	106
Statistical Analyses.....	107
Results.....	109
Discussion.....	111
REFERENCES.....	117
Table 1 - Demographic and smoking related variables by week 10 smoking status	123
Table 2 - Logistic Regression week 10 abstinence	124
Figure 1 – Structural Measurement (Manifest) model of Smoking Cessation Self-Efficacy and Expired-CO (standardized co-efficients).....	125

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

Figure Two – Structural Causal Path-Model of Smoking Cessation Self-Efficacy, Expired-CO and smoking status at Week 10 (outcome: abstinence)	126
Dissertation Article 4: Interpersonal Determinants of Smoking Cessation in Treatment-Seeking Smokers With and Without Psychiatric illness: A Population and Cross-lagged Analysis.....	127
Title page.....	128
Abstract.....	129
INTRODUCTION.....	131
Methods.....	134
Eligibility and Screening	135
Procedures	135
Measures.....	136
Statistical Analyses.....	138
Results.....	140
Discussion.....	143
References	149
Table 1 – Demographic Variables by psychiatric categories.....	163
Table 2 – Mean Scores for interpersonal-determinants by week	164
Table 3 – GEE Logistic Regression stratified by Psychiatric Category	165
Table 4 – Overall sample GEE with interaction effects.....	166
Figure 1 – All Significant pathways paths for interpersonal-factors onto week 22 abstinence (overall population).....	167
Figure 2 – Significant pathways only for interpersonal-factors onto week 52 abstinence (overall population).....	168
Part 3 – Discussion	169
Strengths of the studies.....	174
Implications for theory and practice.....	177
Theoretical implications: self-efficacy as a cause or reflecting behaviour?	179
Theoretical implication: Self-efficacy psychological processes and relapse models.....	181
Practical implications: cessation self-efficacy measurement variability	182
Practical and clinical implications for relapse prevention	187
Limitations	190
Future directions.....	194
Conclusion.....	196
References	198

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

Appendices..... 212
Appendix 1 - Consort diagram for the *FLEX* trial..... 213
Appendix 2 - Timeline for measurements of the FLEX trial 214
Appendix 3 - Consent Form 215

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

Introduction

Smoking remains a leading cause of morbidity and mortality, aptly described as a global health epidemic by the World Health Organization (WHO; World Health Organization, 2013c). As the primary cause of preventable death in both the United States (Danaei et al., 2009) and Canada (Baliunas et al., 2007), tobacco is projected to account for approximately 8 million annual deaths worldwide by the year 2030 should smoking rates remain constant (Mathers & Loncar, 2006). Indeed, it is the single most important modifiable behavioural risk factor for prevention of disability and premature death worldwide (Health & Services, 2004; Organization, 2011). Economically, smoking and smoking-related conditions account for nearly 15% of all health-care expenditures in Western countries (Ekpu & Brown, 2015). It costs the Canadian healthcare system approximately 17 billion annually in both direct and indirect costs (Reid, Hammond, Rynard, & Burkhalter, 2014). In addition to the medical and economic burden brought on by continued smoking, smoking is the leading cause for poor health-related quality of life (McClave, Dube, Strine, & Mokdad, 2009) and disability (Schmitz, Kruse, & Kugler, 2007), significantly negatively impacting the day-to-day function of millions of people worldwide. Concerted efforts have led to a significant decrease in smoking prevalence in the past two decades, thanks in large part to the growing body of research on smoking's negative impact on health (Surgeon General Report, 2014), addictive properties (Benowitz, 2010), and on interventions aimed at helping smokers become tobacco free.

Interventions for Smoking Cessation

While only 5% of those trying to quit unaided (e.g., cold-turkey) are successful, peer-reviewed publications have demonstrated that abstinence success rates can be improved 2-3-fold through the use of a variety of cessation interventions (Hughes, Keely, & Naud, 2004).

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

Interventions can be split into two general classes: pharmacological (Cahill, Stevens, Perera, & Lancaster, 2013) and behavioural (Lancaster & Stead, 2017), with several modalities proving effective. Pharmacological interventions focus on the physiological symptoms associated with nicotine addiction, such as nicotine dependence, symptoms of withdrawal, and those with affective qualities (Benowitz, 2010). Within this class of intervention, nicotine replacement therapy (NRT), Varenicline, and Bupropion have been the most widely used and studied. The first line treatment has been the use of NRT (Stead, Perera, Bullen, Mant, & Lancaster, 2008). NRT aims to regulate nicotine levels once smoking has stopped to mitigate the impact of symptoms of withdrawal. Several delivery methods exist, including transdermal patch, nicotine gum, and inhaler. The pharmacotherapeutic agent Varenicline is a partial agonist for a subclass of nicotine receptors, helping to mitigate not only symptoms of withdrawal and craving, but also working to block the reinforcing effect of smoking (Tonstad & Rollema, 2010). Bupropion is another non-nicotine pharmacological preparation that has been shown to be effective for smoking cessation, and this antidepressant displays comparative quit-rates to NRT (Hughes, Stead, & Lancaster, 2007).

In contrast to pharmacologic interventions, behavioural interventions focus primarily on interpersonal and cognitive factors (Brown, Lejuez, Kahler, Strong, & Zvolensky, 2005), as well as the relationship between the factors and environmental cues (Janes et al., 2010). These interventions are heterogeneous in their type and delivery, with demonstrated effectiveness of individual (Lancaster & Stead, 2017) and group (Stead, Carroll, & Lancaster, 2000) counselling, the use of self-help materials (Lancaster & Stead, 2005) and social support accessed either in person, by telephone (Stead, Hartmann-Boyce, Perera, & Lancaster, 2013), online (Shahab & McEwen, 2009), or through mobile applications (Whittaker, McRobbie, Bullen, Rodgers, & Gu,

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

2016). Unsurprisingly, given what we now know about the overlap of biological, cognitive, social, and environmental influences of nicotine addiction and dependence (Benowitz, 2010), meta-analyses have concluded that the most effective interventions are those which offer a combination of both pharmacotherapy and behavioural treatments (Stead, Koilpillai, Fanshawe, & Lancaster, 2016).

Limitations in smoking cessation literature: Disadvantaged populations

As a result of these interventions and public health efforts such as knowledge dissemination regarding the dangers of smoking (Health & Services, 2004), changes to social acceptability (Friend & Levy, 2002) and associated laws of tobacco use (Goel & Nelson, 2006), prevalence rates in most developed countries have fallen dramatically over the past 3 decades. Despite this, approximately 1 in 5 Canadians continue to smoke (Reid et al., 2014), and prevalence rates have plateaued for the past several years. Population-level surveys have shed light on the characteristics of these remaining smokers. There remains a disproportionate level of smoking amongst several disadvantaged populations (Thomas et al., 2008), highlighting the fact that these at-risk individuals have not benefitted as much from current health initiatives and interventions (Lawlor, Frankel, Shaw, Ebrahim, & Smith, 2003). Among these individuals, the largest subsample remains smokers with a psychiatric illness, who were the focus of a recent issue of the *Journal of the American Medical Association* (Cook et al., 2014). The authors reported that smoking prevalence rates were virtually unchanged (25.3% to 24.9%) for this at-risk group during the 7 years of the study (2004-2011), a striking finding given the previously noted impressive declines in overall smoking in those with no mental disorder during the same timeframe (19.2% to 16.5%). Previous research has noted that these individuals smoke at rates 2-3 times greater than the general population, consuming nearly 50% of all cigarettes purchased in

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

North America annually (Lasser et al., 2000). Given that this population has a life expectancy nearly 20 years shorter than those in the general population, these elevated prevalence and consumption rates are alarming (Thornicroft, 2011). Given that smoking remains the leading cause of disability and is a major risk factor for numerous non-communicable diseases (e.g., cancer, diabetes), these individuals are threatened by potentially greater health- and economic-related stressors, further impacting their already impaired quality of life (Morbidity and Mortality Weekly Report, 2013). Aiding these individuals to achieve abstinence is therefore imperative; unfortunately, numerous road-blocks exist, and we are only now beginning to understand the full scope of the association between cigarette use and mental illness.

Association between smoking and mental illness

A large body of research has served to establish an important bi-directional association between smoking and mental illness (Lawrence, Mitrou, & Zubrick, 2009; McClave, McKnight-Eily, Davis, & Dube, 2010; Ziedonis et al., 2008). While the exact mechanism underlying these findings remains elusive, research has proposed several potential explanations. These include a shared genetic vulnerability (Kendler et al., 1993; Lyons et al., 2008), nicotine's ability to mimic the effects of anti-depressants (Laje, Berman, & Glassman, 2001), which is in line with the self-medication hypothesis (Chaiton, Cohen, O'Loughlin, & Rehm, 2010; Minnix, Blalock, Marani, Prokhorov, & Cinciripini, 2011; Morrell, Cohen, & McChargue, 2010). Evidence also suggests that individuals with a mental illness hold more positive beliefs about smoking, which may influence their decision to take up the behaviour while also impacting their quit experiences (Weinberger, Desai, & McKee, 2010). What is clear from these epidemiological reports, however, is that several important limitations exist in the literature. The most important limitation to date remains the continued exclusion of smokers with psychiatric illness from large

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

scale trials of smoking cessation (see reviews by Aubin, Rollema, Svensson, & Winterer, 2012; Hitsman, Moss, Montoya, & George, 2009), with only a handful of major trials to-date allowing for open recruitment of these individuals (Anthenelli et al., 2016; Tulloch, Pipe, Els, Clyde, & Reid, 2016). The effect of this systematic exclusion has been a reduced ability to generalize the results and accurately gauge any potential benefit of smoking cessation interventions for this population. For studies which do include psychiatric populations, other limitations are evident, such as their restrictive inclusion criteria of specific sub-populations only. Examples include research focusing on psychiatric inpatients only (Baker et al., 2006; McClure et al., 2010) or those with specific diagnoses (e.g., major depression, anxiety, or schizophrenia (Robert M. Anthenelli et al., 2013; Cerimele & Durango, 2012; Evins et al., 2014; Haug et al., 2005; Piper, Cook, Schlam, Jorenby, & Baker, 2010). In reports that do include heterogeneous psychiatric populations, or which compare to those with no mental health concerns, classifications for mental health disorders rely on self-report questionnaires and symptom checklists as the only means of diagnosis (Burgess et al., 2002; Figueiró et al., 2013; Kinnunen, Korhonen, & Garvey, 2008; Niaura et al., 2001). Taken together, these limitations significantly hinder our ability to apply and generalize findings from the larger scale trials on smoking interventions in the general or for specific sub-populations. In order to theorize and discern how these interventions may or may not be as effective, it is paramount to understand which determinants are important for smoking cessation interventions, and to recognize and study how these determinants may be different for in smokers with a psychiatric diagnosis.

General determinants of smoking cessation

The literature is robust with regards to different factors which play important roles in determining who might achieve abstinence from tobacco. There are a myriad of biopsychosocial

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

factors which might impact cessation outcomes. These include: age, gender, marital and socioeconomic status, and education level, as well as nicotine dependence (Fagerström et al., 1996) and withdrawal (Hughes & Hatsukami, 1986). Both dependence and withdrawal play prominent roles in addictions and are central to models of abstinence and relapse (Marlatt, Bowen, & Witkiewitz, 2009; Witkiewitz & Marlatt, 2004). Nicotine dependence (Etter, 2005) is defined as a persistent and continual pattern of abuse despite potential serious consequences. Nicotine dependent individuals smoke at much higher rates than those with low levels of dependence (Breslau, Johnson, Hiripi, & Kessler, 2001). This model is reinforced via both biological or affect-trait driven characteristics and contextually conditioned models of learning (Benowitz, 2010). From a physiologic and affective perspective, continued smoking becomes necessary to regulate emotional states, which include negative affect (Kenford et al., 2002; S. Shiffman, 2005), anxiety sensitivity (Zvolensky et al., 2006), stress (Bruijnzeel, 2012), and distress tolerance (Hagman, Delnevo, Hrywna, & Williams, 2008). In contextual/learning models, smoking can become conditioned on both classical (i.e., smoking-related cues) and operant (i.e., reinforcing smoking-related outcome expectancies) conditioning pathways (Niaura, 2000). As a result of the development of nicotine dependence, individuals attempting to quit face significant symptoms of nicotine withdrawal. Withdrawal is characterized by physical and psychological symptoms (Hughes & Hatsukami, 1986), and include negatively valenced emotional states (depression, anxiety, irritability), intense craving, and cognitive impairments. Unsurprisingly, the literature strongly supports the notion that individuals with greater degree of nicotine dependence, and/or those who experience more intense symptoms of withdrawal, are less likely to successfully achieve and maintain abstinence (Allen, Bade, Hatsukami, & Center, 2008; Hyland et al., 2006).

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

Given the myriad of factors associated with nicotine dependence and withdrawal, including their impact on affective states and relationship to affect control and distress, it is perhaps not surprising that those with a psychiatric diagnosis are more likely to meet criteria for nicotine dependence (Leonard et al., 2001), score higher on measures of dependency (Grant, Hasin, Chou, Stinson, & Dawson, 2004), and are more likely to experience greater symptoms of withdrawal during a quit attempt (Breslau, Kilbey, & Andreski, 1992; John, Meyer, Rumpf, & Hapke, 2004; J. Williams & Ziedonis, 2004). Many of the aforementioned symptoms of nicotine withdrawal overlap significantly with symptoms of several psychiatric disorders (Pomerleau, Marks, & Pomerleau, 2000), and serve as a contributing factor as to why these individuals have such difficulty quitting (Parrott, 2004). This symptom overlap is also a threat to reliability and validity when attempting to generalize findings across studies in smokers with and without a psychiatric diagnosis (Johnson, Stewart, Rosenfield, Steeves, & Zvolensky, 2012; Piasecki, Jorenby, Smith, Fiore, & Baker, 2003; Piper et al., 2011). While there is no clear mechanism linking nicotine dependence and other psychiatric diagnoses, both nicotine dependence and nicotine withdrawal symptoms are associated with poorer smoking cessation outcomes for this population. This negative association and high prevalence of smoking amongst individuals with a concurrent mental illness make both nicotine dependence and nicotine withdrawal central factors in understanding smoking cessation of treatment-seeking smokers with a mental illness (Pomerleau et al., 2000).

Self-efficacy: A brief primer and definition

Self-efficacy has been defined as the belief in one's capability to organize and execute the courses of action required to produce given attainments (Bandura, 1997). More generally, it refers to our perceived competence in tackling difficult or novel tasks, and our ability to cope

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

with adversity in specific demanding situations. Bandura conceptualized self-efficacy as the belief which influences our ability to integrate a set of skills into a desired action. Thus, ideally an individual would not only possess a certain skill, but have the belief that they would be able to put this skill to specific use given the particular circumstances and goals. In essence, Bandura noted that an individual's level of motivation, affective states, and actions are based more on what they believe they can do than on what is objectively true (Bandura, 1997). As such, self-efficacy is conceptualized as one of the primary means that human beings exert control over their lives. As a core feature of Bandura's Social Cognitive Theory (SCT), self-efficacy is unique in that it affects behaviour both directly (by guiding action / selection of tasks) but also indirectly by affecting other determinants of behaviour, including aspirations, outcome expectations, and perceptions of impediments and opportunities within the social environment.

Self-efficacy not only influences our decisions in the here-and-now, but through reflection on previous experiences, and allows an individual to make future judgements. Those with high self-efficacy beliefs tend to exert themselves more, approach difficult tasks as challenges to be overcome, and set higher goals. They often hold higher expectations for the outcomes of their actions, and attribute failure to unsatisfactory effort or inappropriate skill use. Conversely, low self-efficacy beliefs can lead to avoidance and inaction which, in turn, can limit opportunity and negatively impact the individual's ability to grow. Thus, at the centre of an individual's capacity to learn and grow are self-efficacy beliefs, providing the foundation for human motivation, well-being, and accomplishments.

While general self-efficacy reflects a more global sense of being able to meet new challenges and cope in the face of adversity, Bandura's conceptualization of perceived self-efficacy is best understood as being situation- and domain-specific. Self-efficacy beliefs are best

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

operationalized and understood, therefore, as an individual's belief about their ability to carry out a *specific* task within a *certain* domain. Thus, when faced with a task an individual will evaluate and judge their capability to perform the act in question given the situation. Self-efficacy beliefs can have great variation in terms of levels and strength depending on the situation/context in which the individual is being evaluated. For example, an individual may have a set of self-efficacy beliefs around being a student, which may include more general beliefs around their ability to succeed as a student, but also more specific beliefs around their ability to succeed in particular subjects.

Sources of self-efficacy

Bandura proposed (Bandura, 1977) four components which influence self-efficacy beliefs: mastery information, vicarious experience, verbal/social persuasion, and affective/physiologic feedback. These sources of self-efficacy beliefs are not only directly translated into judgments, but indirectly integrated as information when an individual interprets results of events in which future self-efficacy judgements are based.

In general, mastery is viewed as the strongest and most potent source of self-efficacy beliefs. If an individual has successfully performed the specific behaviour in the past, they are more likely to be confident of their ability to also do so in the future. The opposite can also be true – those who have repeatedly failed in the past are more likely to develop low self-efficacy beliefs in that domain, making them less likely to attempt the behaviour and to desist more easily in the face of future barriers.

Vicarious experience refers to seeing another person perform the behaviour in question. The magnitude of the influence of this source on self-efficacy beliefs is tied to how similar the model is to the individual on a number of salient/relevant features (e.g., age, gender). Having

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

social models on which to base oneself have a number of benefits, including seeing others directly succeed via their effort/action, but also by helping an individual realise new ways of enacting the behaviour, leading to increases in self-efficacy beliefs.

Social persuasion is regarded by Bandura and others as the weakest source of information that influences self-efficacy beliefs. Its form typically includes messages (either general or idiosyncratic), designed to convince the individual that the behaviour is under their control and can be enacted. Persuaders can also be other individuals offering praise, cultivating the individual's belief in their own capability while ensuring that the envisioned goal is attainable. Research demonstrates that in general, positive verbal praise only weakly increased self-efficacy beliefs; conversely, negative verbal feedback can lead to large drops in self-efficacy (Flammer, 2001).

Finally, affective/physiologic states, which can include emotions and other physiologic appraisals (anxiety, depression, stress, withdrawal, sweating during a workout), are also an important sources of self-efficacy beliefs. People often gauge their self-efficacy by paying attention to their emotional state as they contemplate engaging in an action. Strong emotional cues and/or salient reactions are prominent features which can alert the individual to anticipate either success or failure. While high arousal can sometimes facilitate performance, if this arousal is negatively valenced then individuals may be more ineffective in their efforts. This information can in turn be interpreted back into the self-efficacy belief, either serving to increase or decrease these states, triggering additional affective and physical reactions. This source of information can be particularly salient if the situation in question calls for the individual to pay attention specifically to these cues. Helping individuals improve their physical and emotional well-being can raise self-efficacy beliefs, and this can in itself serve to increase an individual's belief about

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

their own ability to alter how they think and feel, further feeding back into these affective/physiologic states themselves.

Measurement considerations for self-efficacy

The variation and context-specificity of self-efficacy beliefs means that evaluations and measures of self-efficacy need to be tailored to specific domains of functioning in order to be sufficiently predictive of motivation and behaviour. Bandura cautioned the use of general “one size fits all” measures; he asserted that these measures as having little to no explanatory or predictive value, given that general items often have little or no relevance to the domain of functioning being assessed (Bandura, 2006). As such, measures of self-efficacy are more informative and better suited to answering questions of what an individual can do when they are specific to the context in question. Assessments of self-efficacy should therefore begin by focusing on psychometric properties derived through empirical knowledge and study of the given domain (e.g., content validity). These include face validity, which ensures that the measure evaluates what they are purported to measure (e.g., perceived capability to produce attainments). Items should be phrased as “can do...” as opposed to “will do” to differentiate between self-efficacy and other related constructs (i.e., capability vs. intention). Measures of self-efficacy must also rely on a good conceptual analysis of the relevant domain of functioning – and this knowledge is in turn translated into aspects of perceived efficacy that can be measured. A well constructed scale will include items which assess different facets of the domain or behaviour; these multifaceted scales are both predictive and offer insight into the dynamics of enacting and managing the behaviour in question.

Scales should be geared towards measuring gradations of challenge/impediments needed to successfully perform the given behaviour. As self-efficacy assessments are relative to the

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

difficulties an individual believes he/she can overcome, items can reflect different aspects including the individual's own levels of motivation, thought processes, emotional state, and environmental conditions. Constructing measures of self-efficacy beliefs entails work identifying the possible challenges/impediments to the behaviour in question, such that the assessment gauges the degree to which an individual feels they are able to *regularly* engage in the task/behaviour in question. These identified barriers should be built directly into the self-efficacy scales, with better scales including an opportunity to rate beliefs around *gradations* of task demands (challenges/barriers). Gradations should be sufficient and easily understandable so that an individual is able to rate the strength of their belief accurately. Scales with more gradations typically are more sensitive and reliable.

Self-efficacy and health behaviour change

Since the concept of self-efficacy was first introduced by Psychologist Albert Bandura in 1977 (Bandura, 1977), it has gone on to become one of the most widely studied and supported variables in health-behaviour change theory and research (Hyde, Hankins, Deale, & Marteau, 2008). In general, self-efficacy is defined as the belief in one's ability to complete the task at hand and to reach one's goals (i.e., task self-efficacy). This definition is sometimes expanded to reflect an individual's confidence in their ability to overcome obstacles in reaching their goal (i.e., barrier self-efficacy; Bandura, Freeman, & Lightsey, 1999). Self-efficacy theory states that individual's with high self-efficacy are more likely to approach a difficult and challenging situation and are better able to set goals and maintain commitment to them. In the face failures or setbacks they can heighten or sustain their effort, and approach threatening situations believing they will be able to exercise their control over them (Bandura, 1994). Self-efficacy beliefs are thus influential in how an individual feels, thinks, motivates themselves, and behaves. These

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

beliefs can affect human functioning through four primary psychological processes, which include: cognitive, motivational, affective, and selection (Bandura, 1993). Cognitive processes include thoughts and beliefs around the behaviour in question, while motivational processes influence an individual in that they (are motivated to) form beliefs and goals around behaviours they can achieve. Affective processes include self-efficacy beliefs around being able to manage stressors and affect, while selection processes govern the types of environments and activities individuals choose. Self-efficacy therefore plays a prominent role in studies on abstinence and relapse prevention for substance use disorders (Brandon, Vidrine, & Litvin, 2007; Carroll, 1996; Collins, Witkiewitz, Kirouac, & Marlatt, 2010; Witkiewitz & Marlatt, 2004).

Smoking cessation self-efficacy thus reflects an individual's belief that they will be able to both quit (task self-efficacy; cognitive and motivational processes) and overcome obstacles to successfully quitting (barrier self-efficacy; cognitive, affective and selection processes). Once cessation has occurred, smoking cessation self-efficacy becomes important for maintenance of abstinence, as the former-smoker attempts to cope with the symptoms of withdrawal triggered through distressing states (affective processes) and situational cues (e.g., under stress, in the presence of other smokers; selection processes). Smoking cessation outcome studies consistently identify self-efficacy as a predictor of smoking outcomes (Amodei & Lamb, 2005; Diemert, Bondy, Brown, & Manske, 2013; Herd, Borland, & Hyland, 2009), a finding which is shared across both self-quitting and treatment-seeking smokers (Ockene et al., 2000). More recent reports have extended these findings by assessing changes in cessation self-efficacy following the delivery of an intervention. These reports note increases in smoker's confidence to quit following behavioural (Blevins, Farris, Brown, Strong, & Abrantes, 2016; Schuck, Otten, Kleinjan, Bricker, & Engels) and pharmacological (Burns et al., 2016; Piper et al., 2016)

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

interventions as directly related to improved cessation outcomes (Piper et al., 2015).

These often-replicated findings have cemented self-efficacy's inclusion into models of relapse for addictions, including the influential Relapse Prevention Model (RPM; (Collins et al., 2010; Witkiewitz & Marlatt, 2004). The RPM, a dynamic cognitive-behavioural model of addiction, features both tonic (stable/trait) and phasic (transient) processes that interact during an attempt to maintain abstinence. Within this model, self-efficacy is listed as both a tonic (general level of confidence) and phasic-variable (changing in response to antecedent behaviour), in which self-efficacy both mediates the likelihood of experience a lapse, and moderates the relationship linking lapsing to relapse. While cessation self-efficacy is robustly associated within the literature for cessation outcomes, several methodological and measurement-related limitations exist.

Smoking Cessation Self-Efficacy: Definition and Limitations

Despite the promise of self-efficacy, limitations related to its' measurement and assessment prevail. Specifically, measurement variability makes it difficult to generalize or determine the specific mechanisms by which cessation self-efficacy is tied to cessation outcomes. A recent meta-analysis (Gwaltney et al., 2009) investigated factors related to the measurement variability in measures of cessation self-efficacy in order to assess how they might mediate and/or moderate the relationship between self-efficacy and smoking outcomes. Importantly, the authors confirmed what numerous previous studies had reported: cessation self-efficacy is significantly associated with cessation outcomes, with a moderate effects size. The magnitude of the effect size, however, was impacted by two factors: the timing of the self-efficacy evaluation (i.e., latency), and the need to account for concurrent smoking amongst study participants.

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

Cessation self-efficacy assessments usually take place at one of two times during a smoking cessation trial: 1) prior to the attempt commencing (usually referred to as the pre-attempt/baseline cessation self-efficacy) or 2) post attempt, once the individual has already quit smoking. In the meta-analysis (Gwaltney et al., 2009), both pre- and post-quit measurements yielded statistically significant and positive effect sizes for smoking outcomes, with those estimates made post-cessation attempt resulting in effect sizes greater in magnitude. This finding was theorized to reflect the fact that individuals are better able to estimate their confidence in remaining abstinent only once they have begun the quit attempt and, therefore, already experiencing the negative symptoms associated with nicotine withdrawal and craving. Conversely, evaluations made pre-cessation may be impacted by the individual's overconfidence in their ability to abstain, a notion that has been supported theoretically (Williams & Rhodes, 2016), in studies of health care delivery (Spaulding, Haley, & Zhao, 2014) and in correctional facilities for substance abuse (Zhang, Feng, Geng, Owens, & Xi, 2016). Higher cessation self-efficacy in general is believed to be predictive of better abstinence outcomes; however, some studies (Elfeddali, Bolman, Candel, Wiers, & De Vries, 2012; McCarthy, Ebssa, Witkiewitz, & Shiffman, 2015) have noted that overly inflated levels of confidence can be potentially counter-productive. For example, in a latent class analysis of smokers attempting to quit (McCarthy et al., 2015), those with the highest baseline self-efficacy scores were more likely to be in the group who were able quit early but who ultimately relapsed by the final follow-up. Investigating how this measurement variability impacts treatment-seeking smokers will help us better understand the relationship between cessation self-efficacy and smoking outcomes.

The second major finding emanating from this meta-analysis was the impact of whether studies controlled for smoking status at the time of self-efficacy measurement. The authors

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

identified a positive bias (evidenced by inflated effect sizes) for studies that did not take into account the smoking status of study participants when compared to studies which either investigated abstainers only or which controlled for smoking status at time of self-efficacy measure. The researchers hypothesized that rather than being predictive of smoking outcomes, it was possible that self-efficacy measures were simply reflective of a smoking lapse (i.e., a resumption of smoking before returning to the quit attempt). The authors posited that as behavior changed (e.g., abstinence maintained, or smoking resumed), so too would we see changes in an individual's confidence, thus negating the potential predictive power of self-efficacy. Indeed, lapsing has been identified as a significant predictor of ultimate relapse (i.e., full resumption of smoking; (Shiffman, Ferguson, & Gwaltney, 2006; Shiffman et al., 1996), calling into question the prognostic value of cessation self-efficacy. If self-efficacy measures truly only echoed the most recent behavior of the individual (i.e., success vs. failure in abstinence), it would call into question the concept of self-efficacy as an important driver and mechanism for many theories of health behaviour change (Bandura, 1999; DiClemente, Fairhurst, & Piotrowski, 1995) and challenge current paradigms of relapse prevention.

These reciprocal interactions between cessation self-efficacy, smoking lapses and relapses have been the focus of some recent work with findings remaining equivocal (Perkins, Parzynski, Mercincavage, Conklin, & Fonte, 2012; Romanowich, Mintz, & Lamb, 2009; S. Shiffman, 2005; Van Zundert, Ferguson, Shiffman, & Engels, 2010). In one study which employed ecological momentary assessment to measure minute changes over a number of smoking cessation variables, baseline self-efficacy did predict an eventual lapse (Shiffman, 2005). However, after the lapse had occurred, self-efficacy scores dropped sharply, with day-to-day changes in self-efficacy measured post-lapse ultimately predicting relapse, independent of

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

concurrent smoking. Similarly, a study in adolescents found that although self-efficacy measures showed variability after a smoking lapse, having low self-efficacy was significantly associated with future lapses and eventual relapse even after controlling for concomitant smoking (Van Zundert et al., 2010). Finally, Perkins and colleagues (2012) found a bi-directional relationship between cessation self-efficacy and abstinence, such that previous day self-efficacy measures predicted next day abstinence, while a return to smoking predicted a drop in the subsequent day's self-efficacy evaluation. While some of this preliminary evidence suggests that self-efficacy perceptions are impacted by smoking status, more research is required to clarify this complicated relationship between cessation self-efficacy and smoking outcomes.

Cessation Self-Efficacy and Mental Illness

In contrast to the numerous studies investigating self-efficacy and cessation in the general population, little is available when it comes to the relationship between cessation self-efficacy and smoking cessation outcomes for individuals with a mental illness. In spite of this, confidence in one's ability to quit is frequently highlighted as an important barrier to successful quitting in this population (Ashton, Rigby, & Galletly, 2013). A general characteristic shared by the few studies which do investigate this relationship is an overall lower magnitude of self-efficacy ratings across different studies of psychiatric populations as compared to the general population. For example, individuals with elevated symptoms of depression (as measured by the Beck Depression Inventory; BDI-II), were found to have high motivation to quit but low cessation self-efficacy (as measured via dichotomous yes/no; (Haukkala, Uutela, Vartiainen, Mcalister, & Knekt, 2000). Another study (Mann-Wrobel, Bennett, Weiner, Buchanan, & Ball, 2011) found overall low baseline levels of cessation self-efficacy among inpatient smokers with schizophrenia pre-quit attempt. Similarly, inpatients with psychotic disorders recruited for a

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

combined exercise and counselling cessation program found (Bernard et al., 2013) that increased confidence during the quit attempt predicted reduction in smoking as measured by expired CO-levels 6-weeks following the intervention. Cinciripini and colleagues (2003) found that measures of post-cessation self-efficacy (10-point Likert scale) mediated the relationship between 6-month abstinence and pre-cessation depressed mood measured by the Profile of Moods States (POMS) Depression Scale. This finding was not replicated by Berndt et al. (2013), however, who found that the mediation pathway between craving and cessation self-efficacy was not moderated by depression as assessed via the Hospital Anxiety and Depression Scale (HADS). However, the team did find self-efficacy to mediate this pathway (craving to 6-month abstinence rates) for those with low- to moderate levels of anxiety (measured via HADS). Brodbeck & colleagues (2014) used ecological momentary assessment measures during an unassisted quit attempt reported that higher depressive symptoms at baseline (assessed via the self-report Centre for Epidemiologic Studies Depression Scale; CES-D) predicted poorer longer-term outcomes; smokers were more likely to experience elevated negative affect dependent on situational contexts. In their multi-level model, they noted that this indirect pathway (depression – negative affect – outcomes) was partially mediated by cessation self-efficacy, such that elevated negative affect significantly decreased confidence which, in turn, was related to elevated potential to experience a lapse. Greenfield, Venner, Kelly, Slaymaker, and Bryan (2012) investigated the impact of a diagnosis of major depression and high depressive symptoms on cessation self-efficacy and smoking outcomes in 302 adults in residential addictions treatment facility. They found that receiving a diagnosis of Major Depressive Disorder (MDD) or high baseline depressive symptoms (assessed via the Brief Symptom Inventory; BSI 18) was associated with lower cessation self-efficacy. Mirroring the findings of Brodbeck et al. (2014), this was

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

particularly true in high negative affect states. Despite this, no moderating effect of MDD on self-efficacy was found, with self-efficacy continuing to increase at follow-ups. Moreover, only cessation self-efficacy predicted smoking outcomes at 3-months.

These limited studies offer some preliminary evidence to support self-efficacy as an important driver of cessation outcomes in those with a psychiatric illness. Unfortunately, these results remain equivocal, and fall prey to the same limitations previously noted. Firstly, they rely on specific populations (inpatient psychotic $n=2$, outpatient diagnosed depression $n=1$), mainly use symptom checklists ($n=4$), and employ primarily cross-sectional design ($n=2$), highlighting the need for more in-depth analysis in this research area. To date, no study has directly compared cessation self-efficacy evaluations across smokers with and without mental illness in a concurrent study, or across multiple-time points during a quit attempt. There are several important issues that need to be addressed within this literature in order to better inform the development of cessation interventions moving forward.

Measurement limitations for cessation self-efficacy in psychiatric smokers

Before a comparison in overall cessation self-efficacy scores between those with and without a psychiatric diagnosis can take place, it is important that we first consider the reliability and validity of cessation self-efficacy measures within this population. It is possible that individuals who have a psychiatric diagnosis (e.g., mood disorder, anxiety disorders) might evaluate their confidence levels differently. Research supports this idea. Individuals with a mental illness often suffer from poor overall self-esteem, experience more negative affect and related cognitions (Strong, Brown, Kahler, Lloyd-Richardson, & Niaura, 2004) and tend to self-stigmatize (Corrigan, Larson, & Ruesch, 2009; Corrigan, Watson, & Barr, 2006). Given this information, it is important to consider the internal consistency and factor structure of our

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

cessation self-efficacy scale by investigating across psychiatric diagnoses.

Another key measurement-related question relates to the timing of the self-efficacy evaluation. As previously highlighted in the meta-analysis of self-efficacy and smoking outcomes (Gwaltney et al., 2009), post-quit measures were stronger predictors of smoking outcomes compared to those taken prior to the quit attempt. Self-efficacy measured in the face of withdrawal symptoms (after the quit attempt has occurred) may be an important mediator of these symptoms for smoking cessation. Investigating differences between baseline and post-cessation self-efficacy measures' ability to predict smoking outcomes across diagnostic groups will allow us to comment on the impact of evaluation timing for smokers attempting to quit. Finally, the absolute magnitude of self-efficacy evaluations is an important area to investigate across those with and without a psychiatric diagnosis. Previous studies have identified lower scores of self-efficacy in relation to elevated symptoms on psychiatric measures (Brodbeck et al., 2014; Greenfield et al., 2012). Directly comparing across diagnostic groups (both psychiatric diagnoses, as well as current or lifetime diagnoses) will allow us to determine whether these potential differences serve as mediators to the association between self-efficacy measures and smoking outcomes. It is possible that while absolute measures might be lower in magnitude amongst those with a diagnosis compared to those without, they may not differentially impact treatment outcomes.

Beyond the potential influence that a concurrent mental illness might have on the individual's evaluation of their degree of confidence, self-efficacy estimates in this population might be impacted by other important smoking-related variables. It is possible that while cessation self-efficacy may be significantly associated with smoking outcomes, measure of nicotine dependence, symptoms of withdrawal, and negative affect might be more important

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

(i.e., offer superior discriminant validity) to monitor during the course of a quit attempt. To better understand how these variables interact and impact one another, it will be important to investigate their relationship from throughout the quit attempt. An assessment of the reciprocal nature of these predictors as well as their mediation effects is required. Concurrently assessing cessation self-efficacy along with these other important indicators of smoking outcomes is needed to determine the relative strength of each measure.

Equally important is the need to better understand temporally how cessation self-efficacy is related to smoking outcomes. One major limitation raised previously was the biased effect size between self-efficacy and smoking outcome when not controlling for concurrent smoking status. An investigation of the association of both pre- and post-cessation self-efficacy measures while controlling for concurrent smoking status will allow us to further disentangle this relationship. In order to account for the potential confounding of cessation self-efficacy and concurrent smoking, we investigated this relationship using advanced statistical techniques. These include: structural equation modeling (SEM), with reciprocal path analyses, and general linear models, specifically General Estimating Equations (GEE), to leverage the longitudinal, repeated-measures design of our study. Using these techniques, we hope to meaningfully contribute to the body of knowledge and the field of behavioural addiction specifically related to smoking cessation self-efficacy and provide important indices for how self-efficacy can help inform our interventions moving forward.

Study design and Purpose

The data for this dissertation comes from a larger study conducted at the University of Ottawa Heart Institute: the “Flexible and extended dosing of nicotine replacement therapy (NRT) and varenicline in comparison to fixed-dose NRT for smoking cessation: the FLEX trial”. The

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

FLEX trial was a randomized control trial with the primary aim of investigating the effectiveness of three pharmacotherapeutic agents for smoking cessation: 1) standard 10-week fixed dosage transdermal patch nicotine replacement therapy (NRT: the control arm); 2) titrated-dose and extended duration (up to 15-weeks) combination (transdermal path and choice of nicotine gum or inhaler) NRT (NRT+ condition); and 3) titrated-dose and extended duration (up to 15-weeks prescription) varenicline (VR condition). The *FLEX trial* followed participants for 52-weeks following their quit-date, and included visits at baseline (pre-quit), and post-target quit-date at weeks 1, 3, 5, 8, 10, 22, and 52. At baseline, all participants were assessed for a psychiatric diagnosis (current or past) via structured clinical interview by clinical psychology staff, the gold standard for confirming a diagnosis. They also completed a questionnaire that assessed for sociodemographic variables, and answered questions about their smoking histories, including cigarettes smoked per day, previous quit attempts, and years spent smoking. At baseline and during each follow-up visit, participants also completed empirically supported questionnaires assessing indices of smoking cessation, including nicotine withdrawal (Minnesota Nicotine Withdrawal Scale; MNWS; Hughes & Hatsukami, 1986), negative affect (Beck Depression Inventory 2nd edition; BDI-II; Beck A, Steer, & Brown, 1996), and cessation self efficacy (Smoking Cessation Self-Efficacy Questionnaire; SEQ-12; Etter, Bergman, Humair, & Perneger, 2000).

The purpose of the overall dissertation is to assess self-efficacy's role in the process of quitting smoking. Specifically, we investigated a measure of cessation self-efficacy in a sample of treatment-seeking smokers with and without a psychiatric diagnosis. Outcomes of interest included the measure's predictive validity (smoking outcomes), concurrent validity (compared low and high self-efficacy); discriminant validity (compared to other indices including nicotine

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

withdrawal and negative affect, motivation), and content validity (self-efficacy as cause or reflection of behavior). Several analytical procedures were employed to answer our specific research aims and hypotheses (see next section). Analyses, including structural equation modeling and general linear models, were selected to compare results of our research aims at different times during a quit attempt (temporal aspect of self-efficacy measures), leveraging the repeated measures design of the *FLEX trial*. This dissertation also attempted to address the previously identified limitations within the smoking cessation literature, including: the biased exclusion or choice of specific samples (i.e., in-patient, specific diagnoses only; no comparison group), and the use of self-report measures to classify psychiatric status. Investigating differences amongst community-dwelling treatment seekers with various diagnosed mental illnesses as determined by a structured interview is important for the development of a more complete understanding of factors that support or inhibit cessation success in this population.

Our study systematically tracked and compared across psychiatric groups for important indicators of relapse, including: nicotine dependence, withdrawal symptoms, negative affect, and smoking cessation self-efficacy. This permitted us to compare our results to those within the literature, and make suggestions for current cessation interventions, especially should these populations differ in meaningful ways on these indices. As a first step, we investigated the reliability and validity of a measure of cessation self-efficacy, the 12-item Smoking Cessation Self-Efficacy Questionnaire (SEQ-12; Etter et al., 2000). This entailed investigating differences across those with and without a psychiatric diagnosis on pre- and post-cessation SEQ-12 scores, as well as comparing both single-item (task) and multi-item (barrier) measures across groups, via logistic regression and controlling for concurrent smoking. Next, we assessed the psychometric properties of the SEQ-12 through factor analysis. This ensured equivalence in its factor structure

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

across psychiatric categories. Following these preliminary analyses, we applied more complex longitudinal measures to our data in an attempt to disentangle the relationship between cessation self-efficacy, concurrent smoking, and other indicators of cessation, including: nicotine dependence, withdrawal symptoms, and negative affect. Thus, the intention of the articles which make up the body of this dissertation was to build on each other in a meaningful way (i.e., regarding measurement properties; from a temporal perspective) through various analyses and by testing specific research hypotheses.

Specific Research Aims and Hypotheses

Article 1:

Research aim: To assess the reliability, validity and factor structure of the smoking cessation self-efficacy measure (SEQ-12) across individuals with a current, past or no lifetime psychiatric diagnosis.

Hypothesis: The SEQ-12 will have comparable psychometric properties (e.g., internal consistency, internal and external validity) for participants regardless of a psychiatric diagnosis.

Article 2:

Research aim: To determine whether single- or multi-item measures of smoking cessation self-efficacy differ across those with a current, past or no lifetime psychiatric diagnosis.

Hypothesis: Both single- and multi-item measures will be significantly correlated. Both types of measures will differ by psychiatric status, and those with a diagnosis (current or lifetime) will have lower magnitude scores.

Article 3:

Research Aim: To investigate the complex relationship between smoking cessation self-efficacy, concurrent smoking (expired-CO), and cessation outcomes. Our primary research question

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

examined whether self-efficacy during a quit-attempt accurately reflected an individual's confidence and predicted abstinence outcomes, or whether self-efficacy was simply a reflection of their most recent behavior.

Hypothesis: Smoking cessation self-efficacy would be impacted by smoking behavior, but would continue to be predictive of smoking outcomes at 10 weeks.

Article 4:

Research Aim: To evaluate the relationship between symptoms of withdrawal, negative affect, and smoking cessation self-efficacy, and determine which indice is best able to predict abstinence at weeks 22 and 52 post-target quit-date.

Hypothesis: There will be significant associations between all measures. Higher scores on symptoms of withdrawal and negative affect will be associated with lower scores of cessation self-efficacy. Those with a psychiatric diagnosis (lifetime or current) will have lower self-efficacy scores compared to those with no diagnosis. Symptoms of withdrawal, negative affect, and cessation self-efficacy will all be associated with outcomes at 22- and 52-weeks. There will be evidence for an indirect effect of self-efficacy on symptoms of negative affect and withdrawal.

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

References

- Allen, S. S., Bade, T., Hatsukami, D., & Center, B. (2008). Craving, Withdrawal, and Smoking Urges on Days Immediately Prior to Smoking Relapse. *Nicotine & Tobacco Research, 10*(1), 35-45. doi:10.1080/14622200701705076
- Amodei, N., & Lamb, R. J. (2005). Predictors of initial abstinence in smokers enrolled in a smoking cessation program. *Subst Use Misuse, 40*(2), 141-149.
- Anthenelli, R. M., Benowitz, N. L., West, R., St Aubin, L., McRae, T., Lawrence, D., . . . Evins, A. E. (2016). Neuropsychiatric safety and efficacy of varenicline, bupropion, and nicotine patch in smokers with and without psychiatric disorders (EAGLES): a double-blind, randomised, placebo-controlled clinical trial. *The Lancet, 387*(10037), 2507-2520.
- Anthenelli, R. M., Morris, C., Ramey, T. S., Dubrava, S. J., Tsilkos, K., Russ, C., & Yunis, C. (2013). Effects of Varenicline on Smoking Cessation in Adults With Stably Treated Current or Past Major DepressionA Randomized Trial. *Annals of Internal Medicine, 159*(6), 390-400. doi:10.7326/0003-4819-159-6-201309170-00005
- Ashton, M., Rigby, A., & Galletly, C. (2013). What do 1000 smokers with mental illness say about their tobacco use? *Australian & New Zealand Journal of Psychiatry, 47*(7), 631-636.
- Aubin, H.-J., Rollema, H., Svensson, T. H., & Winterer, G. (2012). Smoking, quitting, and psychiatric disease: A review. *Neuroscience & Biobehavioral Reviews, 36*(1), 271-284.
- Baker, A., Richmond, R., Haile, M., Lewin, T., Carr, V., Taylor, R., . . . Wilhelm, K. (2006). A randomized controlled trial of a smoking cessation intervention among people with a psychotic disorder. *American Journal of Psychiatry, 163*(11), 1934-1942.
- Baliunas, D., Patra, J., Rehm, J., Popova, S., Kaiserman, M., & Taylor, B. (2007). Smoking-

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

- attributable mortality and expected years of life lost in Canada 2002: Conclusions for prevention and policy. *Chronic Diseases and Injuries in Canada*, 27(4), 154.
- Bandura, A. (1977). Self-Efficacy – Toward a Unifying Theory of Behavioral Change. *Psychological Review*, 84(2), 191-215. doi:10.1037//0033-295x.84.2.191
- Bandura, A. (1993). Perceived self-efficacy in cognitive development and functioning. *Educational psychologist*, 28(2), 117-148.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York, NY, US: W H Freeman/Times Books/ Henry Holt & Co.
- Bandura, A. (1999). Self-efficacy: Toward a unifying theory of behavioral change *The self in social psychology* (pp. 285-298). New York, NY, US: Psychology Press.
- Bandura, A., Freeman, W., & Lightsey, R. (1999). Self-efficacy: The exercise of control. *Journal of Cognitive Psychotherapy*, 13(2), 158-166.
- Bandura, A. (2006). Guide for constructing self-efficacy scales. *Self-efficacy beliefs of adolescents*, 5(1), 307-337.
- Beck A, Steer, R., & Brown, G. (1996). *Beck Depression Inventory-2nd edition*. San Antonio, Tx: Psychological Coporation.
- Benowitz, N. L. (2010). Nicotine addiction. *New England Journal of Medicine*, 362(24), 2295-2303.
- Bernard, P. P., Esseul, E. C., Raymond, L., Dandonneau, L., Xambo, J. J., Carayol, M. S., & Ninot, G. J. (2013). Counseling and exercise intervention for smoking reduction in patients with schizophrenia: a feasibility study. *Arch Psychiatr Nurs.*, 27(1), 23-31. doi: 10.1016/j.apnu.2012.1007.1001. Epub 2012 Dec 1021.
- Berndt, N. C., Hayes, A. F., Verboon, P., Lechner, L., Bolman, C., & De Vries, H. (2013). Self-

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

- efficacy mediates the impact of craving on smoking abstinence in low to moderately anxious patients: Results of a moderated mediation approach. *Psychology of Addictive Behaviors*, 27(1), 113.
- Blevins, C. E., Farris, S. G., Brown, R. A., Strong, D. R., & Abrantes, A. M. (2016). The role of self-efficacy, adaptive coping, and smoking urges in long-term cessation outcomes. *Addictive disorders & their treatment*, 15(4), 183.
- Brandon, T. H., Vidrine, J. I., & Litvin, E. B. (2007). Relapse and relapse prevention. *Annu. Rev. Clin. Psychol.*, 3, 257-284.
- Breslau, N., Johnson, E. O., Hiripi, E., & Kessler, R. (2001). Nicotine dependence in the United States: prevalence, trends, and smoking persistence. *Archives of General Psychiatry*, 58(9), 810-816.
- Breslau, N., Kilbey, M. M., & Andreski, P. (1992). Nicotine withdrawal symptoms and psychiatric disorders: findings from an epidemiologic study of young adults. *The American journal of psychiatry*.
- Brodbeck, J., Bachmann, M. S., Brown, A., & Znoj, H. J. (2014). Effects of depressive symptoms on antecedents of lapses during a smoking cessation attempt: an ecological momentary assessment study. *Addiction*, 109(8), 1363-1370.
- Brown, R. A., Lejuez, C., Kahler, C. W., Strong, D. R., & Zvolensky, M. J. (2005). Distress tolerance and early smoking lapse. *Clinical Psychology Review*, 25(6), 713-733.
- Bruijnzeel, A. W. (2012). Tobacco addiction and the dysregulation of brain stress systems. *Neuroscience & Biobehavioral Reviews*, 36(5), 1418-1441.
doi:<http://dx.doi.org/10.1016/j.neubiorev.2012.02.015>
- Burgess, E. S., Brown, R. A., Kahler, C. W., Niaura, R., Abrams, D. B., Goldstein, M. G., &

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

- Miller, I. W. (2002). Patterns of change in depressive symptoms during smoking cessation: who's at risk for relapse? *Journal of consulting and clinical psychology, 70*(2), 356.
- Burns, R. J., Rothman, A. J., Fu, S. S., Lindgren, B., Vock, D. M., & Joseph, A. M. (2016). Longitudinal Care Improves Cessation in Smokers Who Do Not Initially Respond to Treatment by Increasing Cessation Self-Efficacy, Satisfaction, and Readiness to Quit: A Mediated Moderation Analysis. *Annals of Behavioral Medicine, 50*(1), 58-69.
doi:10.1007/s12160-015-9732-1
- Cahill, K., Stevens, S., Perera, R., & Lancaster, T. (2013). Pharmacological interventions for smoking cessation: an overview and network meta-analysis. *Cochrane Database Syst Rev, 5*, Cd009329. doi:10.1002/14651858.CD009329.pub2
- Carroll, K. M. (1996). Relapse prevention as a psychosocial treatment: A review of controlled clinical trials. *Experimental and Clinical psychopharmacology, 4*(1), 46.
- Cerimele, J. M., & Durango, A. (2012). Does varenicline worsen psychiatric symptoms in patients with schizophrenia or schizoaffective disorder? A review of published studies. *J Clin Psychiatry., 73*(8), e1039-1047. doi: 1010.4088/JCP.1011r07410.
- Chaiton, M., Cohen, J., O'Loughlin, J., & Rehm, J. (2010). Use of cigarettes to improve affect and depressive symptoms in a longitudinal study of adolescents. *Addictive behaviors, 35*(12), 1054-1060.
- Cinciripini, P. M., Wetter, D. W., Fouladi, R. T., Blalock, J. A., Carter, B. L., Cinciripini, L. G., & Baile, W. F. (2003). The effects of depressed mood on smoking cessation: Mediation by postcessation self-efficacy. *Journal of consulting and clinical psychology, 71*(2), 292-301. doi:10.1037/0022-006x.71.2.292

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

- Collins, S. E., Witkiewitz, K., Kirouac, M., & Marlatt, G. A. (2010). Preventing Relapse Following Smoking Cessation. *Curr Cardiovasc Risk Rep*, 4(6), 421-428.
doi:10.1007/s12170-010-0124-6
- Cook, B. L., Wayne, G. F., Kafali, E. N., Liu, Z., Shu, C., & Flores, M. (2014). Trends in smoking among adults with mental illness and association between mental health treatment and smoking cessation. *JAMA*, 311(2), 172-182.
- Corrigan, P. W., Larson, J. E., & Ruesch, N. (2009). Self-stigma and the “why try” effect: impact on life goals and evidence-based practices. *World Psychiatry*, 8(2), 75-81.
- Corrigan, P. W., Watson, A. C., & Barr, L. (2006). The self-stigma of mental illness: implications for self-esteem and self-efficacy. *Journal of Social and Clinical Psychology*, 25(8), 875-884.
- Danaei, G., Ding, E. L., Mozaffarian, D., Taylor, B., Rehm, J., Murray, C. J., & Ezzati, M. (2009). The preventable causes of death in the United States: comparative risk assessment of dietary, lifestyle, and metabolic risk factors. *PLoS medicine*, 6(4), e1000058.
- DiClemente, C. C., Fairhurst, S. K., & Piotrowski, N. A. (1995). Self-efficacy and addictive behaviors *Self-efficacy, adaptation, and adjustment* (pp. 109-141): Springer.
- Diemert, L. M., Bondy, S. J., Brown, K. S., & Manske, S. (2013). Young adult smoking cessation: predictors of quit attempts and abstinence. *Am J Public Health.*, 103(3), 449-453. doi: 410.2105/AJPH.2012.300878. Epub 302013 Jan 300817.
- Ekpu, V. U., & Brown, A. K. (2015). The economic impact of smoking and of reducing smoking prevalence: review of evidence. *Tobacco use insights*, 8, TUI. S15628.
- Elfeddali, I., Bolman, C., Candel, M. J. J. M., Wiers, R. W., & De Vries, H. (2012). The role of

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

self-efficacy, recovery self-efficacy, and preparatory planning in predicting short-term smoking relapse. *British journal of health psychology*, *17*(1), 185-201.

doi:10.1111/j.2044-8287.2011.02032.x

Etter, J. F. (2005). A comparison of the content-, construct- and predictive validity of the cigarette dependence scale and the Fagerström test for nicotine dependence. *Drug & Alcohol Dependence*, *77*(3), 259-268.

Etter, J. F., Bergman, M. M., Humair, J. P., & Perneger, T. V. (2000). Development and validation of a scale measuring self-efficacy of current and former smokers. *Addiction*, *95*(6), 901-913.

Evins, A. E., Cather, C., Pratt, S. A., Pachas, G. N., Hoepfner, S. S., Goff, D. C., . . . Schoenfeld, D. A. (2014). Maintenance treatment with varenicline for smoking cessation in patients with schizophrenia and bipolar disorder: a randomized clinical trial. *JAMA*, *311*(2), 145-154.

Fagerström, K. O., Kunze, M., Schoberberger, R., Breslau, N., Hughes, J. R., Hurt, R. D., . . . Zatoński, W. (1996). Nicotine dependence versus smoking prevalence: comparisons among countries and categories of smokers. *Tobacco Control*, *5*(1), 52.

Figueiró, L. R., Bortolon, C. B., Benchaya, M. C., Bisch, N. K., Ferigolo, M., Barros, H. M. T., & Dantas, D. C. M. (2013). Assessment of changes in nicotine dependence, motivation, and symptoms of anxiety and depression among smokers in the initial process of smoking reduction or cessation: a short-term follow-up study. *Trends in Psychiatry and Psychotherapy*, *35*, 212-220.

Flammer, A. (2001). Self-efficacy. In N. J. Smelser & P. B. Baltes (Eds.), *International Encyclopedia of the Social & Behavioral Sciences* (pp. 13812-13815). Oxford:

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

Pergamon.

Friend, K., & Levy, D. T. (2002). Reductions in smoking prevalence and cigarette consumption associated with mass-media campaigns. *Health Education Research, 17*(1), 85-98.

Goel, R. K., & Nelson, M. A. (2006). The effectiveness of Anti-Smoking legislation: A review. *Journal of Economic Surveys, 20*(3), 325-355.

Grant, B. F., Hasin, D. S., Chou, S., Stinson, F. S., & Dawson, D. A. (2004). Nicotine dependence and psychiatric disorders in the united states: Results from the national epidemiologic survey on alcohol and related conditions. *Archives of General Psychiatry, 61*(11), 1107-1115. doi:10.1001/archpsyc.61.11.1107

Greenfield, B. L., Venner, K. L., Kelly, J. F., Slaymaker, V., & Bryan, A. D. (2012). The impact of depression on abstinence self-efficacy and substance use outcomes among emerging adults in residential treatment. *Psychology of Addictive Behaviors, 26*(2), 246.

Gwaltney, C. J., Metrik, J., Kahler, C. W., & Shiffman, S. (2009). Self-efficacy and smoking cessation: A meta-analysis. *Psychology of Addictive Behaviors, 23*(1), 56-66.
doi:10.1037/a0013529

Hagman, B. T., Delnevo, C. D., Hrywna, M., & Williams, J. M. (2008). Tobacco use among those with serious psychological distress: results from the national survey of drug use and health, 2002. *Addictive behaviors, 33*(4), 582-592.

Haug, N. A., Hall, S. M., Prochaska, J. J., Rosen, A. B., Tsoh, J. Y., Humfleet, G., . . .
Eisendrath, S. (2005). Acceptance of Nicotine Dependence Treatment Among Currently Depressed Smokers. *Nicotine & Tobacco Research, 7*(2), 217-224.
doi:10.1080/14622200500055368

Haukkala, A., Uutela, A., Vartiainen, E., Mcalister, A., & Knekt, P. (2000). Depression and

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

- smoking cessation: the role of motivation and self-efficacy. *Addictive behaviors*, 25(2), 311-316.
- U.S. Department of Health Services. (2004). *The health consequences of smoking: A report of the Surgeon General*: US Department of Health and Human Services.
- Herd, N., Borland, R., & Hyland, A. (2009). Predictors of smoking relapse by duration of abstinence: findings from the International Tobacco Control (ITC) Four Country Survey. *Addiction*, 104(12), 2088-2099. doi:10.1111/j.1360-0443.2009.02732.x
- Hitsman, B., Moss, T. G., Montoya, I. D., & George, T. P. (2009). Treatment of tobacco dependence in mental health and addictive disorders. *Canadian Journal of Psychiatry - Revue Canadienne de Psychiatrie*, 54(6), 368-378.
- Hughes, J. R., & Hatsukami, D. (1986). Signs and symptoms of tobacco withdrawal. *Archives of General Psychiatry*, 43(3), 289.
- Hughes, J. R., Keely, J., & Naud, S. (2004). Shape of the relapse curve and long-term abstinence among untreated smokers. *Addiction*, 99(1), 29-38.
- Hughes, J. R., Stead, L. F., & Lancaster, T. (2007). Antidepressants for smoking cessation. *Cochrane Database Syst Rev*, 1(1).
- Hyde, J., Hankins, M., Deale, A., & Marteau, T. M. (2008). Interventions to Increase Self-efficacy in the Context of Addiction Behaviours: A Systematic Literature Review. *Journal of Health Psychology*, 13(5), 607-623. doi:10.1177/1359105308090933
- Hyland, A., Borland, R., Li, Q., Yong, H.-H., McNeill, A., Fong, G. T., . . . Cummings, K. M. (2006). Individual-level predictors of cessation behaviours among participants in the International Tobacco Control (ITC) Four Country Survey. *Tobacco Control*, 15(suppl 3), iii83-iii94. doi:10.1136/tc.2005.013516

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

- Janes, A. C., Pizzagalli, D. A., Richardt, S., Chuzi, S., Pachas, G., Culhane, M. A., . . . Kaufman, M. J. (2010). Brain reactivity to smoking cues prior to smoking cessation predicts ability to maintain tobacco abstinence. *Biological Psychiatry*, *67*(8), 722-729.
- John, U., Meyer, C., Rumpf, H. J., & Hapke, U. (2004). Self-efficacy to refrain from smoking predicted by major depression and nicotine dependence. *Addictive behaviors*, *29*(5), 857-866. doi:<http://dx.doi.org/10.1016/j.addbeh.2004.02.053>
- Johnson, K. A., Stewart, S., Rosenfield, D., Steeves, D., & Zvolensky, M. J. (2012). Prospective evaluation of the effects of anxiety sensitivity and state anxiety in predicting acute nicotine withdrawal symptoms during smoking cessation. *Psychology of Addictive Behaviors*, *26*(2), 289.
- Kendler, K., Neale, M., Maclean, C., Heath, A., Eaves, L., & Kessler, R. (1993). Smoking and major depression: a causal analysis. *Arch Gen Psychiatry*, *50*, 36 - 43.
- Kenford, S. L., Smith, S. S., Wetter, D. W., Jorenby, D. E., Fiore, M. C., & Baker, T. B. (2002). Predicting relapse back to smoking: contrasting affective and physical models of dependence. *Journal of consulting and clinical psychology*, *70*(1), 216.
- Kinnunen, T., Korhonen, T., & Garvey, A. J. (2008). Role of nicotine gum and pretreatment depressive symptoms in smoking cessation: twelve-month results of a randomized placebo controlled trial. *The International Journal of Psychiatry in Medicine*, *38*(3), 373-389.
- Laje, R., Berman, J., & Glassman, A. (2001). Depression and nicotine: preclinical and clinical evidence for common mechanisms. *Curr Psychiatry Rep*, *3*, 470 - 474.
- Lancaster, T., & Stead, L. F. (2005). Self-help interventions for smoking cessation. *Cochrane Database Syst Rev*, *3*(3).

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

- Lancaster, T., & Stead, L. F. (2017). Individual behavioural counselling for smoking cessation. *Cochrane Database of Systematic Reviews*(3). doi:10.1002/14651858.CD001292.pub3
- Lasser, K., Boyd, J., Woolhandler, S., Himmelstein, D. U., McCormick, D., & Bor, D. H. (2000). Smoking and mental illness: A population-based prevalence study. *JAMA*, *284*(20), 2606-2610. doi:10.1001/jama.284.20.2606
- Lawlor, D. A., Frankel, S., Shaw, M., Ebrahim, S., & Smith, G. D. (2003). Smoking and ill health: Does lay epidemiology explain the failure of smoking cessation programs among deprived populations? *American journal of public health*, *93*(2), 266-270.
- Lawrence, D., Mitrou, F., & Zubrick, S. (2009). Smoking and mental illness: results from population surveys in Australia and the United States. *BMC Public Health*, *9*(1), 285.
- Leonard, S., Adler, L., Benhammou, K., Berger, R., Breese, C., Drebing, C., . . . Freedman, R. (2001). Smoking and mental illness. *Pharmacol Biochem Behav*, *70*, 561 - 570.
- Lyons, M., Hitsman, B., Xian, H., Panizzon, M. S., Jerskey, B. A., Santangelo, S., . . . Tsuang, M. T. (2008). A Twin Study of Smoking, Nicotine Dependence, and Major Depression in Men. *Nicotine & Tobacco Research*, *10*(1), 97-108.
- Mann-Wrobel, M. C., Bennett, M. E., Weiner, E. E., Buchanan, R. W., & Ball, M. P. (2011). Smoking history and motivation to quit in smokers with schizophrenia in a smoking cessation program. *Schizophrenia research*, *126*(1), 277-283.
- Marlatt, G. A., Bowen, S. W., & Witkiewitz, K. (2009). Relapse prevention: Evidence base and future directions. *Evidence-based addiction treatment*, 215-232.
- Mathers, C. D., & Loncar, D. (2006). Projections of global mortality and burden of disease from 2002 to 2030. *PLoS medicine*, *3*(11), e442.
- McCarthy, D. E., Ebssa, L., Witkiewitz, K., & Shiffman, S. (2015). Paths to tobacco abstinence:

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

- A repeated-measures latent class analysis. *Journal of consulting and clinical psychology*, 83(4), 696-708. doi:10.1037/ccp0000017
- McClave, A. K., Dube, S. R., Strine, T. W., & Mokdad, A. H. (2009). Associations between health-related quality of life and smoking status among a large sample of US adults. *Preventive medicine*, 48(2), 173-179.
- McClave, A. K., McKnight-Eily, L. R., Davis, S. P., & Dube, S. R. (2010). Smoking characteristics of adults with selected lifetime mental illnesses: results from the 2007 National Health Interview Survey. *American journal of public health*, 100(12), 2464-2472.
- McClure, J. B., Swan, G. E., Catz, S. L., Jack, L., Javitz, H., McAfee, T., . . . Zbikowski, S. M. (2010). Smoking outcome by psychiatric history after behavioral and varenicline treatment. *Journal of Substance Abuse Treatment*, 38(4), 394-402.
- Minnix, J. A., Blalock, J. A., Marani, S., Prokhorov, A. V., & Cinciripini, P. M. (2011). Self-Efficacy Mediates the Effect of Depression on Smoking Susceptibility in Adolescents. *Nicotine & Tobacco Research*, 13(8), 699-705.
- Morbidity and Mortality Weekly Report. (2013). Vital Signs - Current Cigarette Smoking Among Adults Aged ≥ 18 Years with Mental Illness—United States, 2009–2011. *Morbidity and Mortality Weekly Report, Early Release*, 62.
- Morrell, H. E. R., Cohen, L. M., & McChargue, D. E. (2010). Depression vulnerability predicts cigarette smoking among college students: Gender and negative reinforcement expectancies as contributing factors. *Addictive behaviors*, 35(6), 607-611.
- Niaura, R. (2000). Cognitive social learning and related perspectives on drug craving. *Addiction*, 95(8s2), 155-163.

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

Niaura, R., Britt, D. M., Shadel, W. G., Goldstein, M., Abrams, D., & Brown, R. (2001).

Symptoms of depression and survival experience among three samples of smokers trying to quit. *15*, 13-17. doi:10.1037/0893-164X.15.1.13

Ockene, J. K., Emmons, K. M., Mermelstein, R. J., Perkins, K. A., Bonollo, D. S., Voorhees, C. C., & Hollis, J. F. (2000). Relapse and maintenance issues for smoking cessation. *Health Psychol.*, *19*(1 Suppl), 17-31.

Organization, W. H. (2011). *Global status report on noncommunicable diseases 2010*: Geneva: World Health Organization.

Parrott, A. C. (2004). Heightened stress and depression follow cigarette smoking. *Psychol Rep.*, *94*(1), 33-34.

Perkins, K. A., Parzynski, C., Mercincavage, M., Conklin, C. A., & Fonte, C. A. (2012). Is self-efficacy for smoking abstinence a cause of, or a reflection on, smoking behavior change? *Experimental and clinical psychopharmacology*, *20*(1), 56.

Piasecki, T. M., Jorenby, D. E., Smith, S. S., Fiore, M. C., & Baker, T. B. (2003). Smoking Withdrawal Dynamics: III. Correlates of Withdrawal Heterogeneity. *Experimental and clinical psychopharmacology*, *11*(4), 276-285. doi:10.1037/1064-1297.11.4.276

Piper, M. E., Cook, J. W., Schlam, T. R., Smith, S. S., Bolt, D. M., Collins, L. M., . . . Baker, T. B. (2016). Toward precision smoking cessation treatment II: Proximal effects of smoking cessation intervention components on putative mechanisms of action. *Drug & Alcohol Dependence*, *171*, 50-58. doi:10.1016/j.drugalcdep.2016.11.027

Piper, M. E., Schlam, T. R., Cook, J. W., Sheffer, M. A., Smith, S. S., Loh, W.-Y., . . . Hefner, K. R. (2011). Tobacco withdrawal components and their relations with cessation success. *Psychopharmacology*, *216*(4), 569-578.

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

- Piper M. E., Cook, J., Schlam, T., Jorenby, D., & Baker, T. (2010). Anxiety diagnoses in smokers seeking cessation treatment: relations with tobacco dependence, withdrawal, outcome and response to treatment. *Addiction, 106*(2), 418-427. doi:10.1111/j.1360-0443.2010.03173.x
- Piper M, E., Fiore, M., Smith, S., Fraser, D., Bolt, D., Collins, L., . . . Baker, T. (2015). Identifying effective intervention components for smoking cessation: a factorial screening experiment. *Addiction, 111*(1), 129-141. doi:10.1111/add.13162
- Pomerleau, C. S., Marks, J. L., & Pomerleau, O. F. (2000). Who gets what symptom? Effects of psychiatric cofactors and nicotine dependence on patterns of smoking withdrawal symptomatology. *Nicotine & Tobacco Research, 2*(3), 275-280. doi:10.1080/14622200050147547
- Reid, J. L., Hammond, D., Rynard, V. L., & Burkhalter, R. (2014). *Tobacco use in Canada: patterns and trends*: University of Waterloo, Propel Centre for Population Health Impact.
- Romanowich, P., Mintz, J., & Lamb, R. J. (2009). The relationship between self-efficacy and reductions in smoking in a contingency management procedure. *Experimental and clinical psychopharmacology, 17*(3), 139-145. doi:10.1037/a0015842
- Schmitz, N., Kruse, J., & Kugler, J. (2007). Smoking and its association with disability in chronic conditions: results from the Canadian Community and Health Survey 2.1. *Nicotine & Tobacco Research, 9*(9), 959-964.
- Schuck, K., Otten, R., Kleinjan, M., Bricker, J. B., & Engels, R. C. M. E. Self-efficacy and acceptance of cravings to smoke underlie the effectiveness of quitline counseling for smoking cessation. *Drug & Alcohol Dependence, 142*, 269-276. doi:10.1016/j.drugalcdep.2014.06.033

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

- Shahab, L., & McEwen, A. (2009). Online support for smoking cessation: a systematic review of the literature. *Addiction, 104*(11), 1792-1804.
- Shiffman, S. (2005). Dynamic influences on smoking relapse process. *J Pers, 73*(6), 1715-1748. doi:10.1111/j.0022-3506.2005.00364.x
- Shiffman, S. (2005). Dynamic Influences on Smoking Relapse Process. *Journal of personality, 73*(6), 1715-1748. doi:10.1111/j.0022-3506.2005.00364.x
- Shiffman, S., Ferguson, S. G., & Gwaltney, C. J. (2006). Immediate hedonic response to smoking lapses: relationship to smoking relapse, and effects of nicotine replacement therapy. *Psychopharmacology, 184*(3-4), 608-618.
- Shiffman, S., Hickcox, M., Paty, J. A., Gnys, M., Kassel, J. D., & Richards, T. J. (1996). Progression from a smoking lapse to relapse: prediction from abstinence violation effects, nicotine dependence, and lapse characteristics. *J Consult Clin Psychol., 64*(5), 993-1002.
- Spaulding, A., Haley, D. R., & Zhao, M. (2014). Highly self-efficacious or simply delusional. *International Journal of Health Sciences, 2*(1), 01-17.
- Stead, L. F., Carroll, A. J., & Lancaster, T. (2000). Group behaviour therapy programmes for smoking cessation. *The Cochrane Library*.
- Stead, L. F., Hartmann-Boyce, J., Perera, R., & Lancaster, T. (2013). Telephone counselling for smoking cessation. *The Cochrane Library*.
- Stead, L. F., Koilpillai, P., Fanshawe, T. R., & Lancaster, T. (2016). Combined pharmacotherapy and behavioural interventions for smoking cessation. *Cochrane Database of Systematic Reviews*(3). doi:10.1002/14651858.CD008286.pub3
- Stead, L. F., Perera, R., Bullen, C., Mant, D., & Lancaster, T. (2008). Nicotine replacement therapy for smoking cessation. *Cochrane Database Syst Rev, 1*(1).

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

Strong, D. R., Brown, R. A., Kahler, C. W., Lloyd-Richardson, E. E., & Niaura, R. (2004).

Depression proneness in treatment-seeking smokers: A taxometric analysis. *Personality and individual differences*, *36*(5), 1155-1170.

Surgeon General. (2014). *The health consequences of smoking—50 years of progress: a report of the surgeon general*. Paper presented at the US Department of Health and Human Services.

Thomas, S., Fayter, D., Misso, K., Ogilvie, D., Petticrew, M., Sowden, A., . . . Worthy, G.

(2008). Population tobacco control interventions and their effects on social inequalities in smoking: systematic review. *Tobacco Control*, *17*(4), 230-237.

Thornicroft, G. (2011). Physical health disparities and mental illness: the scandal of premature mortality. *The British Journal of Psychiatry*, *199*(6), 441-442.

Tonstad, S., & Rollema, H. (2010). Varenicline in smoking cessation. *Expert Review of Respiratory Medicine*, *4*(3), 291-299.

Tulloch, H. E., Pipe, A. L., Els, C., Clyde, M. J., & Reid, R. D. (2016). Flexible, dual-form nicotine replacement therapy or varenicline in comparison with nicotine patch for smoking cessation: a randomized controlled trial. *BMC medicine*, *14*(1), 80.

Van Zundert, R. M., Ferguson, S. G., Shiffman, S., & Engels, R. C. (2010). Dynamic effects of self-efficacy on smoking lapses and relapse among adolescents. *Health Psychology*, *29*(3), 246.

Weinberger, A. H., Desai, R. A., & McKee, S. A. (2010). Nicotine withdrawal in US smokers with current mood, anxiety, alcohol use, and substance use disorders. *Drug and Alcohol Dependence*, *108*(1), 7-12.

Whittaker, R., McRobbie, H., Bullen, C., Rodgers, A., & Gu, Y. (2016). Mobile phone-based

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

- interventions for smoking cessation. *The Cochrane database of systematic reviews*, 4(100909747), CD006611.
- Williams, D. M., & Rhodes, R. E. (2016). The confounded self-efficacy construct: conceptual analysis and recommendations for future research. *Health Psychology Review*, 10(2), 113-128. doi:10.1080/17437199.2014.941998
- Williams, J., & Ziedonis, D. (2004). Addressing tobacco among individuals with a mental illness or an addiction. *Addict Behav*, 29, 1067 - 1083.
- Witkiewitz, K., & Marlatt, G. A. (2004). Relapse prevention for alcohol and drug problems: that was Zen, this is Tao. *American psychologist*, 59(4), 224.
- Zhang, Y., Feng, B., Geng, W., Owens, L., & Xi, J. (2016). “Overconfidence” versus “helplessness”: A qualitative study on abstinence self-efficacy of drug users in a male compulsory drug detention center in China. *Substance Abuse Treatment, Prevention, and Policy*, 11(1), 29. doi:10.1186/s13011-016-0073-2
- Ziedonis, D., Hitsman, B., Beckham, J. C., Zvolensky, M., Adler, L. E., Audrain-McGovern, J., . . . Riley, W. T. (2008). Tobacco use and cessation in psychiatric disorders: National Institute of Mental Health report. *Nicotine & Tobacco Research*, 10(12), 1691-1715. doi:10.1080/14622200802443569
- Zvolensky, M. J., Bonn-Miller, M. O., Feldner, M. T., Leen-Feldner, E., McLeish, A. C., & Gregor, K. (2006). Anxiety sensitivity: Concurrent associations with negative affect smoking motives and abstinence self-confidence among young adult smokers. *Addictive behaviors*, 31(3), 429-439. doi:http://dx.doi.org/10.1016/j.addbeh.2005.05.027

Dissertation Article 1: Task and barrier self-efficacy amongst treatment-seeking smokers with current, past or no psychiatric diagnosis.

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

Task and barrier self-efficacy amongst treatment-seeking smokers with current, past or no psychiatric diagnosis.

Clyde, M^{1,2}., Tulloch, H^{1,2,3}., Reid, R¹., Els, C⁴., & Pipe, A^{1,3}.

Author affiliation

¹University of Ottawa Heart Institute

²University of Ottawa, Department of Psychology

³University of Ottawa, Faculty of Medicine

⁴University of Alberta, Department of Psychiatry Medicine

Copyright permission and Publication reference:

Clyde, M., Tulloch, H., Reid, R., Els, C., & Pipe, A. (2015). Task and barrier self-efficacy among treatment-seeking smokers with current, past or no psychiatric diagnosis. *Addictive behaviors*, 46, 65-69

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

Abstract

Objective: Individuals with a lifetime diagnosis of mental illness smoke at rates greater than the general population, and have more difficulty quitting. Cessation self-efficacy has been linked with positive cessation outcomes and can be assessed as either task (confidence to quit) or barrier self-efficacy (confidence in the face of obstacles). We investigated differences in self-efficacy among individual smokers with a current, past or no lifetime diagnosis of psychiatric illness.

Methods: 737 treatment-seeking smokers provided demographics and smoking history and were assessed for nicotine dependence, motivation to quit, and task and barrier self-efficacy (Smoking Self-Efficacy Questionnaire; SEQ-12) for smoking cessation. Current and past psychiatric diagnosis was assessed with the Mini International Psychiatric Interview (M.I.N.I. 6.0).

ANOVA, chi-square and correlations were calculated for the smoking-related variables across the psychiatric categories.

Results: Those with a current diagnosis smoked more cigarettes and were highly nicotine dependent. These individuals had lower barrier self-efficacy compared to those with past or no diagnosis; no differences between groups were observed on task self-efficacy. Motivation to quit was significantly correlated with task self-efficacy in all 3 groups, but with barrier-self efficacy only amongst those with no lifetime diagnosis of psychiatric illness.

Conclusion: Our results highlight the differences in task and barrier cessation self-efficacy in treatment-seeking smokers. Those with a current psychiatric diagnosis have less confidence in their ability to quit when confronting barriers, especially those reflecting internal states. These results highlight the need for targeted interventions to improve cessation self-efficacy, an important determinant of health behavior change.

Key Words: Smoking Cessation; Self-Efficacy; Psychiatric

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

Introduction

Despite an overall decline in the prevalence rates of smoking in many communities, smoking remains a pervasive behaviour worldwide. Although approximately 17% of the Canadian population currently smokes, smoking rates are higher amongst marginalized groups including individuals with mental illness (Leonard et al., 2001). Prevalence rates in this population are 2-3 times higher than those in the general population (Lawrence, Mitrou, & Zubrick, 2009). People with mental illness consume nearly 50% of all cigarettes purchased each year (Lasser et al., 2000).

Guidelines (Fiore, Jaen, & Baker, 2008) and evidence-based interventions (Cahill, Stevens, & Lancaster, 2014) provide direction in effectively treating the general population, but those suffering from mental illness continue to have more difficulty quitting (Aubin, Rollema, Svensson, & Winterer, 2012). This suggests that current interventions are not as effective within this at-risk population (Cook et al., 2014). Motivation to quit has consistently been shown to be a major predictor of future quit attempts in the general population (McCaul et al., 2006). Lower motivation to quit amongst those with mental illness has been one hypothesis put forth to explain the poor cessation rates in this population (Prochaska, 2011). A recent meta-analysis contradicts this assumption -- individuals with mental illness reported similar levels of motivation to quit as those within the general population (Siru, Hulse, & Tait, 2009). Despite these findings, those with psychiatric diagnoses are less likely to receive interventions for smoking cessation; it is clear that we need to further investigate both motivation and factors associated with motivation in individuals with mental illness in order to enhance the success of smoking cessation interventions.

One factor strongly associated with motivation to quit and smoking abstinence is self-

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

efficacy (De Vries, Mudde, Dijkstra, & Willemsen, 1998; Dijkstra, De Vries, & Bakker, 1996).

The term self-efficacy was coined by Bandura (1977; 1997), and reflects the belief in one's ability to complete the task at hand and to reach one's goals (i.e., task self-efficacy). An expansion of this definition, sometimes referred to as barrier self-efficacy (Bandura, 1990), posits not only the individual's confidence in their ability to achieve their goal but also in their confidence to overcome the barriers that can hinder goal achievement. Therefore, to quit smoking one must not only believe that they are capable of quitting, but that they are able to do so in the face of numerous barriers.

Cessation self-efficacy is commonly assessed via either a single item assessing confidence (i.e., task self-efficacy) or by a multi-item barrier self-efficacy scale (Gwaltney, Metrik, Kahler, & Shiffman, 2009). Barrier self-efficacy scales often assess self-efficacy in the face of various challenging circumstances, including external (e.g., in the presence of friends who smoke) as well as internal factors (e.g., when feeling depressed). Although correlated, these two assessment methods might be measuring slightly different aspects of self-efficacy. In the recent review of self-efficacy and smoking cessation literature, a small (but insignificant) trend emerged in which single-item (task) questions better predicted future abstinence when directly compared with multi-item barrier self-efficacy measures (Gwaltney et al., 2009). More information is needed to elucidate if these two measures differ in order to better understand cessation self-efficacy. Independent of how cessation self-efficacy is assessed, it has been shown to be a robust predictor of future quit attempts, reduced relapse and abstinence outcome (Baer, Holt, & Lichtenstein, 1986; Cupertino et al., 2012; C. DiClemente, S. Fairhurst, & N. Piotrowski, 1995; DiClemente, Prochaska, & Gibertini, 1985; Elfeddali, Bolman, Candel, Wiers, & De Vries, 2012).

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

One major gap in research with self-efficacy and smoking outcomes is a lack of understanding as to how this relationship is affected by the presence of mental illness. The few studies that have explicitly investigated the influence of mental illness have found self-efficacy to be attenuated. Individuals with elevated symptoms of depression, for example, displayed high motivation to quit but low cessation task self-efficacy (Haukkala, Uutela, Vartiainen, Mcalister, & Knekt, 2000), while others found low levels of barrier self-efficacy among inpatients with schizophrenia (Mann-Wrobel, Bennett, Weiner, Buchanan, & Ball, 2011). Similarly, in substance users seeking treatment, elevated symptoms of depression were associated with lower abstinence barrier self-efficacy (Greenfield, Venner, Kelly, Slaymaker, & Bryan, 2012). The relationship between mental illness and cessation self-efficacy remains complex and poorly characterized.

The current study seeks to address a number of limitations within the smoking cessation literature. Most studies investigating smoking cessation among those with mental illness have been limited to in-patient settings of specific populations or have classified individuals using screening tools as opposed to structured diagnostic interviews. Investigating differences amongst community-dwelling treatment seekers with various diagnosed mental illnesses is important for the development of a more complete understanding of factors that support or inhibit smoking cessation success. Previous research also tends to examine only one of either single item (task) or multi-item (barrier) cessation self-efficacy; investigating differences in response patterns between both types of scales would provide information for the development of both clinical interventions and future research. In our present study, we investigated task and barrier cessation self-efficacy in community-dwelling treatment-seeking smokers with current, past or no lifetime diagnoses of mental illness. We also examined the relationship between task and barrier self-

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

efficacy and smoking-related variables by psychiatric diagnosis. Determining if there are differences across mental health status on pre-quit attempt task and barrier self-efficacy will help clarify the role self-efficacy may play in smoking cessation interventions.

Methods

This manuscript is based on data from smokers participating in the “*Flexible and extended dosing of nicotine replacement therapy (NRT) and varenicline in comparison to fixed dose NRT for smoking cessation: the FLEX trial*”, a parallel 3-group pre-post randomized control trial examining the relative effectiveness of varenicline (VR), long-term NRT with other NRT formulations (transdermal patch + adjunct nicotine product); NRT+) or NRT alone (transdermal patch; NRT). A more detailed account of the study rationale and methods can be found elsewhere (Tulloch et al., 2014).

Study participants and recruitment

Participants were recruited via media announcements, the Quit Smoking Program at the University of Ottawa Heart Institute (UOHI), word of mouth and referrals from primary care physicians. Individuals who were interested underwent preliminary screening for eligibility by a research coordinator. To be eligible, participants needed to be 18 or older, smoke 10 or more cigarettes per day over the past 6 months, be willing to make a quit attempt within 2-4 weeks following initial screening and be able to provide informed consent. Exclusion criteria included current or past month (more than 72 consecutive hours) use of the smoking cessation pharmacologic interventions (varenicline, NRT patch/gum/inhaler), being pregnant, breastfeeding or intending to become pregnant within the next year, current or previous (past 3 month) substance abuse, inability to read/write in English or French or having contraindications to varenicline or NRT products. In order to prevent contamination, only one individual per

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

household was eligible to participate. Eligible smokers were invited to a baseline assessment at which informed consent was obtained. This study received approval from the Ottawa Health Sciences Network Research Ethics Board.

Measures

Demographic information

At baseline, individuals completed a number of questionnaires assessing demographic information, including age, gender, marital and employment status, and education.

Psychiatric Diagnoses

At baseline, participants were assessed for current or lifetime psychiatric history using the Mini International Psychiatric Interview (M.I.N.I 6.0.0; D. V. Sheehan et al., 1998), a structured interview used to assess the presence of DSM-IV and ICD-10 psychiatric disorders. The M.I.N.I. has been shown to have high reliability and validity when compared to other structured clinical interviews for DSM-IV diagnoses (D. Sheehan, Janavs, Harnett-Sheehan, Sheehan, & Gray, 2009). Participants who did not meet any psychiatric diagnostic criteria in their lifetime were classified as ‘none’, while individuals who met criteria were classified as either ‘past’ or ‘current’ psychiatric diagnosis.

Smoking variables

Participants reported the number of cigarettes smoked per day and number of years as a daily smoker. Nicotine dependence was assessed via the 6-item Fagerstrom Test for Nicotine Dependence (FTND; Fagerstrom & Schneider, 1989). The mean score was calculated, with scores of 6 or more indicative of high dependence (Heatherton, Kozlowski, Frecker, & Fagerstrom, 1991). The FTND has been shown to have good reliability and validity compared to other measures of nicotine dependence (Cynthia S Pomerleau, Carton, Lutzke, Flessland, &

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

Pomerleau, 1994). Previous quit attempts were assessed by asking the participants to estimate the number of quit attempts lasting at least 24 hours over the past 12 months. Motivation to quit was assessed via the question “On a scale of 1 to 10, how motivated are you to quit smoking at the present time?” where 1 indicated being ‘not motivated at all’ and 10 indicating being ‘completely’ motivated. Task self-efficacy (i.e., general confidence to quit) was assessed at baseline using the question “On a scale of 1 to 10, how confident are you that you could quit smoking completely if you wanted to?” with a score of 1 indicating ‘not at all confident’ and 10 indicating ‘completely confident’. Barrier self-efficacy was assessed using the Smoking Cessation Self-Efficacy Questionnaire, a 12-item questionnaire with good reliability and validity compared to other measures of smoking cessation self-efficacy (SEQ-12; Etter, Bergman, Humair, & Perneger, 2000). Each item asks participants to state how sure they are that they would be able to refrain from smoking across different situations (1 – not sure at all; 5 – absolutely sure). The SEQ-12 is comprised of two factors (6-items each) of smoking cessation self-efficacy: internal stimuli (e.g., ‘when I’m stressed’; ‘when I’m sad’) and external stimuli (e.g., ‘when I’m with other smokers’; ‘after a meal’) self-efficacy. The SEQ-12 has a total score of 60, with higher scores indicating higher barrier self-efficacy. The total score and sub-scale scores were used in the statistical analyses. In addition to total scores, all 12 items were dichotomized, with those who responded ‘not at all sure’ or ‘not very sure’ being categorized as ‘Not confident’ (vs. ‘Confident’).

Statistical Analyses

Data were analyzed via IBM SPSS Statistics Version 21 (SPSS, 2012). To account for the missing data (6% or less for all individual items), all analyses were carried out using the SPSS multiple imputation procedure: five datasets were imputed using all variables as predictors and

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

analyzed concurrently. Frequency and Chi-square analyses were computed for demographic characteristics and dichotomized items of the SEQ-12 across psychiatric diagnosis (none, past and current). Univariate Analysis of Variance (ANOVA) was performed by psychiatric diagnosis across our dependent variables: Previous quit attempts, motivation, task self-efficacy and barrier self-efficacy (SEQ-12 total score, internal and external subscale scores). Finally, Pearson correlation coefficients were calculated for all variables stratified by psychiatric diagnosis.

Results

A total of 737 participants met inclusion criteria and completed the baseline assessment. Table 1 displays the demographic characteristics of our sample. Many of our participants (59%) were identified as having either a current (24.3%, N=179) or past (34.7%, N=256) psychiatric disorder. Those with a current psychiatric diagnosis were more likely to be female, single, have completed fewer overall years of formal education, and receiving disability benefits (all $p < 0.001$).

Table 2 displays the results for the smoking-related variables stratified by psychiatric diagnosis. On average, our study population reported consuming just less than a pack a day, smoking for over 31 years, making one serious quit attempt in the past 12 months, and scored high on nicotine dependence. Participants were highly motivated to quit smoking, and possessed relatively high task and barrier self-efficacy. Those with a current psychiatric diagnosis consumed more cigarettes per day, had higher dependence and lower barrier self-efficacy (overall scale and internal scale) than either of the other 2 groups. We found no differences between groups in terms of cumulative years smoked, previous quit attempts, motivation to quit and task or external barrier self-efficacy.

Table 3 presents the percentage of participants responding ‘not confident’ in their ability

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

to refrain from smoking to the 12-item barrier self-efficacy scale by psychiatric categories. Compared to those with no or past diagnoses, a greater proportion of those with a current diagnosis were not confident in their ability to refrain on four out of the six internal subscale items. On the external subscale, those with no diagnosis were less confident in their ability to refrain while drinking alcohol, while those with a current diagnosis were less confident when celebrating or when drinking coffee compared to those with a past or no diagnosis, respectively.

Table 4 shows Pearson correlations between the smoking-related variables across the three psychiatric diagnostic categories. As expected, there were significant (but modest) correlations between task and barrier self-efficacy for all 3 groups. Motivation to quit was significantly positively correlated with task self-efficacy across all three groups; however, motivation to quit was only significantly positively correlated with barrier self-efficacy amongst individuals with no lifetime diagnosis. Those meeting criteria for a current diagnosis had a significant negative correlation between barrier self-efficacy and both cigarettes smoked per day and the total score for nicotine dependence, a finding not shared by those with no lifetime or past diagnosis. Significant positive correlation between past quit attempts and barrier self-efficacy (overall and external subscale) was found for the current diagnosis group only.

Discussion

This study is the first to compare both task and barrier cessation self-efficacy simultaneously across a community sample of treatment-seeking smokers with and without a lifetime diagnosis of psychiatric illness. Our results highlight differences between task and barrier self-efficacy evaluations measured pre-cessation as well as by psychiatric category. Those with a current psychiatric diagnosis had significantly lower scores on total and internal-state barrier self-efficacy than those with past or no diagnosis. In fact, individuals with a current

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

illness were more likely to endorse being ‘not confident’ in reference to their ability to refrain from smoking for the majority of the items of the SEQ-12, especially those related to internal affective states (e.g., when feeling depressed, feeling nervous).

Our principal finding of lower self-efficacy amongst those with a psychiatric diagnosis are consistent with previous studies, including patients with elevated depressive symptoms (Haukkala et al., 2000), psychiatric inpatients (Mann-Wrobel et al., 2011) and individuals with major depression and nicotine dependence (John, Meyer, Rumpf, & Hapke, 2004). The present study significantly adds to these findings by evaluating psychiatric illness through a structured diagnostic clinical interview as opposed to symptom checklists, through the recruitment of community-dwelling smokers with a variety of mental health issues rather than specific psychiatric samples (e.g., inpatients with schizophrenia), and by evaluating self-efficacy across those with and without a lifetime diagnosis of psychiatric illness.

Our results and the discrepancy between task and barrier self-efficacy may reflect the beliefs surrounding smoking amongst those with a mental illness. Previous studies have identified negative reinforcement motives (e.g., smoking to relieve their negative affect; Piper et al., 2010) and the endorsement of more positive expectancies about smoking (e.g., reduction of negative affect, boredom; Weinberger, George, & McKee, 2010). These beliefs may play an important role when individuals evaluate their cessation self-efficacy in the face of specific barriers. This effect is seemingly stronger amongst those with a current psychiatric diagnosis. In actuality, research has shown these beliefs to be myths; long-term abstinence has been shown to be associated with improved mood (Shahab & West, 2009). Combating this misconception is an important goal for all smokers, who should be made aware of the detrimental effects smoking can have on mood. One study found that providing smokers with a leaflet explaining the effects

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

of tobacco (increased stress and negative affect) was a simple yet effective way of educating current tobacco users about this mistaken belief (Parrott & Murphy, 2012). To date, it is unknown if this knowledge acquisition translates into behavior change.

Given the lower confidence and scores for internal-state self-efficacy in participants with a current psychiatric disorder, additional support and training of enhanced coping strategies are needed as adjuncts to current cessation interventions. The benefits of combining psychiatric treatments (pharmacological and/or behavioural) with cessation interventions have been established (American Psychiatric Association, 2006; Campion, Checinski, & Nurse, 2008; Weinberger, Mazure, Morlett, & McKee, 2013). Future research should now focus on which combined therapies work best for psychiatric patients in general, as well as in specific psychiatric disorders (e.g., concurrent CBT for individuals with major depression (van der Meer, Willemsen, Smit, & Cuijpers, 2013)). Both clinicians and individuals with a history of psychiatric illness need to be reminded that quitting has not been shown to precipitate relapse of mental health symptoms (Judith J. Prochaska, 2010).

In developing the SEQ-12, Etter and colleagues (2000) found a strong relationship between their scale and a single item measuring confidence to quit in current smokers. Our results emphasize the important role that mental illness plays in influencing the evaluation of self-efficacy. When measured pre-cessation, task and barrier cessation self-efficacy appear to be evaluated differently within this subpopulation, as they were very modestly correlated. That a multi-item scale assessing an individual's belief in their ability to abstain from smoking across multiple situations can elicit different responses compared to a single item measuring overall confidence (task self-efficacy) is not entirely surprising. Given the chance to consider their ability to refrain from smoking in high-risk situations, the barrier self-efficacy scale might be

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

expected to give a more realistic estimation. A recent meta-analysis (Gwaltney et al., 2009) found that only a small number of studies (n=2) evaluated both single vs. multi-item scales of self-efficacy on abstinence simultaneously; no studies investigated these measures concurrently across psychiatric samples. Future studies should assess both task and barrier self-efficacy in order to optimize our understanding of the information each scale can provide for intervention development. The inclusion of barrier self-efficacy may add valuable clinical information by identifying potential relapse triggers (Gwaltney et al., 2009), particularly when counseling smokers with a current psychiatric illness.

Not surprisingly for a study of treatment-seeking smokers, motivation to quit was high in all three groups, providing further evidence that those with a psychiatric diagnosis are motivated to quit (Siru et al., 2009). Bandura's (1997) self-efficacy theory posits that self-efficacy is an important predictor of motivation and health behavior change. In our sample, correlations between motivation and task self-efficacy were significant across groups, while the relationship with barrier self-efficacy was very modest for individuals with no diagnosis, and not significant for those with a lifetime diagnosis. One previous study found that elevated symptoms of depression were associated with high motivation to quit but low task self-efficacy; unfortunately, they did not assess for barrier self-efficacy (Haukkala et al., 2000). The presence of mental illness complicates the relationship between motivation to quit and cessation self-efficacy and needs to be addressed in subsequent research.

Bandura (1997) also postulated that self-efficacy may be influenced by physiological or psychological arousal and previous experience (e.g., mastery; Bandura, 1997). In our study, barrier self-efficacy was significantly correlated with cigarettes smoked per day and nicotine dependence (both negative), and previous quit attempts (positive), only amongst those with a

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

current diagnosis. Interestingly, these results were not found for task self-efficacy. It may be that those with a current diagnosis take into account their current smoking level when assessing their confidence in the face of barriers. While they appear to associate previous quit attempts as positive experiences (i.e., sense of mastery), their high consumption and dependence might be considered difficult barriers to overcome.

Our study had a number of strengths. Eligibility criteria for the FLEX trial did not restrict participation based on mental health status. As a result, our baseline sample included a large number of individuals meeting criteria for a lifetime psychiatric diagnosis (59%). This allowed for the first concurrent comparison of task and barrier cessation self-efficacy between those with and without a psychiatric diagnosis. It is also important to note that all participants were evaluated with a structured clinical diagnostic interview conducted by clinical psychology staff, considered the gold standard for diagnosing mental illness. Finally, our study examined both single-item (task self-efficacy) and a multi-item scale (barrier self-efficacy), which allowed us to directly compare how participants responded differentially to these two measures, as well as examine how each type of self-efficacy relates to different smoking-related variables. Despite these strengths, it is important to note that results presented are cross-sectional and, therefore, no causal linkages can be established. We look forward to building on these findings with abstinence outcomes as follow-up measures are completed.

In conclusion, we found that individuals with a current psychiatric diagnosis had statistically significantly lower overall and internal barrier self-efficacy. Previous research has shown that interventions aimed at increasing self-efficacy (Hyde et al., 2008) can be effective in stimulating health behaviour change. They may be of particular benefit to the psychiatric population, given the propensity for lower overall self-efficacy. Finally, we have highlighted

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

differences in ratings of task and barrier self-efficacy, which might have important implications for future smoking cessation research.

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

References

- Aubin, H.-J., Rollema, H., Svensson, T. H., & Winterer, G. (2012). Smoking, quitting, and psychiatric disease: a review. *Neuroscience & Biobehavioral Reviews*, *36*(1), 271-284.
- Baer, J. S., Holt, C. S., & Lichtenstein, E. (1986). Self-efficacy and smoking reexamined: Construct validity and clinical utility. *Journal of consulting and clinical psychology*, *54*(6), 846-852. doi: 10.1037/0022-006x.54.6.846
- Bandura, A. (1977). Self-efficacy – Toward a unifying theory of behavioural change. *Psychological Review*, *84*(2), 191-215. doi: 10.1037//0033-295x.84.2.191
- Bandura, A. (1990). Perceived self-efficacy in the exercise of personal agency. *Journal of Applied Sport Psychology*, *2*(2), 128-163. doi: 10.1080/10413209008406426
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York, NY, US: W H Freeman/Times Books/ Henry Holt & Co.
- Bandura, A. (1998). Health promotion from the perspective of social cognitive theory. *Psychology and Health*, *13*(4), 623-649.
- Cahill, K., Stevens, S., & Lancaster, T. (2014). PHarmacological treatments for smoking cessation. *JAMA*, *311*(2), 193-194. doi: 10.1001/jama.2013.283787
- Campion, J., Checinski, K., & Nurse, J. (2008). Review of smoking cessation treatments for people with mental illness. *Advances in Psychiatric Treatment*, *14*(3), 208-216.
- Cook, B., Wayne, G., Kafali, E., Liu, Z., Shu, C., & Flores, M. (2014). Trends in smoking among adults with mental illness and association between mental health treatment and smoking cessation. *JAMA*, *311*(2), 172-182. doi: 10.1001/jama.2013.284985
- Cupertino, A.-P., Berg, C., Gajewski, B., Hui, S.-k. A., Richter, K., Catley, D., & Ellerbeck, E. F. (2012). Change in self-efficacy, autonomous and controlled motivation predicting

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

- smoking. *Journal of Health Psychology*, 17(5), 640-652.
- De Vries, H., Mudde, A. N., Dijkstra, A., & Willemsen, M. C. (1998). Differential beliefs, perceived social influences, and self-efficacy expectations among smokers in various motivational phases. *Preventive medicine*, 27(5), 681-689.
- DiClemente, C., Fairhurst, S., & Piotrowski, N. (1995). Self-Efficacy and Addictive Behaviors. In J. Maddux (Ed.), *Self-Efficacy, Adaptation, and Adjustment* (pp. 109-141): Springer US.
- DiClemente, C., Prochaska, J., & Gibertini, M. (1985). Self-efficacy and the stages of self-change of smoking. *Cognitive Therapy and Research*, 9(2), 181-200. doi: 10.1007/bf01204849
- DiClemente, C. C., Fairhurst, S. K., & Piotrowski, N. A. (1995). Self-efficacy and addictive behaviors *Self-efficacy, adaptation, and adjustment* (pp. 109-141): Springer.
- Dijkstra, A., De Vries, H., & Bakker, M. (1996). Pros and cons of quitting, self-efficacy, and the stages of change in smoking cessation. *Journal of consulting and clinical psychology*, 64(4), 758.
- Elfeddali, I., Bolman, C., Candel, M., Wiers, R., & De Vries, H. (2012). The role of self-efficacy, recovery self-efficacy, and preparatory planning in predicting short-term smoking relapse. *British journal of health psychology*, 17(1), 185-201.
- Etter, J. F., Bergman, M. M., Humair, J. P., & Perneger, T. V. (2000). Development and validation of a scale measuring self-efficacy of current and former smokers. *Addiction*, 95(6), 901-913.
- Fagerstrom, K.-O., & Schneider, N. G. (1989). Measuring nicotine dependence: a review of the Fagerstrom Tolerance Questionnaire. *Journal of behavioral medicine*, 12(2), 159-182.

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

- Fiore, M., Jaen, C., & Baker, T. (2008). A clinical practice guideline for treating tobacco use and dependence: 2008 update. A U.S. Public Health Service report. *Am J Prev Med.*, *35*(2), 158-176. doi: 110.1016/j.amepre.2008.1004.1009.
- Greenfield, B. L., Venner, K. L., Kelly, J. F., Slaymaker, V., & Bryan, A. D. (2012). The impact of depression on abstinence self-efficacy and substance use outcomes among emerging adults in residential treatment. *Psychology of Addictive Behaviors*, *26*(2), 246.
- Gulliver, S. B., Hughes, J. R., Solomon, L. J., & Dey, A. N. (1995). An investigation of self-efficacy, partner support and daily stresses as predictors of relapse to smoking in self-quitters. *Addiction*, *90*(6), 767-772. doi: 10.1046/j.1360-0443.1995.9067673.x
- Gwaltney, C. J., Metrik, J., Kahler, C. W., & Shiffman, S. (2009). Self-efficacy and smoking cessation: A meta-analysis. *Psychology of Addictive Behaviors*, *23*(1), 56-66. doi: 10.1037/a0013529
- Hall, S. M., Muñoz, R. F., Reus, V. I., & Sees, K. L. (1993). Nicotine, negative affect, and depression. *Journal of Consulting and Clinical Psychology*, *61*(5), 761-767. doi: 10.1037/0022-006X.61.5.761
- Haukkala, A., Uutela, A., Vartiainen, E., Mcalister, A., & Knekt, P. (2000). Depression and smoking cessation: the role of motivation and self-efficacy. *Addictive behaviors*, *25*(2), 311-316.
- Heatherton, T. F., Kozlowski, L. T., Frecker, R. C., & Fagerstrom, K.-O. (1991). The Fagerström Test for Nicotine Dependence: a revision of the Fagerstrom Tolerance Questionnaire. *British journal of addiction*, *86*(9), 1119-1127. doi: 10.1111/j.1360-0443.1991.tb01879.x
- Hyde, J., Hankins, M., Deale, A., & Marteau, T. M. (2008). Interventions to Increase Self-efficacy in the Context of Addiction Behaviours: A Systematic Literature Review.

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

Journal of Health Psychology, 13(5), 607-623. doi: 10.1177/1359105308090933

- John, U., Meyer, C., Rumpf, H. J., & Hapke, U. (2004). Self-efficacy to refrain from smoking predicted by major depression and nicotine dependence. *Addictive behaviors, 29(5), 857-866. doi: <http://dx.doi.org/10.1016/j.addbeh.2004.02.053>*
- Lasser, K., Boyd, J. W., Woolhandler, S., Himmelstein, D. U., McCormick, D., & Bor, D. H. (2000). Smoking and mental illness: a population-based prevalence study. *JAMA, 284(20), 2606-2610.*
- Lawrence, D., Mitrou, F., & Zubrick, S. (2009). Smoking and mental illness: results from population surveys in Australia and the United States. *BMC Public Health, 9(1), 285.*
- Leonard, S., Adler, L., Benhammou, K., Berger, R., Breese, C., Drebing, C., . . . Olincy, A. (2001). Smoking and mental illness. *Pharmacology Biochemistry and Behavior, 70(4), 561-570.*
- Mann-Wrobel, M. C., Bennett, M. E., Weiner, E. E., Buchanan, R. W., & Ball, M. P. (2011). Smoking history and motivation to quit in smokers with schizophrenia in a smoking cessation program. *Schizophrenia research, 126(1), 277-283.*
- McCaul, K. D., Hockemeyer, J. R., Johnson, R. J., Zetocha, K., Quinlan, K., & Glasgow, R. E. (2006). Motivation to quit using cigarettes: a review. *Addictive behaviors, 31(1), 42-56.*
- McClave, A. K., McKnight-Eily, L. R., Davis, S. P., & Dube, S. R. (2010). Smoking characteristics of adults with selected lifetime mental illnesses: results from the 2007 National Health Interview Survey. *American journal of public health, 100(12), 2464-2472.*
- Morrell, H. E. R., Skarbek, E. A., & Cohen, L. M. (2011). The relationship between self-efficacy and nicotine withdrawal severity among adult smokers. *Addiction Research & Theory,*

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

19(6), 494-503. doi: 10.3109/16066359.2011.562995

- Parrott, A. C., & Murphy, R. S. (2012). Explaining the stress-inducing effects of nicotine to cigarette smokers. *Human Psychopharmacology: Clinical and Experimental*, 27(2), 150-155. doi: 10.1002/hup.1247
- Perkins, K. A., Parzynski, C., Mercincavage, M., Conklin, C. A., & Fonte, C. A. (2012). Is self-efficacy for smoking abstinence a cause of, or a reflection on, smoking behavior change? *Experimental and clinical psychopharmacology*, 20(1), 56.
- Piper, M. E., Smith, S. S., Schlam, T. R., Fleming, M. F., Bittrich, A. A., Brown, J. L., . . . Baker, T. B. (2010). Psychiatric disorders in smokers seeking treatment for tobacco dependence: relations with tobacco dependence and cessation. *Journal of consulting and clinical psychology*, 78(1), 13.
- Pomerleau, C. S., Carton, S. M., Lutzke, M. L., Flessland, K. A., & Pomerleau, O. F. (1994). Reliability of the Fagerstrom tolerance questionnaire and the Fagerstrom test for nicotine dependence. *Addictive behaviors*, 19(1), 33-39.
- Prochaska, J. J. (2010). Failure to treat tobacco use in mental health and addiction treatment settings: A form of harm reduction? *Drug and alcohol dependence*, 110(3), 177-182. doi: <http://dx.doi.org/10.1016/j.drugalcdep.2010.03.002>
- Prochaska, J. J. (2011). Smoking and mental illness—breaking the link. *New England Journal of Medicine*, 365(3), 196-198.
- Shahab, L., & West, R. (2009). Do ex-smokers report feeling happier following cessation? Evidence from a cross-sectional survey. *Nicotine & Tobacco Research*, 11(5), 553-557.
- Sheehan, D., Janavs, J., Harnett-Sheehan, K., Sheehan, M., & Gray, C. (2009). The Mini International Neuropsychiatric Interview Version 6.0 (MINI 6.0).

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

- Sheehan, D. V., Lecrubier, Y., Sheehan, K. H., Amorim, P., Janavs, J., Weiller, E., . . . Dunbar, G. C. (1998). The Mini-International Neuropsychiatric Interview (MINI): the development and validation of a structured diagnostic psychiatric interview for DSM-IV and ICD-10. *Journal of clinical psychiatry*, *59*, 22-33.
- Siru, R., Hulse, G. K., & Tait, R. J. (2009). Assessing motivation to quit smoking in people with mental illness: a review. *Addiction*, *104*(5), 719-733.
- SPSS, I. (2012). IBM SPSS Statistics Version 21. *Boston, Mass: International Business Machines Corp.*
- Strecher, V. J., DeVellis, B. M., Becker, M. H., & Rosenstock, I. M. (1986). The role of self-efficacy in achieving health behavior change. *Health Education & Behavior*, *13*(1), 73-92.
- Tulloch, H., Pipe, A., Els, C., Aitken, D., Clyde, M., Corran, B., & Reid, R. D. (2014). Flexible and extended dosing of nicotine replacement therapy or varenicline in comparison to fixed dose nicotine replacement therapy for smoking cessation: Rationale, methods and participant characteristics of the FLEX trial. *Contemporary Clinical Trials*, *38*(2), 304-313. doi: <http://dx.doi.org/10.1016/j.cct.2014.05.011>
- van der Meer, R. M., Willemsen, M. C., Smit, F., & Cuijpers, P. (2013). Smoking cessation interventions for smokers with current or past depression. *Cochrane Database Syst Rev*, *8*.
- Weinberger, A. H., George, T. P., & McKee, S. A. (2010). Differences in smoking expectancies in smokers with and without a history of major depression. *Addictive Behaviors*, *36*(4), 434-437.
- Weinberger, A. H., Mazure, C. M., Morlett, A., & McKee, S. A. (2013). Two Decades of

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

Smoking Cessation Treatment Research on Smokers with Depression: 1990–2010.

Nicotine & Tobacco Research, 15(6), 1014-1031. doi: 10.1093/ntr/nts213

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

Table 1 – Demographic variables by psychiatric categories					
	Overall (N=737)	None (N=302)	Lifetime (N=256)	Current (N=179)	p-value
Age	48.61 (10.83)	48.57 (11.07)	49.33 (11.11)	47.64 (9.95)	0.276
Gender					
<i>Male</i>	395 (53.6)	188 (62.3)	128 (50.0)	79 (44.1)	0.000
<i>Female</i>	342 (46.4)	114 (37.7)	128 (50.0)	100 (55.9)	
Marital Status					
<i>Single</i>	161 (22.0)	52 (17.3)	52 (20.4)	57 (32.0)	0.000
<i>Married</i>	340 (46.3)	172 (57.3)	99 (38.8)	69 (38.8)	
<i>Separated/Divorced</i>	169 (27.2)	63 (21.0)	90 (35.2)	46 (25.8)	
<i>Widowed</i>	33 (4.5)	13 (4.3)	14 (5.5)	6 (3.4)	
Education	14.13 (2.95)	14.61 (2.81)	14.00 (2.99)	13.48 (3.01)	0.000
Employment					
<i>Full time</i>	381 (52.0)	203 (67.9)	125 (49.0)	53 (29.6)	0.000
<i>Part Time</i>	68 (9.3)	23 (7.7)	21 (8.2)	24 (9.3)	
<i>Retired</i>	92 (12.6)	41 (13.7)	38 (14.9)	13 (7.3)	
<i>Unemployed</i>	66 (9.0)	19 (6.3)	25 (9.5)	22 (12.3)	
<i>Disability</i>	126 (17.2)	13 (4.3)	46 (18.0)	67 (37.4)	

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

Table 2 - Smoking variables by psychiatric categories					
	Overall	None (N=302)	Lifetime (N=256)	Current (N=179)	p-value
Cigarettes smoked per day	23.24 (10.76)	21.9 (9.66)	23.09 (9.57)	25.68 (13.43)	0.001
Years smoked	31.04 (11.67)	30.81 (11.82)	31.97 (11.83)	30.10 (11.17)	0.238
Previous Quit attempts	1.15 (2.96)	1.07 (3.21)	1.24 (3.23)	1.14 (1.95)	0.800
Nicotine Dependence	6.14 (2.22)	5.59 (2.19)	6.27 (2.20)	6.85 (2.07)	0.000
Barrier Self-efficacy overall	35.03 (11.28)	35.99 (11.00)	35.43 (10.50)	32.82 (12.50)	0.009
Barrier Self-efficacy internal scale	17.31 (6.18)	18.14 (6.00)	17.28 (5.86)	15.96 (6.70)	0.001
Barrier Self-efficacy external scale	17.72 (6.19)	17.86 (6.13)	18.15 (5.88)	16.86 (6.66)	0.089
Task self-efficacy	7.37 (2.16)	7.44 (2.18)	7.40 (2.18)	7.21 (2.11)	0.441
Motivation to quit	8.69 (1.47)	8.76 (1.39)	8.76 (1.36)	8.46 (1.71)	0.060

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

Table 3 Percentage responding 'Not confident' for SEQ-12 items by Psychiatric Diagnosis				
SEQ Item	None	Past	Current	p-value
Internal Scale				
1. Feeling Nervous	103 (34.2)	94 (36.3)	94 (52.2)	0.000
2. Feeling Depressed	106 (35.7)	107 (42.0)	100 (55.9)	0.000
3. Feeling Angry	127 (42.6)	133 (52.2)	104 (58.4)	0.002
4. Feeling Anxious	121 (41.2)	121 (47.8)	107 (60.5)	0.000
5. When thinking of a problem	97 (32.3)	74 (29.6)	76 (43.2)	0.010
6. When you have the urge to smoke	128 (42.7)	102 (39.8)	91 (51.4)	0.051
External Scale				
7. Drinking with friends	130 (43.6)	96 (38.1)	70 (39.8)	0.402
8. When celebrating	95 (31.7)	63 (24.6)	65 (36.3)	0.027
9. Drinking alcohol	140 (47.0)	94 (37.0)	79 (45.1)	0.050
10. With smokers	149 (49.7)	146 (57.0)	103 (57.5)	0.128
11. After a meal	127 (42.5)	106 (41.6)	91 (51.1)	0.104
12. Drinking coffee	109 (36.3)	105 (41.2)	87 (48.6)	0.030

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

Table 4 - Correlations by psychiatric diagnosis

	<i>CPD</i>	<i>FTND</i>	<i>Quit att.</i>	<i>Motivation</i>	<i>Task SE</i>	<i>Barrier SE Total</i>	<i>Barrier SE Int.</i>	<i>Barrier SE Ext.</i>	
No lifetime diagnosis	<i>CPD</i>	.555**	.025	.025	-.078	.021	.005	.026	
	<i>FTND</i>	.555**	-.026	-.060	-.144*	-.107	-.139*	-.092	
	<i>Quit att.</i>	.025	-.026		-.087	-.037	-.051	-.019	
	<i>Motivation</i>	.025	-.060	.060	.429**	.228**	.219**	.177**	
	<i>Task SE</i>	-.078	-.144*	-.087	.429**	.321**	.336**	.261**	
	<i>Barrier SE Total</i>	.021	-.107	-.037	.228**	.321**	.904**	.913**	
	<i>Barrier SE Int.</i>	.005	-.139*	-.051	.219**	.336**	.904**	.650**	
	<i>Barrier SE Ext.</i>	.026	-.092	-.019	.177**	.261**	.913**	.650**	
	<i>CPD</i>		.617**	.138*	-.054	-.041	.000	-.029	.006
Past psychiatric diagnosis	<i>FTND</i>	.617**	.003	-.025	-.110	-.065	-.112	-.040	
	<i>Quit att.</i>	.138*	.003	.039	.054	-.118	-.112	-.114	
	<i>Motivation</i>	-.054	-.025	.039	.403**	.045	.061	.059	
	<i>Task SE</i>	-.041	-.110	.054	.403**	.209**	.243**	.133*	
	<i>Barrier SE Total</i>	.000	-.065	-.118	.045	.209**	.895**	.892**	
	<i>Barrier SE Int.</i>	-.029	-.112	-.112	.061	.243**	.895**	.597**	
	<i>Barrier SE Ext.</i>	.006	-.040	-.114	.059	.133*	.892**	.597**	
	<i>CPD</i>		.566**	-.122	-.011	-.109	-.175*	-.117	-.171*
	<i>FTND</i>	.566**		-.139	-.002	-.088	-.252**	-.212**	-.217**
Current psychiatric diagnosis	<i>Quit att.</i>	-.122	-.139	.135	.053	.233**	.136	.211**	
	<i>Motivation</i>	-.011	-.002	.135	.270**	-.016	-.001	.002	
	<i>Task SE</i>	-.109	-.088	.053	.270**	.243**	.240**	.202*	
	<i>Barrier SE Total</i>	-.175*	-.252**	.233**	-.016	.243**	.947**	.949**	
	<i>Barrier SE Int.</i>	-.117	-.212**	.136	-.001	.240**	.947**	.797**	
	<i>Barrier SE Ext.</i>	-.171*	-.217**	.211**	.002	.202*	.949**	.797**	

Note: CPD = Cigarettes Per Day; FTND = Fagerstrom Test of Nicotine Dependence (Sum score); Quit att. = Number of quit attempts lasting at least 24 hour quit attempts in the last 12 months; Barrier SE Total = SEQ-12 total score; Barrier SE Int. = SEQ-12 internal subscale score; Barrier SE Ext. = SEQ-12 external subscale score; SE = Self-Efficacy
 ** p < 0.001; * p < 0.05

Dissertation Article 2: Factor structure of the Smoking Cessation Self-Efficacy Questionnaire among smokers with and without a psychiatric diagnosis.

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

Factor structure of the Smoking Cessation Self-Efficacy Questionnaire among smokers with and without a psychiatric diagnosis.

Matthew Clyde^{1,2}, Andrew Pipe^{1,3}, Charles Els⁴, Robert Reid^{1,3}, Heather Tulloch^{1,2,3}

Author affiliation

¹University of Ottawa Heart Institute

²University of Ottawa, Department of Psychology

³University of Ottawa, Faculty of Medicine

⁴University of Alberta, Department of Psychiatry

Publication Reference:

Clyde, M., Pipe, A., Els, C., Reid, R., & Tulloch, H. (2017). Factor structure of the Smoking Cessation Self-Efficacy Questionnaire among smokers with and without a psychiatric diagnosis. *Psychology of Addictive Behaviors*, 31(2), 162.

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

Abstract

Cessation self-efficacy has been shown to be a consistent predictor of smoking cessation outcomes. To date no scale assessing cessation self-efficacy has been validated across smokers with and without a psychiatric diagnosis (current or past). Smokers with a psychiatric diagnosis are typically heavy smokers, have a more difficult time quitting and are more prone to experience lower self-efficacy. Determining whether smoking cessation self-efficacy scores are invariant across these populations is crucial for future research and intervention strategies. Data from the FLEX study, a randomized control trial for smoking cessation, was used to assess the factor structure of the Smoking Cessation Self-Efficacy Questionnaire (SEQ-12), a 12-item scale assessing an individual's confidence to refrain from smoking. Exploratory factor analysis (EFA) was performed to assess factor loadings. Confirmatory factor analysis (CFA) was used to compare the model's fit between the original factor structure and the present data, and to test for measurement invariance across with a current, past or no psychiatric diagnosis.

Initial support was found for both a two- and three-factor structure. Using CFA, only the three-factor model displayed adequate fit indices (GFI=0.924, CFI=0.973, NFI = 0.950, RMSEA = 0.040, RMR=0.063). Results from the model comparisons showed no differences between those with a current, past or no psychiatric diagnosis ($\chi^2(30) = 38.64, p = 0.134$). The three factors were highly correlated, indicative of an underlying global factor. The SEQ-12 showed evidence for validity and measurement invariance across treatment-seeking smokers, regardless of psychiatric status.

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

Introduction

There have been distinct changes in smoking acceptability and an overall decline in the prevalence of smoking over the past two decades (Brown, Moodie, & Hastings, 2009; Levy & Friend, 2003; Thomas et al., 2008). Unfortunately, smoking rates have stabilized in recent years, and are elevated among several at-risk populations, particularly those with a psychiatric illness (Cook et al., 2014). These individuals smoke at rates 2-3 times greater than the general population, smoke more cigarettes per day and are more likely to be nicotine dependent (Grant, Hasin, Chou, Stinson, & Dawson, 2004). They appear to have more difficulty quitting (Lasser et al., 2000) and numerous additional health problems as a consequence; smoking is a major contributor to higher rates of premature mortality amongst this population (Ziedonis & Williams, 2003).

Recent evidence suggests that smokers with a psychiatric illness are equally motivated to quit smoking (Siru, Hulse, Khan, & Tait, 2010), but are more likely to experience more severe symptoms of withdrawal and lower levels of confidence during a cessation attempt (Haukkala, Uutela, Vartiainen, Mcalister, & Knekt, 2000; Weinberger, Desai, & McKee, 2010). Research which investigated stigmatization among individuals who have a psychiatric diagnosis found that they frequently endorse overly negative self-concepts (Livingston & Boyd, 2010), leading them to experience increased feelings of hopelessness and less confidence in their ability when implementing health behavior changes (Corrigan, Larson, & Ruesch, 2009). Before investigating how one's confidence to quit among individuals with a psychiatric illness might affect a quit attempt, a better evaluation of the psychometric properties associated with cessation self-efficacy scales is required.

Self-efficacy theory remains one of the most widely applied theories of health behavior

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

change (Clark & Dodge, 1999; DiClemente, Fairhurst, & Piotrowski, 1995; Kang, Deren, Andia, Colon, & Robles, 2004; Marcus, Selby, Niaura, & Rossi, 1992). Self-efficacy refers to an individual's belief in their ability to produce or master behaviours in order to reach a particular goal (e.g., an individual's confidence in their ability to quit smoking). The definition has since been expanded to encompass an individual's confidence in their ability to achieve goals in the face of specific barriers (e.g., remaining smoke-free when with other smokers). While self-efficacy continues to be applied across many domains, it has become widely adopted in research examining addictions (Livingston & Boyd, 2010), including smoking cessation (DiClemente, Prochaska, & Gibertini, 1985; Dijkstra, De Vries, & Bakker, 1996; Martinez et al., 2010). Cessation self-efficacy is a consistent predictor of both abstinence and relapse in smoking cessation trials; it is considered an important target when seeking to enhance smoking cessation success.

Cessation self-efficacy has been assessed with a single-item to measure global confidence, as well as via multi-item scales that measure an individual's confidence in remaining smoke-free in varying situations (Gwaltney, Metrik, Kahler, & Shiffman, 2009). Not surprisingly, research that has focused on these potential 'high-risk' situations have led to the development of several cessation self-efficacy scales of differing length and with varying reliability and validity (Baer, Holt, & Lichtenstein, 1986; DiClemente et al., 1985; Mudde, Kok, & Strecher, 1995; Stuart, Borland, & McMurray, 1994). This variability has made it difficult to generalize findings across studies.

In an effort to account for these issues, Etter and colleagues (Etter, Bergman, Humair, & Perneger, 2000) began construction of the Smoking Cessation Self-Efficacy Questionnaire (SEQ-12), a measure which assesses an individual's belief in their ability to refrain from

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

smoking in 12 previously identified and empirically supported high-risk situations. The goal was to amalgamate findings from several studies to derive a more clinically meaningful scale, which demonstrated psychometrically sound properties. Item selection was derived in a systematic fashion by first selecting items previously identified in the literature endorsed by their sample of current and former smokers. The results of their factor analyses yielded a two-dimensional 12-item scale, with the two subscales assessing the individual's confidence in refraining from smoking when faced with *internal* (e.g., feeling depressed, feeling anxious) and *external* stimuli (e.g., when with other smokers, when drinking alcohol). Both internal and external subscales displayed high internal consistency (alpha of 0.95 and 0.94, respectively), high test-retest reliability (0.95 and 0.93, respectively), and construct validity (high scores predicting cessation, lower scores being associated with higher cigarette consumption). Importantly, both subscales were determined to be clinically meaningful and interpretable based on previous findings, reflecting smoking habits and changes in the social tolerance of smoking of the time.

To date, no study has assessed the reliability and validity of any cessation self-efficacy scale among smokers with psychiatric illness. The present study sought to address this limitation in the literature by assessing the psychometric properties of the SEQ-12 in treatment-seeking smokers with either a current, past and no psychiatric diagnosis.

Methods

This paper is based on data from smokers participating in the “*Flexible and extended dosing of nicotine replacement therapy (NRT) and varenicline in comparison to fixed dose NRT for smoking cessation: the FLEX trial*”: a parallel, 3-group, pre-post, randomized control trial examining the effectiveness of nicotine replacement therapy (transdermal patch; NRT); extended and combined nicotine replacement therapy (NRT) + adjunct NRT formulations (transdermal

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

patch + adjunct nicotine product; NRT+) or, extended varenicline (VR) treatment. Prior to randomization, all eligible participants were stratified based on psychiatric status (no diagnosis vs. lifetime diagnosis). Participants received 6 (at baseline and weeks 1, 3, 5, 8 and 10 post target quit date) 15-minute counselling sessions with nurses specialized in smoking cessation counseling. During these sessions, participants provided expired CO samples to verify smoking status, and completed questionnaires assessing withdrawal symptoms and cessation self-efficacy. A more detailed account of the *FLEX* study rationale and methods can be found elsewhere (Tulloch et al., 2014).

Participants

Subjects were recruited via media announcements, the Quit Smoking Program at the University of Ottawa Heart Institute, word of mouth, and referrals from primary care physicians. To be eligible, participants needed to be 18 or older, have smoked 10 or more cigarettes per day over the past 6 months, be willing to make a quit attempt within 2-4 weeks and be able to provide informed consent. Exclusion criteria included: current or past month (more than 72 consecutive hours) use of the smoking cessation pharmacologic interventions offered in the study (varenicline, NRT patch/gum/inhaler); pregnancy; current or previous (past 3 month) substance abuse; inability to read/write in English or French; or having a contraindication to varenicline or NRT products. Only one individual per household was eligible to participate in the trial. Eligible smokers were invited to a baseline assessment at which informed consent was obtained. This study received approval from the Ottawa Health Sciences Network Research Ethics Board.

At baseline, participants answered questionnaires assessing demographic (age; gender; ethnicity; marital, employment and education status) and smoking-related information (nicotine dependence, cigarettes smoked per day). At one-week post target-quit date, smokers completed

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

questionnaires assessing smoking cessation self-efficacy and symptoms of withdrawal. Finally, smoking status was confirmed using expired carbon-monoxide (<9ppm), and was assessed at week 10.

Measures

Psychiatric Diagnoses. All participants were evaluated for current or past psychiatric history using the Mini International Psychiatric Interview (M.I.N.I 6.0.0), a structured interview used to assess DSM-IV and ICD-10 psychiatric disorders (Sheehan, Janavs, Harnett-Sheehan, Sheehan, & Gray, 2009). The MINI has demonstrated high reliability and validity when compared with other structured clinical interviews for DSM-IV diagnoses. Based on the interview, all participants were classified as either having a current, past or no lifetime psychiatric diagnosis. Individuals who met either a lifetime or current diagnosis were also classified by their primary diagnosis: major depressive disorder, anxiety disorder, bipolar disorder, and psychotic disorder. The primary diagnoses were reviewed and determined by the study Psychologist and Psychiatrist. In determining the primary diagnosis, we used the following guidelines: 1) current superseded past diagnosis, and 2) more severe superseded less severe (i.e., comorbid psychotic and depression would be categorized as psychotic).

Smoking-related variables. Participants reported, the number of cigarettes smoked per day and number of years spent as a daily smoker. Nicotine dependence was assessed via the 6-item Fagerstrom Test for Nicotine Dependence (FTND; Heatherton, Kozlowski, Frecker, & Fagerstrom, 1991). Nicotine withdrawal was assessed using the Minnesota Nicotine Withdrawal Scale (MWNS; Hughes & Hatsukami, 1986), a 15-item scale which assesses symptoms of nicotine withdrawal in the preceding 24 hours. Participants indicated on a 5-point scale (0 = none, 4 = severe) the degree to which they experienced each symptom (e.g., increased appetite;

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

dizziness). Smoking status was assessed via CO-confirmed 7-day point prevalence abstinence (i.e., smoking no cigarettes, not even a puff, in the last 7 days).

Cessation Self-Efficacy. Cessation self-efficacy was assessed at week 1 post-target quit date using the Smoking Cessation Self-Efficacy Questionnaire (SEQ-12; Etter et al., 2000), a 12-item questionnaire asking participants to state how sure they were that they would be able to refrain from smoking in different situations (1 – not sure at all; 5 – absolutely sure). The SEQ-12 is comprised of 2 factors (6-items each) of smoking cessation self-efficacy: internal-driven (e.g., ‘when I’m stressed’; ‘when I’m sad’) and external-driven (e.g., ‘when I’m with other smokers’; ‘after a meal’) cessation self-efficacy. The SEQ-12 has a total score of 60, with higher scores indicating higher self-efficacy.

Statistical Analyses

Analyses were conducted with SPSS version 20 with the SPSS Essentials for R package installed (R version 1.12.1) and using SPSS AMOS version 22 (SPSS, 2012). Chi-square and analysis of variance were conducted to determine if there were differences in demographic and smoking-related variables at baseline, between those with and without a history of psychiatric illness; where there were significant differences, post-hoc analyses included Bonferroni correction (chi-square) and Tukey’s HSD (ANOVA). Pearson correlations were then calculated between the following variables: SEQ-12 score and MNWS scores (at week 1), nicotine dependence (FTND) and the number of cigarettes smoked per day (at baseline). Prior to exploratory factor analysis (EFA), to evaluate the item loadings, the number of factors to be retained was assessed via Horn’s parallel analysis (Lautenschlager, 1989) and Velicer’s Minimum Average Partial (MAP) test (Zwick & Velicer, 1982); both considered the gold standards in determining factor retention (Zwick & Velicer, 1986). EFA was then conducted

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

using principal component extraction with oblique direct oblimin rotation. This method was selected as Etter and colleagues had previously identified high covariance between their theorized subscales. Loadings from the EFA were then used in order to conduct a confirmatory factor analysis (CFA). Prior to investigating for factor invariance and model fit, overall model fit was evaluated by splitting our sample, and confirmed the EFA the factor loadings on each half independently (i.e., splitting the data). The principal objectives of the CFA were: 1) to assess model fit of the resultant factor loadings; and, 2) using the model with the best fit, to determine if there was measurement invariance across psychiatric categories (current-past-none). Model fit was assessed using maximum-likelihood and fitting both saturated and independence models, with modification indices specified at output to improve model-fit. Factor invariance was measured using the multi-group analysis function of AMOS. Constraints were placed on the model in the following order: (1) constraining regression weights across groups; (2) holding structural covariances equivalent across groups; and (3) holding measurement residuals equivalent across groups. Analyses compared fit-indices of these constrained models (each model holding all previous constraints equivalent) to the unconstrained model. To test the predictive validity of the SEQ-12, as well as our model, we conducted a logistic regression, using the SEQ-12 total scale score as well as each subscale (week 1 scores) as predictors. The subscales were tested using block entry, first individually (unadjusted model), and then simultaneously (adjusted model), with smoking status at week 10 as the outcome (reference category: smokers).

Results

A total of 737 individuals met the inclusion criteria for the *FLEX* study, with 24.3%, 34.7% and 41.0% meeting criteria for a current, past or no psychiatric diagnosis, respectively. In

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

terms of primary psychiatric diagnoses, 38.4% met criteria for major depression, 12.7% for anxiety disorders, 5.2% for bipolar disorder, and 2.5% for psychotic disorder. Table 1 displays the demographic and smoking-related variables of the study population by psychiatric status. At baseline, those with a current diagnosis were more likely to be female, be single, on disability leave, and have lower education. These individuals also smoked more cigarettes per day and were more nicotine dependent at baseline, and, at week 1, had significantly lower confidence, and higher symptoms of withdrawal. At both week 1 and week 10, those with a current diagnosis were less likely to be abstinent compared to those with either a past or no diagnosis. In terms of primary diagnosis (not in table), individuals with bipolar or psychotic disorder were significantly heavier smokers ($M=27.36$, $SD=14.5$ and $M=33.18$, $SD=16.7$, respectively) compared to those with no diagnosis, while individuals with anxiety disorders had significantly lower cessation self-efficacy scores ($M=37.08$, $SD=11.9$) compared to those with no diagnosis or those with depression.

The 12-items of the SEQ-12 scale demonstrated good internal consistency (Cronbach's $\alpha = 0.940$). Results from Horn's parallel analysis and Velicer's MAP were divergent, with results of the former in favor of a two-factor model, while the latter specifying the retention of a three-factor model. The sampling of the 12-items was determined to be adequate based on the results of the Kaiser-Meyer-Olkin measure ($KMO=0.924$) and Barlett's test of sphericity ($p < 0.01$), indicating adequate factorability of the 12-items. The EFA, with the loadings of the 12-items first forced onto two factors (principal component method specifying two factors using direct oblimin oblique rotation), was determined to account for 72.5% (factor 1 eigenvalue = 7.323, factor 2 eigenvalue = 1.381) of the overall variance; the three-factor model explained 79.3% (third factor eigenvalue = 0.818) of the overall variance. Results for the item loading on

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

each factor can be found in Table 2. In the two factor model, the majority of items (9 of 12) loaded strongly onto the first factor, with some cross loading evident on item 10 (with other smokers). In contrast, the model specifying three factors had better discrimination between items for each factor; however, item 10 loaded only moderately onto the third factor. Correlations between scores on the SEQ-12 and the MNWS were in the low-moderate range ($r = -0.356$, $p < 0.01$). Correlations between the SEQ-12 and cigarettes smoked per day ($r = -0.085$, $p = 0.054$) and nicotine dependence ($r = -0.148$, $p < 0.01$) were small.

CFA was used to assess model fit of three competing models: the SEQ-12 original factor structure; and the two-factor and three-factor models determined by EFA results. Fit indices (GFI, CFI, NFI, RMSEA, RMR) for all three models are displayed in Table 3. Both two-factor models had inadequate fit indices, even after investigating modification indices. The fit indices for the three-factor model were significant and met criterion (Marsh, Balla, & McDonald, 1988) for adequate fit (CMIN/DF= 2.61, GFI=0.924, CFI=0.973, NFI=0.950, RMR=0.063, RMSEA = 0.040). The modified three-factor model with loading estimates is displayed in Figure 4. CFA was then used to test for measurement invariance using the three-factor model across those with a current, past or no psychiatric diagnosis. Compared to the unconstrained model, results were non-significant [$\chi^2(9) = 6.5814$, $p = 0.681$; $\chi^2(15) = 9.95$, $p = 0.823$, and $\chi^2(30) = 38.64$, $p = 0.134$], holding regression weights, structural covariances, and measurement residuals constant, respectively, indicating that there was measurement invariance across psychiatric status. In order to ensure that the model based on the three factor EFA was appropriate, we also split our original data in two and tested the measurement model on one half at a time; fit-indices were within criterion for adequate fit on this split dataset, and were in-line with those presented for the overall model.

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

Finally, in order to test the discriminant and predictive validity of the scale, we conducted logistic regression analyses (Table 4) and Pearson correlation. In order to control for the potential effects of continued smoking or smoking lapses on cessation self-efficacy, we controlled for week 1 smoking status as well as study treatment condition in all analyses. We divided our analyses into two models: in model 1, each cessation self-efficacy factor (total score, factor 1, factor 2, and factor 3) were entered independently; in the second model, all three factors are entered simultaneously. Results for model 1 showed that in the overall sample, higher total SEQ-12 scores (indicative of higher confidence) were associated with increased odds of being abstinent at week 10 (Odds Ratio (OR)= 1.03, 95% confidence interval (CI) 1.01-1.04, $p < 0.002$); this pattern persisted when investigating each factor independently. When investigating by psychiatric status, we found that the overall SEQ-12 score was associated with abstinence in those with either a past or current psychiatric diagnosis, but not in those with no diagnosis ($p = 0.324$). There were distinct associations between each factor and week 10 abstinence depending on psychiatric status; for example, factor 1 (negative affect) was associated with our outcomes only amongst those with a current diagnosis. Factor 2 (conditioned cues) was associated with outcomes in both those with a lifetime and current diagnosis, but not amongst those with no diagnosis. Factor 3 (alcohol-related situations) was associated with our outcome for those with a past diagnosis; interestingly, in the unadjusted model, this was true for those with no diagnosis (OR=1.09, 95% CI 1.03-1.17, $p < 0.01$), although this was attenuated when controlling for smoking status and treatment condition (OR=1.05 95% CI 0.98-1.13 $p = 0.186$). Our findings changed slightly in model 2, where all three factors were entered simultaneously. In the overall sample, prior to adjustment for smoking status at week 1 and treatment condition, only ‘conditioned cues’ was associated with week 10 abstinence (OR= 1.11, 95% CI 1.04-1.19, $p <$

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

0.04; not shown table); after controlling for these variables, this finding was again attenuated after controlling for smoking and treatment condition (OR= 1.06, 95% CI 0.99-1.15, $p = 0.110$).

When comparing across psychiatric status, both ‘negative affect’ and ‘conditioned cues’ factors emerged as significant. Factor 2 (conditioned cues) was associated with abstinence only amongst those with a past diagnosis (OR= 1.15, 95% CI 1.01-1.31, $p < 0.05$), while factor 1 (negative affect) was the only factor associated with abstinence amongst those with a current diagnosis (OR= 1.15, 95% CI 1.02-1.30, $p < 0.05$).

Discussion

This study is the first to investigate the factor structure of a smoking cessation self-efficacy scale in a sample of treatment-seeking smokers with either a current, past or no psychiatric diagnosis. Results demonstrate that the SEQ-12 is a psychometrically sound instrument that can be used to assess confidence to refrain from smoking among smokers both with, and without, any psychiatric condition present. Our results indicated better model fit for a three-factor solution as opposed to the two-factor solution reported by Etter and colleagues. In fact, confirmatory factor analysis found that only the three-factor model met criterion for adequate model fit. The results presented herein suggest that cessation self-efficacy is reflective of three domains: confidence when experiencing negative affect (factor 1), in alcohol-related situations (factor 2) and with conditioned cues (factor 3).

Our results highlight that individuals with current or lifetime psychiatric illness experience lower cessation self-efficacy than do individuals with no such history. Our evidence suggests that the scale is both valid and measurement invariant amongst treatment-seeking smokers regardless of psychiatric diagnosis. Factor loadings were similar for the vast majority of items across the groups, with the exception of one item: item 10 (when I’m with other smokers).

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

Among those with no diagnosis, this item loaded moderately (0.507) onto factor 2 (alcohol-related situations), whereas it loaded more strongly onto factor 3 (conditioned cues) among those with both a current (0.620) or past diagnosis (0.414). When compared to the results of the original factor analyses by the authors of the scale, there were large discrepancies with items 11 (after a meal) and 12 (when drinking coffee). In the two-factor solution, both of these items loaded only onto factor one (clustered with other items which the original authors interpreted in as one's confidence in the face of internal stimuli), as opposed to the factor 2 (external situations) as in the original validation; this was the only major difference observed in the EFA between our two-factor solution and those of the original authors. In the three-factor model, items 6 (urge to smoke), 11 (after a meal) and 12 (drinking coffee) all loaded in the moderate-high range onto a third factor (i.e., conditioned cues). That these items did not load onto 'external situations' as found by the original authors but instead loaded more strongly with negative affect situations appears to suggest that our sample associates these situations with some level of internal distress. Given the converging results between two- and three-factor solutions, these items may reflect situations that elicit particularly strong sensations of craving in response to conditioned cues within our sample of smokers.

Unlike previous psychometric evaluations of this measure, we did not find a clear six-item split in terms of factor loadings in the specified two-factor solution; instead, the majority of the items (9 of 12) loaded onto factor one, which alone accounted for 61% of the variance. Further, the three-factor model fit was the best in terms of variance explained (79.3%), and also produced three factors which were interpretable. In the development of the scale, Etter and colleagues considered, but ultimately rejected, a three-factor model as no item loaded highly onto a third hypothesized factor, a finding which we did not replicate. In our three-factor model,

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

items tended to load strongly on one factor each, with the exception of item 10 (with other smokers). The discrepancies between our results and those of the original paper may reflect geographic and cultural differences in our samples. It is possible, for instance, that the original European sample was more likely to associate eating/drinking coffee as an external/social phenomenon. The original sample was recruited over 15 years ago, and the characteristics of smokers have presumably changed in the intervening years. The discrepancy in factor structure, while ultimately interesting, should not come as a major surprise given previous studies on cessation self-efficacy. Previous scales constructed to assess this measure in the past have employed many different factor structures, varying from one (DiClemente et al., 1985) to several factors (Gwaltney et al., 2001). While the authors of the SEQ-12 posited that a craving subscale may have been subsumed by their ‘internal stimuli’ factor, our results indicate this is may not be the case. In fact, given the low-moderate correlation between the total cessation self-efficacy score and the score on symptoms of nicotine withdrawal, nicotine dependence and cigarettes smoked per day, measures of cessation self-efficacy may in fact reflect each smokers’ individual experience and expectations for the quit attempt than simply mirroring their degree of nicotine withdrawal; however, further studies disentangling cessation self-efficacy and its relation to nicotine withdrawal are required.

Cessation self-efficacy measures, regardless of how many factors proposed, may ultimately be reflective of one general underlying factor assessing overall confidence. In our study, the first factor accounted for a very large proportion of the overall variance, and in either the two-factor or three-factor solution, all factors were significantly correlated. A recent meta-analysis of the smoking cessation self-efficacy literature found that there was a trend for single-item measures assessing confidence to better predict smoking outcomes (i.e., relapse) than scales

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

composed of multiple-items (Gwaltney et al., 2009). Using baseline data, we previously looked at differences between a single-item measure of confidence to quit and the SEQ-12 score across psychiatric diagnoses (Clyde, Tulloch, Reid, Els, & Pipe, 2015), finding no difference between groups for the single item. However, the total score for the SEQ-12 differed significantly in those with a lifetime diagnosis (either current or past), who had lower scores on the measure at both baseline and week 1. In this current study, the single-item assessing confidence was only moderately correlated with the SEQ-12 score. The timing of the measurement for cessation self-efficacy is also an important consideration. Post-quit (week one) cessation self-efficacy was selected for the present study as previous studies (Gwaltney et al., 2009; Mudde et al., 1995) have noted that pre-quit measures are sometimes inflated, and have poorer predictive validity compared to post-quit measures. Although the variance of any one cessation self-efficacy scale may best be explained by one universal factor, from a clinical standpoint it may be meaningful to continue assessing across previously identified high-risk situations. In fact, another study found that the total score of the Relapse Situation Efficacy Questionnaire (RSEQ; Gwaltney et al., 2001) failed to predict cessation outcomes, but information obtained from the factors was able to predict subsequent relapse. In our study, each factor was individually associated with abstinence at week 10; however, when entered together, different factors emerged depending on the psychiatric group (current – past – no diagnosis). The conditioned cues factor was the most important sub-factor in predicting abstinence at week 10; negative affect, on the other hand, was more strongly associated with abstinence amongst those with a current diagnosis. Although not implicitly tested, information gleaned from not only the total score, but individual subscales may provide valuable information for health-care professionals aiding individuals during a cessation attempt. Multi-item scales would then be useful to measure overall confidence but also to

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

provide additional information to clinicians and smokers in identifying areas of particular difficulty. More research is needed in this area to clarify the utility of single- vs. multi-item scales; clinicians and researchers might also consider the type of information they are interested in (i.e., predicting abstinence outcomes, or identifying potential relapse situations) when ultimately choosing one scale over another. The practicality of the measure (e.g., time to complete the survey) may also play an important role in the decision making process.

Our study had a number of strengths and limitations. We are the first to assess the factor structure of a validated measure of cessation self-efficacy across treatment-seeking smokers with and without a lifetime psychiatric diagnosis. Psychiatric status was determined via a structured clinical interview -- the current gold standard for diagnostic purposes. One limitation of our study was the unequal group sizes between those with a current, past or no diagnosis; in addition, we had smaller sample sizes for some primary diagnoses (i.e., bipolar, psychotic disorder), which lead us to collapse these categories into current, past, and no psychiatric diagnosis. In addition, we did not assess for concurrent alcohol use, which may have biased how our sample responded to items associated with alcohol. Our results may not be generalizable to all smokers, as our sample was comprised of treatment-seeking smokers, and we excluded individuals with comorbid substance abuse/dependence. Finally, the EFA and CFA were conducted on one sample and therefore may be sample specific. Although we later split our data (and found no difference), this was not pure cross-validation, which may be preferable in some cases, and therefore our results should be interpreted with caution. Finally, although we controlled for smoking status at time of self-efficacy measure, it is possible that smoking status (or some other smoking variable) may have impacted the results of our logistic regression analyses, and therefore need to be considered with some caution. Future studies investigating smoking

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

cessation self-efficacy amongst treatment-seeking smokers with a diagnosed mental illness should seek to further investigate the predictive validity of self-efficacy scales in order to help improve the provision of resources and increase the success rate of the cessation attempt.

REFERENCES

- Baer, J. S., Holt, C. S., & Lichtenstein, E. (1986). Self-efficacy and smoking reexamined: Construct validity and clinical utility. *Journal of consulting and clinical psychology*, 54(6), 846-852. doi:10.1037/0022-006x.54.6.846
- Brown, A., Moodie, C., & Hastings, G. (2009). A longitudinal study of policy effect (smoke-free legislation) on smoking norms: ITC Scotland/United Kingdom. *Nicotine & Tobacco Research*, ntp087.
- Clark, N. M., & Dodge, J. A. (1999). Exploring self-efficacy as a predictor of disease management. *Health Education & Behavior*, 26(1), 72-89.
- Clyde, M., Tulloch, H., Reid, R., Els, C., & Pipe, A. (2015). Task and barrier self-efficacy among treatment-seeking smokers with current, past or no psychiatric diagnosis. *Addictive behaviors*, 46, 65-69.
- Corrigan, P. W., Larson, J. E., & Ruesch, N. (2009). Self-stigma and the “why try” effect: impact on life goals and evidence-based practices. *World Psychiatry*, 8(2), 75-81.
- DiClemente, C., Prochaska, J., & Gibertini, M. (1985). Self-efficacy and the stages of self-change of smoking. *Cognitive Therapy and Research*, 9(2), 181-200.
doi:10.1007/bf01204849
- DiClemente, C. C., Fairhurst, S. K., & Piotrowski, N. A. (1995). Self-Efficacy and Addictive Behaviors. In J. Maddux (Ed.), *Self-Efficacy, Adaptation, and Adjustment* (pp. 109-141): Springer US.
- Dijkstra, A., De Vries, H., & Bakker, M. (1996). Pros and cons of quitting, self-efficacy, and the stages of change in smoking cessation. *Journal of consulting and clinical psychology*, 64(4), 758.

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

- Etter, J. F., Bergman, M. M., Humair, J. P., & Perneger, T. V. (2000). Development and validation of a scale measuring self-efficacy of current and former smokers. *Addiction*, 95(6), 901-913.
- Grant, B. F., Hasin, D. S., Chou, S., Stinson, F. S., & Dawson, D. A. (2004). Nicotine dependence and psychiatric disorders in the united states: Results from the national epidemiologic survey on alcohol and related conditions. *Archives of General Psychiatry*, 61(11), 1107-1115. doi:10.1001/archpsyc.61.11.1107
- Gwaltney, C. J., Metrik, J., Kahler, C. W., & Shiffman, S. (2009). Self-efficacy and smoking cessation: A meta-analysis. *Psychology of Addictive Behaviors*, 23(1), 56-66. doi:10.1037/a0013529
- Gwaltney, C. J., Shiffman, S., Normal, G. J., Paty, J. A., Kassel, J. D., Gnys, M., . . . Balabanis, M. (2001). Does smoking abstinence self-efficacy vary across situations? Identifying context-specificity within the Relapse Situation Efficacy Questionnaire. *Journal of consulting and clinical psychology*, 69(3), 516-527. doi:10.1037/0022-006X.69.3.516
- Haukkala, A., Uutela, A., Vartiainen, E., Mcalister, A., & Knekt, P. (2000). Depression and smoking cessation: the role of motivation and self-efficacy. *Addictive behaviors*, 25(2), 311-316.
- Heatherton, T. F., Kozlowski, L. T., Frecker, R. C., & Fagerstrom, K.-O. (1991). The Fagerström Test for Nicotine Dependence: a revision of the Fagerstrom Tolerance Questionnaire. *British Journal of Addiction*, 86(9), 1119-1127. doi:10.1111/j.1360-0443.1991.tb01879.x
- Hughes, J. R., & Hatsukami, D. (1986). Signs and symptoms of tobacco withdrawal. *Archives of General Psychiatry*, 43(3), 289.

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

- Kang, S.-Y., Deren, S., Andia, J., Colon, H. M., & Robles, R. (2004). Effects of changes in perceived self-efficacy on HIV risk behaviors over time. *Addictive behaviors, 29*(3), 567-574.
- Lasser, K., Boyd, J., Woolhandler, S., Himmelstein, D. U., McCormick, D., & Bor, D. H. (2000). Smoking and mental illness: A population-based prevalence study. *JAMA, 284*(20), 2606-2610. doi:10.1001/jama.284.20.2606
- Lautenschlager, G. J. (1989). A comparison of alternatives to conducting Monte Carlo analyses for determining parallel analysis criteria. *Multivariate Behavioral Research, 24*(3), 365-395. doi:10.1207/s15327906mbr2403_6
- Lê Cook, B., Wayne, G. F., Kafali, E. N., Liu, Z., Shu, C., & Flores, M. (2014). Trends in smoking among adults with mental illness and association between mental health treatment and smoking cessation. *JAMA, 311*(2), 172-182.
- Levy, D. T., & Friend, K. B. (2003). The effects of clean indoor air laws: what do we know and what do we need to know? *Health Education Research, 18*(5), 592-609. doi:10.1093/her/cyf045
- Livingston, J. D., & Boyd, J. E. (2010). Correlates and consequences of internalized stigma for people living with mental illness: A systematic review and meta-analysis. *Social Science & Medicine, 71*(12), 2150-2161.
- Marcus, B. H., Selby, V. C., Niaura, R. S., & Rossi, J. S. (1992). Self-efficacy and the stages of exercise behavior change. *Research quarterly for exercise and sport, 63*(1), 60-66.
- Marsh, H. W., Balla, J. R., & McDonald, R. P. (1988). Goodness-of-fit indexes in confirmatory factor analysis: The effect of sample size. *Psychological bulletin, 103*(3), 391.

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

Martinez, E., Tatum, K. L., Glass, M., Bernath, A., Ferris, D., Reynolds, P., & Schnoll, R. A.

(2010). Correlates of smoking cessation self-efficacy in a community sample of smokers.

Addictive behaviors, 35(2), 175-178. doi:<http://dx.doi.org/10.1016/j.addbeh.2009.09.016>

Mudde, A. N., Kok, G., & Strecher, V. J. (1995). Self-efficacy as a predictor for the cessation of smoking: Methodological issues and implications for smoking cessation programs.

Psychology and Health, 10(5), 353-367.

Sheehan, D., Janavs, J., Harnett-Sheehan, K., Sheehan, M., & Gray, C. (2009). The Mini International Neuropsychiatric Interview Version 6.0 (MINI 6.0).

Siru, R., Hulse, G. K., Khan, R. J., & Tait, R. J. (2010). Motivation to quit smoking among hospitalised individuals with and without mental health disorders. *Australian & New Zealand Journal of Psychiatry*, 44(7), 640-647. Retrieved from

<http://ovidsp.ovid.com/ovidweb.cgi?T=JS&CSC=Y&NEWS=N&PAGE=fulltext&D=medl&AN=20560851>

SPSS Inc. (2012). IBM SPSS Statistics Version 20. *Boston, Mass: International Business Machines Corp.*

Stuart, K., Borland, R., & McMurray, N. (1994). Self-efficacy, health locus of control, and smoking cessation. *Addictive behaviors*, 19(1), 1-12.

Thomas, S., Fayter, D., Misso, K., Ogilvie, D., Petticrew, M., Sowden, A., . . . Worthy, G.

(2008). Population tobacco control interventions and their effects on social inequalities in smoking: systematic review. *Tobacco Control*, 17(4), 230-237.

doi:10.1136/tc.2007.023911

Tulloch, H., Pipe, A., Els, C., Aitken, D., Clyde, M., Corran, B., & Reid, R. D. (2014). Flexible and extended dosing of nicotine replacement therapy or varenicline in comparison to

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

fixed dose nicotine replacement therapy for smoking cessation: Rationale, methods and participant characteristics of the FLEX trial. *Contemporary Clinical Trials*, 38(2), 304-313. doi:<http://dx.doi.org/10.1016/j.cct.2014.05.011>

Weinberger, A. H., Desai, R. A., & McKee, S. A. (2010). Nicotine withdrawal in US smokers with current mood, anxiety, alcohol use, and substance use disorders. *Drug and Alcohol Dependence*, 108(1), 7-12.

Ziedonis, D. M., & Williams, J. M. (2003). Management of smoking in people with psychiatric disorders. *Current Opinion in Psychiatry*, 16(3), 305-315
310.1097/1001.yco.0000069086.0000026384.0000069085f.

Zwick, W. R., & Velicer, W. F. (1982). Factors influencing four rules for determining the number of components to retain. *Multivariate Behavioral Research*, 17(2), 253-269.
doi:10.1207/s15327906mbr1702_5

Zwick, W. R., & Velicer, W. F. (1986). Comparison of five rules for determining the number of components to retain. *Psychological bulletin*, 99(3), 432-442. doi:10.1037/0033-2909.99.3.432

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

Table 1 - Demographic and smoking related variables by psychiatric status

		Overall Sample	No diagnosis	Past	Current	p
Age	M (SD)	48.6 (10.8)	48.6 (11.1)	49.3 (11.1)	47.6 (9.9)	0.276
Gender	Male	395 (53.6)	188 (62.3)	128 (50.0)	79 (44.1)	<0.01
	Female	342 (46.4)	114 (37.7)	128 (50.0)	100 (55.9)	
Education	M (SD)	14.1 (2.9)	14.6 (2.8)	14.0 (2.9)	13.5 (3.0)	<0.01
Marital Status (N (%))	Married	340 (46.4)	172 (57.3)	99 (38.8)	69 (38.8)	<0.01
	Divorced/Widowed	232 (31.7)	76 (25.3)	104 (40.8)	52 (29.2)	
	Single	161 (22.0)	52 (17.3)	52 (20.4)	57 (32.0)	
Employment Status (N (%))	Full/Part-Time	449 (61.3)	226 (75.6)	146 (57.3)	77 (43.0)	<0.01
	Retired/Unemployed	158 (21.6)	60 (20.1)	63 (24.7)	35 (19.6)	
	Disability Leave	126 (17.2)	13 (4.3)	46 (18.0)	67 (37.4)	
Smoking Variables (M (SD))						
	Cigarettes per day	23.2 (10.8)	21.9 (9.7)	23.1 (9.6)	25.7 (13.4)	<0.01
	Nicotine dependence	6.14 (2.2)	5.6 (2.2)	6.3 (2.2)	6.8 (2.1)	<0.01
	Withdrawal symptoms	15.8 (9.8)	12.9 (8.6)	15.7 (10.3)	21.3 (10.3)	<0.01
	SEQ-12	42.0 (12.1)	43.6 (12.0)	42.2 (11.6)	38.6 (12.6)	<0.01
Abstinence	Week 1	173 (23.5)	81 (26.8)	68 (26.6)	24 (13.4)	<0.01
	Week 10	250 (33.9)	111 (44.4)	98 (39.2)	41 (16.4)	<0.01
Note: M=Mean, SD=Standard Deviation						

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

Table 2 - Factor loading from EFA					
SEQ Item	2 Factor specified		3 Factor specified		
	Factor 1	Factor 2	1	2	3
1. Feeling Nervous	0.939		0.897		
2. Feeling Depressed	0.870		0.907		
3. Feeling Angry	0.836		0.906		
4. Feeling Anxious	0.932		0.893		
5. When thinking of a problem	0.866		0.778		
6. When you have the urge to smoke	0.744				0.680
7. Drinking with friends		0.974		0.982	
8. When celebrating		0.722		0.686	
9. Drinking alcohol		0.946		0.953	
10. With smokers	0.521	0.330			0.403
11. After a meal	0.732				0.929
12. Drinking coffee	0.705				0.914
<p>Note: Loadings <0.3 are not displayed. Oblique (Direct Oblimin) rotation applied; 2 factor model component correlation: 0.563 (factor 1 – 2) 3 factor model component correlation(s): 0.519 (factor 1-2), 0.698 (factor 1-3), 0.499 (factor 2-3)</p>					

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

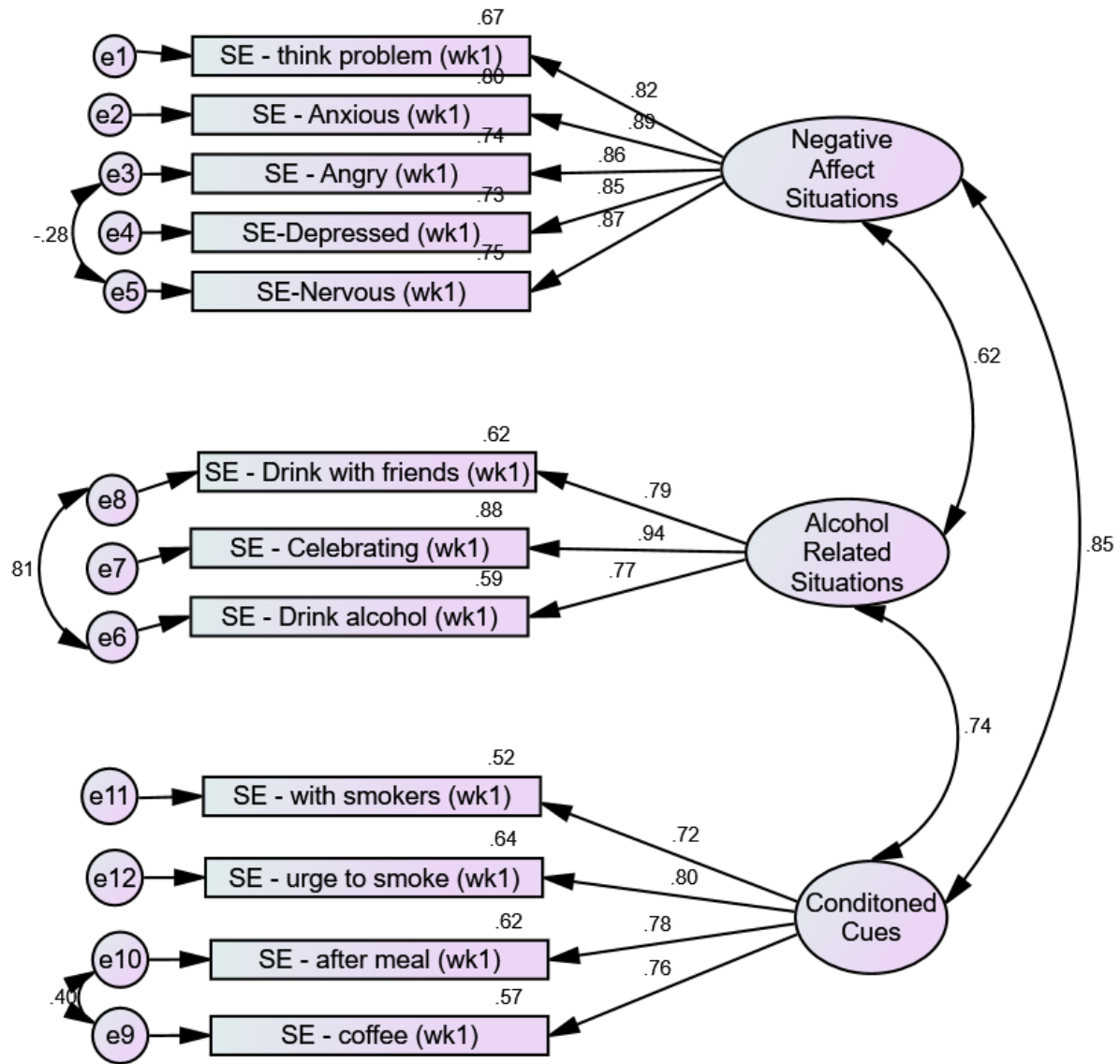
Table 3 - Fit indices for 3 CFA models							
Model	No. factors in model	CMIN/DF	GFI	CFI	NFI	RMSEA	RMR
1	2	6.329	0.881	0.927	0.914	0.085	0.101
2	2	14.15	0.84	0.903	0.896	0.134	0.100
3	3	2.16	0.924	0.973	0.950	0.040	0.063
<p>Note: Model 1 - CFA based on two-factor model proposed by Etter and Colleagues Model 2 - CFA based on two-factor model using loading structure from EFA Model 3 -CFA based on three-factor model using loading structure from EFA</p>							

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

Table 4 - SEQ-12 scores and week 10 abstinence							
	SEQ-12 Total Score	Factor 1: Negative Affect	Factor 2: Conditioned Cues	Factor 3 Alcohol related situations	Factor 1: Negative Affect	Factor 2: Conditioned Cues	Factor 3 Alcohol related situations
	Model 1				Model 2		
Overall Sample	1.03 (1.01-1.04)	1.04 (1.01- 1.08)	1.07 (1.02-1.12)	1.06 (1.01-1.11)	1.01 (0.96- 1.07)	1.06 (0.99-1.15)	1.01 (0.95- 1.08)
p-value	0.002	0.013	0.003	0.026	0.772	0.110	0.756
No diagnosis	1.01 (0.98-1.04)	1.02 (0.97- 1.07)	1.04 (0.97-1.12)	1.05 (0.97-1.13)	1.00 (0.92- 1.09)	1.03 (0.91-1.17)	1.01 (0.91- 1.12)
p-value	0.324	0.474	0.257	0.237	0.953	0.667	0.808
Past diagnosis	1.04 (1.01-1.07)	1.05 (0.98- 1.11)	1.12 (1.03-1.22)	1.10 (1.01-1.19)	0.94 (0.85- 1.04)	1.15 (1.01-1.32)	1.08 (0.96- 1.22)
p-value	0.016	0.148	0.007	0.037	0.213	0.038	0.188
Current diagnosis	1.06 (1.01-1.10)	1.12 (1.03- 1.21)	1.10 (1.00-1.22)	1.07 (0.96-1.20)	1.15 (1.01- 1.31)	1.02 (0.86-1.21)	0.94 (0.80- 1.11)
p-value	0.008	0.006	0.05	0.233	0.031	0.813	0.478
<p>Model 1 - Adjusted for smoking status at week 1 and treatment condition; self-efficacy factors entered individually</p> <p>Model 2 - Adjusted smoking status at week 1 and treatment condition; All factors entered simultaneously</p>							

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

Figure 1 – Path model of CFA



Dissertation Article 3: A Bidirectional Path Analysis Model of Smoking Cessation Self-efficacy and Concurrent Smoking Status: Impact on Abstinence Outcomes

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

A Bidirectional Path Analysis Model of Smoking Cessation Self-efficacy and Concurrent Smoking Status: Impact on Abstinence Outcomes

M Clyde^{1,2}, A Pipe^{1,3}, R Reid^{1,3}, C Els⁴, HE Tulloch^{1,2,3}

Author affiliation

¹University of Ottawa Heart Institute

²University of Ottawa, Department of Psychology

³University of Ottawa, Department of Medicine

⁴University of Alberta, Department of Psychiatry

Publication reference:

Clyde, M., Pipe, A., Reid, R., Els, C., & Tulloch, H. (2018). A bidirectional path analysis model of smoking cessation self-efficacy and concurrent smoking status: impact on abstinence outcomes. *Addiction biology*.

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

Abstract

Introduction: Self-efficacy is routinely associated with abstinence in the addictions literature, and is a major component relapse-prevention models. The magnitude of this relationship has been brought into question following equivocal results in studies controlling for concurrent smoking status. The aim of our study was to clarify the relationship between cessation self-efficacy, smoking status, and cessation outcomes in a cohort of treatment-seeking smokers.

Methods: Smokers participating in the FLEX trial, a randomized trial investigating the efficacy of 3 pharmacologic treatments for smoking cessation, completed questionnaires assessing cessation self-efficacy at baseline and at weeks 1, 3, 5 and 10 post-target quit date; smoking status was verified using expired carbon monoxide. Structural models were fit in order to ascertain the relationship between cessation self-efficacy and concurrent smoking at each time-point, and to assess the association between cessation self-efficacy, smoking, and 7-day point prevalence smoking status at week 10.

Results: A total of 737 treatment-seeking smokers participated. In our path model, self-efficacy and smoking status at all time points were associated with week 10 abstinence (except week 3 self-efficacy), after controlling these values' previous time-points. All direct pathways between cessation self-efficacy and smoking were also significant, supporting a bidirectional relationship.

Conclusion: Our results support a bidirectional and reciprocal relationship between cessation self-efficacy and concurrent smoking behavior; participants with higher confidence were more likely to be smoke-free, and concurrent smoking status predicted levels of confidence over the ensuing weeks. Both measures were associated with week 10 abstinence. Our results indicate that while correlated, both cessation self-efficacy and current smoking behavior during a cessation attempt are important independent markers of ultimate cessation success.

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

Key words: Self-Efficacy, Relapse, Smoking, Structural Modelling, Cessation

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

Introduction

There have been distinct changes in smoking acceptability and an overall decline in the prevalence of smoking over the past two decades (Brown, Moodie, & Hastings, 2009; Levy & Friend, 2003; Thomas et al., 2008). Unfortunately, smoking rates have stabilized in recent years (Jamal et al., 2014), and thus remain a major contributor to premature and preventable morbidity and mortality (Prabhat Jha & Peto, 2014; Ng et al., 2014). Although pharmacologic treatments continue to be a primary area of clinical focus, in both research and clinical settings psychological constructs which may contribute to improved abstinence outcomes continue to be examined (Stead, Koilpillai, & Lancaster, 2015). The results of such investigations may improve our current cessation strategies, assist researchers and clinicians to identify those most likely to benefit from certain interventions and, more importantly, identify new and more innovative strategies for achieving successful cessation. Various approaches (Brandon, Vidrine, & Litvin, 2007; Piasecki, 2006; Katie Witkiewitz & G Alan Marlatt, 2004) have been proposed to predict those likely to achieve long-term abstinence, and several smoking-related variables have been associated with smoking cessation outcomes, including severity of nicotine withdrawal, nicotine dependence, and cessation self-efficacy (McCarthy, Ebssa, Witkiewitz, & Shiffman, 2015; Judith K Ockene et al., 2000).

Originally defined in Albert Bandura's Social Cognitive Theory of behaviour (Bandura, 1977, 1997), self-efficacy remains one of the most versatile, widely applied concepts in models of health behavior change (Clark & Dodge, 1999; DiClemente, Fairhurst, & Piotrowski, 1995; Kang, Deren, Andia, Colon, & Robles, 2004; Marcus, Selby, Niaura, & Rossi, 1992). Self-efficacy refers to an individual's belief in their ability to successfully accomplish a task or goal. Smoking cessation self-efficacy, or an individual's confidence in their ability to refrain from

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

smoking, has been reliably associated with abstinence and relapse outcomes and is, therefore, a potentially important target for intervention (Elfeddali, Bolman, Candel, Wiers, & De Vries, 2012; Gwaltney, Metrik, Kahler, & Shiffman, 2009; Kasten, Eggers, & de Vries, 2015; Schnoll et al., 2011; Zhou et al., 2009). Although the association between cessation outcomes and self-efficacy has been consistently reported, with the precise mechanism underlying this association remaining unexplained. Studies attempting to deconstruct this mechanism have identified great variability in how the concept of cessation self-efficacy is employed.

The most robust summary to date has been the meta-analytic review examining smoking cessation self-efficacy, conducted by Gwaltney et al. (2009). The authors identified measurement heterogeneity across studies that could affect how results are interpreted. Sources of variability included the type of measure (single item vs. scale; number of items per scale), and the time between assessment and outcome. Results indicated that confidence assessed prior to a quit-attempt is somewhat inflated when compared to confidence measured after cessation and, thus, a poorer predictor of cessation outcome. Even measurements taken post-quit attempt are not consistent in predicting success. Self-efficacy varies in its ability to predict abstinence as a function of the time remaining before the point of a chosen outcome. Cessation self-efficacy scores at week 1 post-quit date, for example, are more likely to be significantly associated with early cessation outcomes, but this relationship appears to weaken when applied to distant time points (e.g., quit rates at 6 or 12 months). Nevertheless, despite this apparent drop in predictive validity across time, Gwaltney et al. (2009) determined a robust association between post-quit measures of cessation self-efficacy and abstinence outcomes. Regardless of the type of measure used and the timing of data collection, the largest source of variation regarding self-efficacy's predictive power identified in the review was concurrent smoking.

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

Attempts to quit smoking are rarely linear as those trying to quit may experience several lapses (a brief return to smoking before re-establishing abstinence) and/or relapse (a return to smoking). Self-efficacy may fluctuate during a quit attempt in response to these lapses/relapse. Previous research has investigated the impact of concurrent smoking on cessation self-efficacy and demonstrated that the relationship between self-efficacy and abstinence outcomes was significantly reduced when accounting for concurrent smoking status. Several studies which investigated small time-scale changes in both smoking and self-efficacy employing ecological momentary assessment (Shiffman, Stone, & Hufford, 2008) have also revealed a bidirectional relationship such that initial ratings of self-efficacy are associated with time to first smoking lapse, and significant drops in self-efficacy follow a return to smoking (Gwaltney, Shiffman, Balabanis, & Paty, 2005; Perkins, Parzynski, Mercincavage, Conklin, & Fonte, 2012; Shiffman, 2005). These findings and the results of other recent publications (Aaron Spaulding, D. Rob Haley, & Mei Zhao, 2014), call into question the usefulness of using measures of self-efficacy as a predictor of behaviour change given that they may change dramatically in response to changes in concurrent behaviour.

The purpose of the present study was to further investigate and better understand the complex relationship between smoking cessation self-efficacy, concurrent smoking, and cessation outcomes. Our primary research question examined whether self-efficacy during a quit-attempt accurately reflected an individual's confidence and predicted abstinence outcomes, or whether self-efficacy was simply a reflection of their most recent behavior. We hypothesized that smoking cessation self-efficacy would be impacted by smoking behavior, but would continue to be predictive of smoking outcomes at 10 weeks. In order to accomplish this, we fit a structural model which accounts for both variables of interest across several time-points (weeks 1, 3, and 5

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

post-target quit date), with causal paths in all directions while controlling for previous scores on the measure.

Methods

This paper is based on data derived from participants in the “*Flexible and extended dosing of nicotine replacement therapy (NRT) and varenicline in comparison to fixed dose NRT for smoking cessation: the FLEX trial*”: a parallel, 3-group, pre-post, randomized control trial examining the effectiveness of nicotine replacement therapy (transdermal patch; NRT); extended and combined nicotine replacement therapy (transdermal patch + adjunct nicotine product; NRT+) or, extended varenicline (VR) treatment. Briefly, participants were randomized to receive one of the three pharmacological interventions, and were followed at weeks 1, 3, 5, 10, 22, and 52 post-target quit-date. The present manuscript is a secondary analysis using data from the treatment-phase of the FLEX trial, analyzing data from follow-up visits of participants at weeks 1, 3, 5 and 10 following their target quit-date, which was set following a baseline assessment (week 0). Primary outcomes and a more detailed account of the *FLEX* study rationale and methods are published elsewhere (H. Tulloch et al., 2014; H. E. Tulloch, Pipe, Els, Clyde, & Reid, 2016).

Participants

Participants were recruited using media announcements, from the Quit Smoking Program at the University of Ottawa Heart Institute, by ‘word of mouth’, and referrals from primary care physicians. Eligibility criteria of the *FLEX* trial (and of the present secondary analyses) included being aged 18 or older, smoking 10 or more cigarettes per day over the past 6 months, being willing to make a quit attempt within 2-4 weeks, and being able to provide informed consent. Exclusion criteria of the FLEX trial (and of the secondary analyses presented

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

here) included: current or past month (more than 72 consecutive hours) use of the smoking cessation pharmacologic interventions offered in the study (varenicline, NRT patch/gum/inhaler); pregnancy; current or previous (past 3 month) substance abuse; inability to read/write in English or French; or having a contraindication to varenicline or NRT products. Only one individual per household was eligible to participate in the trial. Eligible smokers were invited to a baseline assessment at which written informed consent was obtained. This study received approval from the Ottawa Health Sciences Network Research Ethics Board.

Procedure

Once determined to be eligible for the study, participants were screened using the MINI International Neuropsychiatric Interview for psychiatric diagnoses (Sheehan et al., 1998), and if deemed eligible, were randomized via computer to receive one of the three study treatments. During their baseline (week 0) visit, participants completed self-report questionnaires assessing demographic (age; gender; ethnicity; marital, employment and education status) and smoking-related information (nicotine dependence, cigarettes smoked per day, previous quit attempts). Participants established a target-quit date and returned for follow-up appointments during the treatment phase of the study, at weeks 1, 3, 5 and 10 thereafter. At each visit, participants completed self-report questionnaires and participated in 15-minute counselling sessions with nurses experienced in smoking cessation.

Measures

Psychiatric status was assessed via the Mini International Psychiatric Interview (M.I.N.I 6.0.0; (Sheehan et al., 1998), a structured interview used to assess for a DSM-IV and/or ICD-10 psychiatric diagnosis. The M.I.N.I. has demonstrated high internal consistency and test-retest reliability, as well as construct validity when compared to other structured clinical interviews for

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

DSM-IV diagnoses (Sheehan et al., 1998). Participants who did not meet any psychiatric diagnostic criteria in their lifetime were classified as no lifetime history, while individuals who met criteria were classified as having either a lifetime or current psychiatric diagnosis. **Nicotine dependence** was assessed at baseline using the 6-item Fagerstrom Test for Nicotine Dependence (FTND); (Heatherton, Kozlowski, Frecker, & Fagerstrom, 1991); higher scores are indicative of greater nicotine dependence. **Cessation Self-Efficacy** was assessed at each visit using the Smoking Cessation Self-Efficacy Questionnaire (SEQ-12; (J.-F. Etter, Bergman, Humair, & Perneger, 2000), a 12-item instrument assessing participant's confidence in refraining from smoking in different situations (1 – not sure at all; 5 – absolutely sure). The SEQ-12 evaluates 2 factors (6-items each): internal-driven (e.g., 'when I'm stressed'; 'when I'm sad') and external-driven (e.g., 'when I'm with other smokers'; 'after a meal') cessation self-efficacy. The SEQ-12 has a total score of 60; higher scores indicate higher self-efficacy.

Smoking status. Smoking status was determined at each visit by asking participants if they had smoked any cigarettes over the past 7-days (7-day point prevalence) and verified by measuring expired-CO. For modeling purposes, we used expired-CO values at weeks 1, 3, and 5 as a proxy of current smoking status. Previous studies have found expired CO values to be an efficient and reliable method of assessing smoking status (Deveci, Deveci, Açik, & Ozan, 2004). At week 10, we assessed 7-day point prevalence of smoking; participants were classified as either abstinent or smoking based on their self-report verified via expired-CO.

Statistical Analyses

Prior to constructing our path-models, a series of analyses (Chi-Square, ANOVA, correlation) were undertaken to evaluate the relationship between our variables of interest, including demographic and other smoking-related variables, and our primary outcome (week 10

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

abstinence) using SPSS Version 22. Regression (linear and logistic) analyses were then employed to investigate the association between cessation self-efficacy and expired-CO at each week with our primary outcome measure (7-day point prevalence smoking status at week 10), controlling for age, psychiatric status and treatment condition. Linear regression analyses were used with all predictors (self-efficacy and expired-co scores) entered simultaneously to obtain *variance inflation factor (VIF; Miles, 2009)*, a measure used to detect issues regarding multicollinearity, with a cut-off score of greater than 5 indicative of potential multicollinearity due to variance inflation (O'Brien, 2007). Using this information, Mplus Version 7 was then used to fit a series of path models, using the Maximum Likelihood Estimation with Robust standard errors (MLR), which is a robust estimator that can account for missing data. We first constructed a measurement path model using data from weeks 1, 3, and 5, to assess model fit. This entailed creating latent variables for cessation self-efficacy, using scores on the two subscales (internal-states and external-variables) of the SEQ12 at weeks 1 (CSE1), 3 (CSE3), and 5 (CSE5) to ensure model fit and account for measurement error. In this model, we specified all auto-regressive (i.e., regressing all previous scores on the measure with each other) and cross-lagged (i.e., regression pathways between week 1-week 3 and week 3-week 5) pathways between these latent cessation self-efficacy variables and expired CO values for each week. After confirming adequate model fit, we constructed a predictive causal structural path (logistic regression; figure 2) model for weeks 1, 3, and 5 for both cessation self-efficacy and expired-CO, regressed onto week 10 abstinence (dichotomous variable; abstinent vs. smoking), controlling for treatment condition, psychiatric status, age, and gender. These variables were selected because they were significantly associated with smoking status at week 10 (outcome: abstinent), or there was a strong theoretical basis for including them in the analyses. As such, the final model

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

included those variables that independently (in basic models) predicting smoking outcome at week 10 (abstinence). This model included all first-order (previous week) autoregressive pathways for cessation self-efficacy and expired-CO, all cross-lagged paths between the two variables, and logistic regression for each variable onto our outcome variable. Cessation self-efficacy latent variables, using the SEQ12 internal- and external-subcales were used in our causal model to minimize measurement error; however, the manifest subscale scores were not used as independent predictors on the outcome.

Results

A total of 737 individuals met inclusion criteria for the *FLEX* study. Table 1 displays differences in demographic and smoking-related variables by smoking status at week 10. Briefly, participants had a mean age of 48.6 years (SD=10.8), 53.8% were male, and 52% reported fulltime employment, with 59.0% meeting criteria for a lifetime psychiatric diagnosis. Compared to those who were smoking at week 10, those who were abstinent were more likely to be older (M= 50.5 years $p = 0.01$), and were married/living common law (52.0%, $p = 0.004$); no differences were observed for psychiatric, education or employment status. Those who were abstinent at week 10 smoked fewer cigarettes per day ($p < 0.01$) and had lower nicotine dependence ($p < 0.01$) at baseline; participants did not differ on the number of previous quit attempts ($p = 0.127$). As expected, among successful quitters there were significant differences in cessation self-efficacy scores and expired-CO for weeks 1, 3, and 5 (all p -values < 0.01); those who were abstinent at week 10 had higher self-efficacy and lower CO. Baseline self-efficacy (measured pre-quit attempt) was not different according to smoking status at week 10 ($p = 0.672$). Logistic regression analyses, controlling for age, gender, treatment condition, and psychiatric status, revealed a significant relationship at weeks 1, 3, and 5 for both cessation self-

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

efficacy and expired-CO with smoking status at week 10 (outcome: abstinence); results are summarized in table 2. Linear regression to assess for potential multicollinearity in our data fell below cut-offs on the VIF (range 1.90 – 3.51; cut-off typically VIF scores greater than 5; O'Brien, 2007). Finally, correlation analyses revealed that CO-values were moderately correlated with our dichotomous smoking outcomes for weeks 1 ($r = -0.427$, $p < 0.01$), 3 ($r = -0.495$, $p < 0.01$) and week 5 ($r = -0.536$, $p < 0.01$). Cessation self-efficacy was also modestly correlated with concurrent dichotomous smoking status for weeks 1 ($r = 0.255$, $p < 0.01$), 3 ($r = 0.385$, $p < 0.01$) and 5 ($r = 0.506$, $p < 0.01$).

Figure one shows the results of our measurement path-model, with all autoregressive (time 1-3, 1-5, 3-5) and cross-lagged (time 1-3, 3-5) paths specified to assess fit between cessation self-efficacy and expired-CO. Overall, model fit was good (CFI=0.991; RMSEA = 0.050, SRMR=0.049, Chi-Square (df=36) = 2663.97, $p < 0.01$). All autoregressive pathways were significant ($p < 0.01$) for cessation self-efficacy and for CO-scores, except for the path between expired-CO at week 1 to week 5 ($b = -0.036$ (0.030), $p = 0.232$). All cross lagged paths were also significant, such that previous weeks expired-CO predicted the following weeks self-efficacy score, and vice-versa. Figure two extends our structural measurement model into a predictive path model by regressing all variables onto our main outcome, 7-day point prevalence at week 10 (dichotomous variable; outcome: abstinence), while accounting for all autoregressive and cross-lagged paths between predictors, as well as age, gender, treatment condition, and psychiatric status. All autoregressive and cross-lagged pathways were significant once again, with standardized estimates of all predictors significant at week 10 abstinence, except for cessation self-efficacy at week 3 (CSE3; $b = -0.117$ (0.093), $p = 0.209$). These results support and confirm those obtained in our original simple logistic regression analyses, which are displayed in

table 2.

Discussion

We investigated the relationship between smoking cessation self-efficacy, smoking status, and abstinence outcomes in a sample of treatment-seeking smokers motivated to quit. Our results support a bidirectional association between self-efficacy and smoking, such that those who experienced a return to smoking had lower confidence ratings at subsequent follow-ups, whereas those who were confident were more likely to be smoke free during their next assessment. Moreover, in the present study in which measures from the intervention phase of the *FLEX* trial (i.e., weeks 1, 3, 5 and 10 post-target quit-date) were included, both cessation self-efficacy and previous smoking status was significantly associated with being abstinent at week 10, in both simplified and more complex analyses, taking into account previous scores within the same on the same measure as well as the association across measures. Our study thus provides positive support for the important relationship between cessation self-efficacy scores and smoking outcomes, independent of the relationship between self-efficacy and measures of concurrent/past smoking.

Our results support a bidirectional and dynamic relationship between smoking cessation self-efficacy and concurrent smoking; they are consistent with the results of other studies that have identified reciprocal interactions between these variables (T. Boardman, D. Catley, M. S. Mayo, & J. S. Ahluwalia, 2005; Elfeddali et al., 2012; Gwaltney, Shiffman, Balabanis, et al., 2005; Gwaltney et al., 2002; Shiffman, 2005; S. Shiffman et al., 1996). In our analyses, all cross-lagged paths (between week 1 and 3, and 3 and 5) were significant (figure 2), in both directions, highlighting the influence that both smoking and cessation self-efficacy can have on one another. These results support the seemingly intuitive notion that increasing levels of self-efficacy are

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

related to better outcomes and, in our study, were related to early abstinence outcomes (at week 10 post-target quit date). We also found moderate-high correlation across time-points on our measure of self-efficacy, and this relationship persisted in our model accounting for concurrent smoking status. This lends further support to the notion that cessation self-efficacy plays a significant role during a quit attempt, as it was related to smoking status as well as abstinence outcomes at week 10. Our model also found the reverse to be true; those who returned to some level of smoking during the treatment-phase of our study had lower confidence following their lapse, and were more likely to have relapsed to smoking at week 10. Perkins and colleagues (2012), had previously identified a bidirectional relationship between the two variables, using a briefer study design in which the authors investigated the association in a shorter trial using daily measures. Our results contrast with those of other investigators (Romanowich, Mintz, & Lamb, 2009; Wong et al., 2004), who found that abstinence alone predicted changes in self-efficacy scores; in both cases, however, the authors primarily compared outcomes to baseline measures of abstinence self-efficacy. We have evaluated both pre- and post-cessation measures of self-efficacy. While some authors have posited that measures of self-efficacy overestimate the likelihood of success (Williams & Rhodes, 2014), our results are in keeping with the model proposed by Bandura (1977), and of the findings of other models of abstinence and relapse (Katie Witkiewitz & G Alan Marlatt, 2004), which identify self-efficacy as both a determining and reciprocal factor on the path to successful behaviour change.

In their entirety our results lend support to other concepts highlighted in a meta-analysis examining smoking cessation self-efficacy (Gwaltney et al., 2009), which noted that the robustness of cessation self-efficacy as a predictor weakened when studies controlled for concurrent smoking. We too found evidence that measures of cessation self-efficacy, especially

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

those determined following cessation, are associated with abstinence outcomes. In our study, baseline self-efficacy was not associated with abstinence at week 10; it was only modestly correlated with later measures of self-efficacy in our sample (results in table 1). While Gwaltney & colleagues (2009) posited that the poor predictive validity of pre-cessation measures may reflect an overestimation of an individual's confidence, our participants' baseline measures were their lowest scores – even when compared to those who were or were not abstinent at week 10. Scores on the SEQ-12 in our study continued to rise over time; those who were abstinent at week 10 were more likely to see pronounced increases over time. This may reflect our study population, as our participants were heavily nicotine dependent and had made several previous quit attempts. That self-efficacy continued to increase across the study may also be reflective of our intervention – participants met briefly with smoking-cessation counsellors who supported and encouraged participants to maintain their progress or re-commit to quitting; such interventions have previously been associated with better outcomes (Schnoll et al., 2011).

Our results also support others (Gwaltney et al., 2009; Gwaltney, Shiffman, Balabanis, et al., 2005; Shiffman, 2005) who have noted that self-efficacy measures taken more proximally to the outcome show stronger associations. In our study, cessation self-efficacy measured at week 5 was most strongly associated with abstinence at week 10; this was true in both our logistic regression model (table 2) and in the structural model accounting for concurrent smoking (figure 2), although the differences across measurement points was modest. Continued monitoring of self-efficacy over the course of a quit-attempt may alert clinicians and those attempting to quit of potential triggers for a lapse, through either changes or fluctuations in scores on the measure serving as information and potential risk for experiencing a lapse/relapse. Furthermore, multi-item measures of self-efficacy specifically address various situations that may be problematic

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

and, therefore, provide valuable insight for both those quitting and health-care professionals to focus on high-risk situations for potential lapse/relapse (Gwaltney et al., 2001). While more proximal measures of self-efficacy offer the strongest association, this effect was modest (e.g., odds ratios of 1.041 at week 1 as compared to 1.087 at week 5; see table 2), supporting self-efficacy as a more global indicator of being smoke-free. Interestingly, smoking status, while associated with our week 10 outcome at all three time-points, was relatively more stable over time, such that a return to smoking at any measurement point was equally likely to be associated with outcomes at week 10. These results likely reflect the negative effects that any lapse, especially those early during a quit attempt, can have on cessation outcomes. Previous investigations demonstrated that those who experience early lapses are both more likely to experience a subsequent lapse, and ultimately relapse (Kirchner, Shiffman, & Wileyto, 2012; Saul Shiffman et al., 1996). In our study, we saw a high correlation in CO-scores across weeks, likely indicative that those who did lapse continued to smoke (to some degree) and were unsuccessful at ultimately quitting. Despite this, ongoing assessment of cessation self-efficacy may still be important in addressing areas of concern (e.g., around a past or potential lapse-inducing situation), and clinicians should attempt to use this information whenever possible in helping individuals maintain or re-commit to abstinence as these measures can provide moment to moment information and act as warning signs. One interesting aspect to note in our final model, is a negative sign in the coefficient from self-efficacy at week 1 to week 10 abstinence, which was opposite of our expectation and our logistic regression results. This result may reflect some unexplained variance in week 1 self-efficacy that is not being explained by later measures (at weeks 3 and 5) but still associated with our outcome. One potential explanation for this is that self-efficacy measures taken early on in a quit attempt may be somewhat inflated due to

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

overconfidence (Williams & Rhodes, 2014), and not simply a reflection of confidence in their ability to remain abstinent, which in our model was best explained by the most proximal measure of self-efficacy to our outcome (week 5).

Our study had some limitations. We used expired-CO scores as a proxy for current smoking status in order to fit our structural models. Although previous studies have found CO scores to be both reliable and to possess construct validity (Deveci et al., 2004), we identified a moderate correlation between this variable and cessation outcomes at each measurement point. Our results may not be generalizable to all smokers; our sample comprised treatment-seeking smokers who had multiple previous quit attempts and those with substance abuse in the previous 3 months were excluded. Our study possessed a number of strengths. We were able to recruit a large sample (737) of participants and included many individuals with comorbid psychiatric illnesses (n=435, 59.0% lifetime history). We controlled for this in our analyses (lifetime vs. no diagnosis), which we feel extends the generalizability of our findings to real-world populations, given that a disproportionate number of current smokers meet criteria for a psychiatric diagnosis, and that this population is oftentimes excluded from larger smoking cessation trials (Aubin, Rollema, Svensson, & Winterer, 2012). Our structural model (figure 1 – manifest model) displayed adequate fit, and our final predictive structural model was able to account for our longitudinal, repeated measures design, and cross-lagged paths across all variables of interest leading to a sophisticated and detailed model of the interactions between confidence and smoking during the early phase of our study.

Our results reveal a bi-directional relationship between smoking cessation self-efficacy and concurrent smoking status; both constructs predicting week 10 abstinence. These results lend further support to behavioural models of relapse (Katie Witkiewitz & G Alan Marlatt, 2004) in

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

which periods of abstinence increase subsequent confidence and increase the chances of successful cessation. In contrast, early set-backs appear to negatively impact both confidence in one's future ability to refrain from smoking, and the chances of success during the current attempt. Even after controlling for these ongoing set-backs, however, our results highlight that increased confidence is important for both the maintenance and/or recommitment to abstinence during the course of any quit attempt. Future research is required to clarify and differentiate the relationship between smoking lapses and cessation self-efficacy in order to better identify those who are at higher risk of relapsing as compared to those able to resume the quit attempt.

Clinically, our results lend support to the continued use of cessation self-efficacy as a measure to help clinicians those who are more likely to successfully quit smoking.

REFERENCES

- Aubin, H.-J., Rollema, H., Svensson, T. H., & Winterer, G. (2012). Smoking, quitting, and psychiatric disease: A review. *Neuroscience & Biobehavioral Reviews*, *36*(1), 271-284.
- Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychological Review*, *84*(2), 191.
- Bandura, A. (1997). *Self-efficacy: The exercise of self-control*. Gordonsville, VA: WH Freeman & Co.
- Boardman, T., Catley, D., Mayo, M. S., & Ahluwalia, J. S. (2005). Self-efficacy and motivation to quit during participation in a smoking cessation program. *Int J Behav Med*, *12*(4), 266-272.
- Brandon, T. H., Vidrine, J. I., & Litvin, E. B. (2007). Relapse and relapse prevention. *Annu. Rev. Clin. Psychol.*, *3*, 257-284.
- Brown, A., Moodie, C., & Hastings, G. (2009). A longitudinal study of policy effect (smoke-free legislation) on smoking norms: ITC Scotland/United Kingdom. *Nicotine & Tobacco Research*, ntp087.
- Clark, N. M., & Dodge, J. A. (1999). Exploring self-efficacy as a predictor of disease management. *Health Education & Behavior*, *26*(1), 72-89.
- Deveci, S. E., Deveci, F., Açıık, Y., & Ozan, A. T. (2004). The measurement of exhaled carbon monoxide in healthy smokers and non-smokers. *Respiratory Medicine*, *98*(6), 551-556.
doi:<http://dx.doi.org/10.1016/j.rmed.2003.11.018>
- DiClemente, C. C., Fairhurst, S. K., & Piotrowski, N. A. (1995). Self-efficacy and addictive behaviors *Self-efficacy, adaptation, and adjustment* (pp. 109-141): Springer.
- Elfeddali, I., Bolman, C., Candell, M. J. J. M., Wiers, R. W., & De Vries, H. (2012). The role of

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

self-efficacy, recovery self-efficacy, and preparatory planning in predicting short-term smoking relapse. *British journal of health psychology*, *17*(1), 185-201.

doi:10.1111/j.2044-8287.2011.02032.x

Etter, J.-F., Bergman, M. M., Humair, J.-P., & Perneger, T. V. (2000). Development and validation of a scale measuring self-efficacy of current and former smokers. *Addiction*, *95*(6), 901-913. doi:10.1046/j.1360-0443.2000.9569017.x

Gwaltney, C. J., Metrik, J., Kahler, C. W., & Shiffman, S. (2009). Self-efficacy and smoking cessation: A meta-analysis. *Psychology of Addictive Behaviors*, *23*(1), 56-66.

doi:10.1037/a0013529

Gwaltney, C. J., Shiffman, S., Balabanis, M. H., & Paty, J. A. (2005). Dynamic Self-Efficacy and Outcome Expectancies: Prediction of Smoking Lapse and Relapse. *Journal of Abnormal Psychology*, *114*(4), 661-675. doi:10.1037/0021-843x.114.4.661

Gwaltney, C. J., Shiffman, S., Normal, G. J., Paty, J. A., Kassel, J. D., Gnys, M., . . . Balabanis, M. (2001). Does smoking abstinence self-efficacy vary across situations? Identifying context-specificity within the *Relapse Situation Efficacy Questionnaire*. *Journal of consulting and clinical psychology*, *69*(3), 516-527. doi:10.1037/0022-006X.69.3.516

Gwaltney, C. J., Shiffman, S., Paty, J. A., Liu, K. S., Kassel, J. D., Gnys, M., & Hickcox, M. (2002). Using self-efficacy judgments to predict characteristics of lapses to smoking. *Journal of consulting and clinical psychology*, *70*(5), 1140-1149. doi:10.1037/0022-006x.70.5.1140

Heatherton, T. F., Kozlowski, L. T., Frecker, R. C., & Fagerstrom, K.-O. (1991). The Fagerström Test for Nicotine Dependence: a revision of the Fagerstrom Tolerance Questionnaire.

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

- British Journal of Addiction*, 86(9), 1119-1127. doi:10.1111/j.1360-0443.1991.tb01879.x
- Jamal, A., Agaku, I. T., O'Connor, E., King, B. A., Kenemer, J. B., & Neff, L. (2014). Current cigarette smoking among adults—United States, 2005–2013. *MMWR Morb Mortal Wkly Rep*, 63(47), 1108-1112.
- Jha, P., & Peto, R. (2014). Global effects of smoking, of quitting, and of taxing tobacco. *New England Journal of Medicine*, 370(1), 60-68.
- Kang, S.-Y., Deren, S., Andia, J., Colon, H. M., & Robles, R. (2004). Effects of changes in perceived self-efficacy on HIV risk behaviors over time. *Addictive behaviors*, 29(3), 567-574.
- Kasten, S., Eggers, S., & de Vries, H. (2015). The importance of self-efficacy and action planning for smoking cessation. *European Health Psychologist*, 17(S), 694.
- Kirchner, T. R., Shiffman, S., & Wileyto, E. P. (2012). Relapse dynamics during smoking cessation: recurrent abstinence violation effects and lapse-relapse progression. *Journal of abnormal psychology*, 121(1), 187.
- Levy, D. T., & Friend, K. B. (2003). The effects of clean indoor air laws: what do we know and what do we need to know? *Health Education Research*, 18(5), 592-609.
doi:10.1093/her/cyf045
- Marcus, B. H., Selby, V. C., Niaura, R. S., & Rossi, J. S. (1992). Self-efficacy and the stages of exercise behavior change. *Research quarterly for exercise and sport*, 63(1), 60-66.
- McCarthy, D. E., Ebssa, L., Witkiewitz, K., & Shiffman, S. (2015). Paths to tobacco abstinence: A repeated-measures latent class analysis. *Journal of consulting and clinical psychology*, 83(4), 696.
- Miles, J. (2009). Tolerance and variance inflation factor. *Wiley StatsRef: Statistics Reference*

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

Online.

- Ng, M., Freeman, M. K., Fleming, T. D., Robinson, M., Dwyer-Lindgren, L., Thomson, B., . . . Lopez, A. D. (2014). Smoking prevalence and cigarette consumption in 187 countries, 1980-2012. *JAMA*, *311*(2), 183-192.
- O'brien, R. M. (2007). A caution regarding rules of thumb for variance inflation factors. *Quality & Quantity*, *41*(5), 673-690.
- Ockene, J. K., Mermelstein, R. J., Bonollo, D. S., Emmons, K. M., Perkins, K. A., Voorhees, C. C., & Hollis, J. F. (2000). Relapse and maintenance issues for smoking cessation. *Health Psychology*, *19*(1S), 17.
- Perkins, K. A., Parzynski, C., Mercincavage, M., Conklin, C. A., & Fonte, C. A. (2012). Is self-efficacy for smoking abstinence a cause of, or a reflection on, smoking behavior change? *Experimental and clinical psychopharmacology*, *20*(1), 56.
- Piasecki, T. M. (2006). Relapse to smoking. *Clinical Psychology Review*, *26*(2), 196-215. doi:<http://dx.doi.org/10.1016/j.cpr.2005.11.007>
- Romanowich, P., Mintz, J., & Lamb, R. J. (2009). The relationship between self-efficacy and reductions in smoking in a contingency management procedure. *Experimental and clinical psychopharmacology*, *17*(3), 139-145. doi:10.1037/a0015842
- Schnoll, R. A., Martinez, E., Tatum, K. L., Glass, M., Bernath, A., Ferris, D., & Reynolds, P. (2011). Increased self-efficacy to quit and perceived control over withdrawal symptoms predict smoking cessation following nicotine dependence treatment. *Addictive behaviors*, *36*(1-2), 144-147. doi:<http://dx.doi.org/10.1016/j.addbeh.2010.08.024>
- Sheehan, D. V., Lecrubier, Y., Sheehan, K. H., Amorim, P., Janavs, J., Weiller, E., . . . Dunbar, G. C. (1998). The Mini-International Neuropsychiatric Interview (MINI): the

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

development and validation of a structured diagnostic psychiatric interview for DSM-IV and ICD-10. *Journal of clinical psychiatry*, 59, 22-33.

Shiffman, S. (2005). Dynamic Influences on Smoking Relapse Process. *Journal of personality*, 73(6), 1715-1748. doi:10.1111/j.0022-3506.2005.00364.x

Shiffman, S., Hickcox, M., Paty, J. A., Gnys, M., Kassel, J. D., & Richards, T. J. (1996). Progression from a smoking lapse to relapse: prediction from abstinence violation effects, nicotine dependence, and lapse characteristics. *J Consult Clin Psychol.*, 64(5), 993-1002.

Shiffman, S., Hickcox, M., Paty, J. A., Gnys, M., Kassel, J. D., & Richards, T. J. (1996). Progression from a smoking lapse to relapse: prediction from abstinence violation effects, nicotine dependence, and lapse characteristics. *Journal of consulting and clinical psychology*, 64(5), 993.

Shiffman, S., Stone, A. A., & Hufford, M. R. (2008). Ecological momentary assessment. *Annu. Rev. Clin. Psychol.*, 4, 1-32.

Spaulding, A., Haley, D. R., & Zhao, M. (2014). Highly Self-Efficacious or Simply Delusional? *International Journal of Health Sciences*, 2(1), 01-17.

Stead, L. F., Koilpillai, P., & Lancaster, T. (2015). Additional behavioural support as an adjunct to pharmacotherapy for smoking cessation. *The Cochrane database of systematic reviews*(10), CD009670.

Thomas, S., Fayter, D., Misso, K., Ogilvie, D., Petticrew, M., Sowden, A., . . . Worthy, G. (2008). Population tobacco control interventions and their effects on social inequalities in smoking: systematic review. *Tobacco Control*, 17(4), 230-237.
doi:10.1136/tc.2007.023911

Tulloch, H., Pipe, A., Els, C., Aitken, D., Clyde, M., Corran, B., & Reid, R. D. (2014). Flexible

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

- and extended dosing of nicotine replacement therapy or varenicline in comparison to fixed dose nicotine replacement therapy for smoking cessation: Rationale, methods and participant characteristics of the FLEX trial. *Contemporary Clinical Trials*, 38(2), 304-313. doi:<http://dx.doi.org/10.1016/j.cct.2014.05.011>
- Tulloch, H. E., Pipe, A. L., Els, C., Clyde, M. J., & Reid, R. D. (2016). Flexible, dual-form nicotine replacement therapy or varenicline in comparison with nicotine patch for smoking cessation: a randomized controlled trial. *BMC medicine*, 14(1), 80.
- Williams, D. M., & Rhodes, R. E. (2014). The confounded self-efficacy construct: conceptual analysis and recommendations for future research. *Health Psychology Review*, 1-16. doi:10.1080/17437199.2014.941998
- Witkiewitz, K., & Marlatt, G. A. (2004). Relapse prevention for alcohol and drug problems: that was Zen, this is Tao. *American Psychologist*, 59(4), 224.
- Wong, C. J., Anthony, S., Sigmon, S. C., Mongeon, J. A., Badger, G. J., & Higgins, S. T. (2004). Examining interrelationships between abstinence and coping self-efficacy in cocaine-dependent outpatients. *Experimental and clinical psychopharmacology*, 12(3), 190.
- Zhou, X., Nonnemaker, J., Sherrill, B., Gilsenan, A. W., Coste, F., & West, R. (2009). Attempts to quit smoking and relapse: Factors associated with success or failure from the ATTEMPT cohort study. *Addictive behaviors*, 34(4), 365-373. doi:<http://dx.doi.org/10.1016/j.addbeh.2008.11.013>

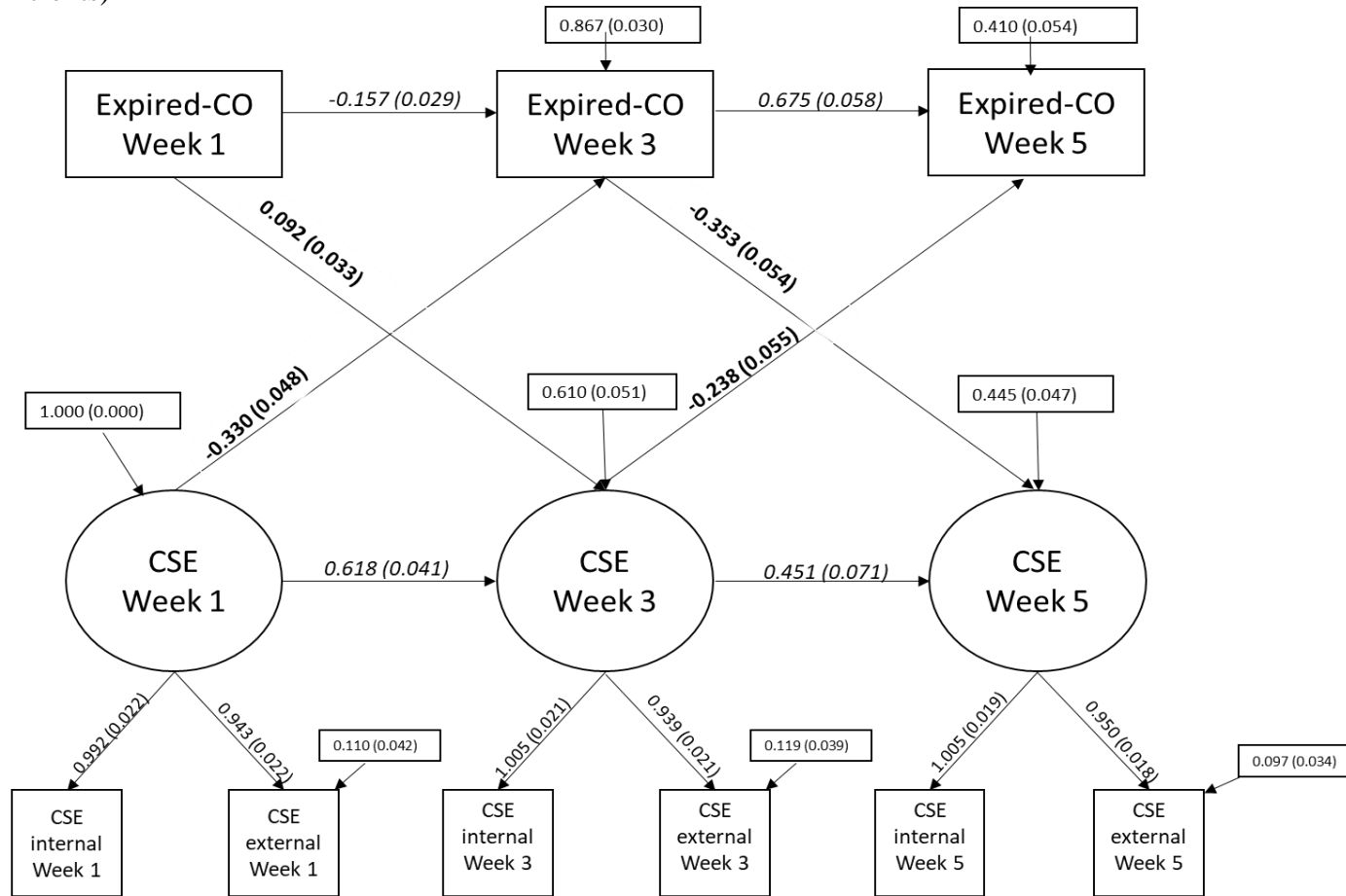
Smoking Cessation Self-Efficacy and Psychiatric comorbidity

Table 1 - Demographic and smoking related variables by week 10 smoking status					
	Total	Week 10 Smoker	Week 10 Abstinent	Test Statistic	p-value
Age	48.61 (10.83)	47.63 (10.95)	50.59 (10.35)	F (1, 735) = 11.741	0.001
Psychiatric diagnosis No diagnosis	435 (59.0%) 302 (41.0%)	296 (60.8%) 191 (39.2%)	139 (55.6%) 111 (44.4%)	$\chi^2 (1, 737) = 1.833$	0.176
Gender Male Female	395 (53.6%) 342 (46.4%)	268 (55.0%) 219 (45.0%)	127 (50.8%) 123 (49.2%)	$\chi^2 (1, 737) = 1.189$	0.276
Education	14.13 (2.95)	14.09 (2.82)	14.20 (3.20)	F (1, 729) = 0.252	0.616
Marital Status Single Married Divorced/Widowed/Separated	161 (22.0%) 340 (46.4%) 232 (31.7%)	124 (25.7%) 211 (43.5%) 150 (30.9%)	37 (14.9%) 129 (52.0%) 82 (33.1%)	$\chi^2 (1, 733) = 11.269$	0.004
Employment Full/Part-time Disability Retired/Unemployed	449 (61.3%) 126 (17.2%) 158 (21.6%)	288 (59.4%) 93 (19.2%) 104 (65.8%)	161 (64.9%) 33 (13.3%) 54 (21.8%)	$\chi^2 (1, 733) = 4.118$	0.128
Cigs/day	23.23 (10.76)	24.49 (11.50)	20.79 (8.66)	F (1, 723) = 19.699	0.001
Previous quit attempts	5.45	5.45 (23.37)	4.48 (5.69)	F (1, 684) = 2.337	0.485
Nicotine Dependence (week 0)	6.14 (2.22)	6.47 (2.12)	5.50 (2.28)	F (1, 695) = 31.478	0.001
Cessation Self-Efficacy pre-quit	34.95 (11.38)	34.84 (11.70)	35.22 (10.75)	F (1, 620) = 0.179	0.672
Cessation Self-Efficacy Week 1	42.00 (12.11)	39.86 (12.39)	45.09 (11.00)	F (1, 521) = 24.693	0.001
Cessation Self-Efficacy Week 3	44.33 (12.10)	41.14 (12.56)	48.17 (10.30)	F (1, 453) = 41.440	0.001
Cessation Self-Efficacy Week 5	45.82 (12.58)	41.21 (13.17)	51.38 (9.14)	F (1, 470) = 91.044	0.001
Expired-CO Week 1	5.52 (6.52)	7.59 (7.66)	2.44 (1.63)	F (1, 449) = 79.485	0.001
Expired-CO Week 3	4.85 (6.03)	7.13 (7.36)	2.16 (1.54)	F (1, 426) = 86.699	0.001
Expired-CO Week 5	4.77 (5.40)	6.99 (6.45)	2.22 (1.64)	F (1, 517) = 124.877	0.001
Note: Displayed as mean (standard deviation) unless otherwise specified; continuous variables assessed via ANOVA, and categorical variables assessed via chi-square.					

Smoking Cessation Self-Efficacy and Psychiatric comorbidity

Table 2 - Logistic Regression week 10 abstinence									
	OR	95% C.I.		Sig.		OR	95% C.I.		Sig.
		Lower	Upper				Lower	Upper	
Cessation Self-Efficacy Week 1	1.042	1.025	1.058	.001	Expired Carbon Monoxide Week 1	0.660	0.590	0.739	.001
Cessation Self-Efficacy Week 3	1.058	1.039	1.078	.001	Expired Carbon Monoxide Week 3	0.657	0.587	0.736	.001
Cessation Self-Efficacy Week 5	1.091	1.068	1.114	.001	Expired Carbon Monoxide Week 5	0.643	0.576	0.718	.001
<p>Note: Logistic regression, controlling for age, gender, treatment condition and psychiatric status; OR= Odds Ratio; 95% C. I. = 95% Confidence interval.</p> <p>Odds of being abstinent (reference category: smokers) at week 10 (7-day point prevalence); missing = classified as smoking.</p>									

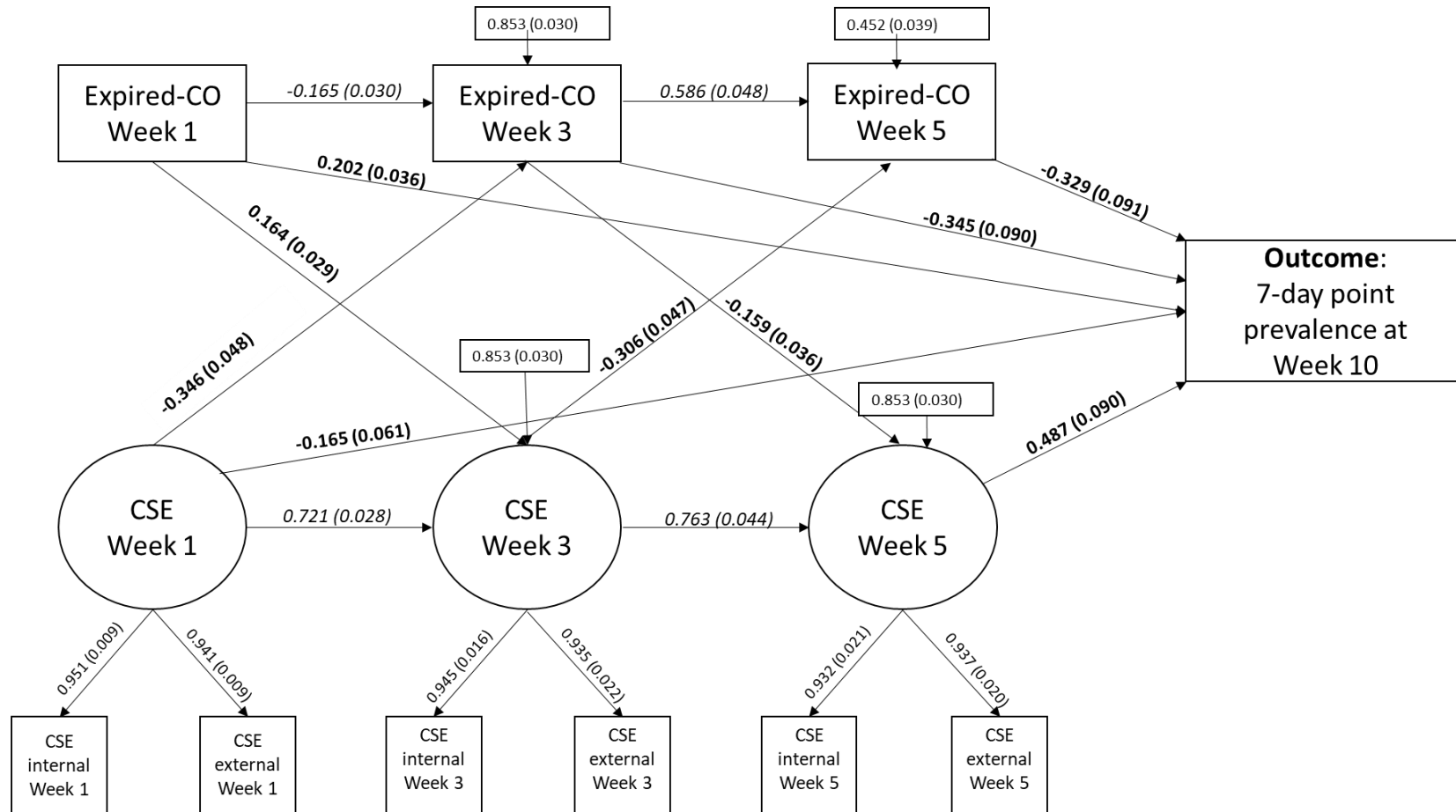
Figure 1 – Structural Measurement (Manifest) model of Smoking Cessation Self-Efficacy and Expired-CO (standardized coefficients)



Note: Numbers are standardized beta-coefficients with standardized errors in parentheses; **Bold** is cross-lagged paths; *italics* is auto-regressive; encased are error terms.
 Legend: CSE = Cessation Self-Efficacy; Expired-CO = Expired Carbon-Monoxide;

Figure Two – Structural Causal Path-Model of Smoking Cessation Self-Efficacy, Expired-CO and smoking status at Week 10

(outcome: abstinence)



Note: Only significant paths shown; Numbers are standardized beta-coefficients with standardized errors in parentheses; **Bold** is cross-lagged paths; *italics* is auto-regressive. Analyses controlling for Age, Gender, Treatment Condition, and Psychiatric Status; Legend: CSE = Cessation Self-Efficacy; Expired-CO = Expired Carbon-Monoxide

Dissertation Article 4: Interpersonal Determinants of Smoking Cessation in Treatment-Seeking Smokers With and Without Psychiatric illness: A Population and Cross-lagged Analysis

Interpersonal Determinants of Smoking Cessation in Treatment-Seeking Smokers With and Without Psychiatric illness: A Population and Cross-lagged Analysis

M Clyde^{1,2}, HE Tulloch^{1,2,3}, R Reid^{1,3}, C Els⁴, A Pipe^{1,3}

Author affiliation

¹University of Ottawa Heart Institute

²University of Ottawa, Department of Psychology

³University of Ottawa, Faculty of Medicine

⁴University of Alberta, Department of Psychiatry

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

Abstract

Introduction: Smoking cessation self-efficacy, nicotine withdrawal, and negative affect are interpersonal predictors of smoking cessation outcomes and central predictors for smokers with a concurrent psychiatric disorder. The present study investigated these determinants impact on smoking outcomes at 22- and 52-weeks.

Methods: Data for the present study are from the FLEX trial, a randomized pre- post-trial investigating the efficacy of 3 pharmacologic treatments for smoking cessation. Participants answered questionnaires assessing cessation self-efficacy, nicotine withdrawal and symptoms of depression at weeks 1, 3, 5 and 10 post-target quit date. Two principal analyses were performed: 1) a path-model of these interactions on outcomes at week 22 and 52; and, 2) using generalized estimating equations (GEE), a population-averaged model taking into account the correlated nature of our longitudinal repeated-measures design.

Results: Cessation self-efficacy emerged as a consistent predictor of outcomes, even when controlling for nicotine withdrawal, symptoms of depression and other smoking-related variables. An adjusted odds ratio (AOR) of 1.08, (95% Confidence Interval = 1.06-1.09, $p < 0.01$) was observed for our overall sample; results were similar for those with and without a psychiatric diagnosis. These results were mirrored in our path model: week 10 cessation self-efficacy was significantly associated with week 52 abstinence outcomes (no diagnosis: $b=0.183$, $se=0.059$, $p < 0.01$; lifetime diagnosis: $b=0.137$, $se=0.04$, $p < 0.001$).

Conclusion: Our results underscore the important role that cessation self-efficacy has in abstinence outcomes, supporting previous theoretical models of abstinence and relapse prevention. These findings are extended to individuals with a psychiatric diagnosis. Together, our results highlight the need for interventions which focus on self-efficacy strategies in order to

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

best equip smokers to achieve and maintain abstinence.

INTRODUCTION

Bandura's social cognitive theory [SCT; (Bandura, 1977)], which posits a causal reciprocal model across beliefs, goals, outcome expectancies, perceived environmental barriers, and self-efficacy (Bandura, 2004), is one of the most widely applied psychological theories of health behaviour change (Hyde, Hankins, Deale, & Marteau, 2008; Noar & Zimmerman, 2005). While all SCT constructs have been investigated to varying degrees, self-efficacy, or an individual's belief in their ability to complete the task at hand in order to reach one's goals, has become the central factor of this and other health behaviour change models (Bandura, 1986, 1999; Godin & Kok, 1996; Green & Murphy, 2014). This is particularly true in addictions research, where abstinence self-efficacy, an individual's belief that they can express the required behaviours to remain substance-free, is central to models of relapse and relapse prevention (Marlatt & George, 1984; Witkiewitz & Marlatt, 2004). Smoking cessation self-efficacy, the belief that one can remain tobacco free in the face of physiological, psychological, and social/environmental impediments, and its relationship to abstinence outcomes, has become one of the most consistently reproduced and robust findings in the smoking cessation literature (Amodei & Lamb, 2005; Diemert, Bondy, Brown, & Manske, 2013; Herd, Borland, & Hyland, 2009; Ockene et al., 2000). Significant heterogeneity in cross-study methodologies (e.g., type of measure, smoking status at time of measure, and latency between measure and outcome), make it difficult, however, to generalize and draw concrete conclusions about the mechanisms of change in measures of self-efficacy (Gwaltney et al., 2009). It is therefore crucial for researchers to continue to investigate the self-efficacy-abstinence outcome relationship in depth in order to further refine these models.

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

Behavioral (Lancaster & Stead, 2017) and combined pharmacotherapy (Stead, Koilpillai, Fanshawe, & Lancaster, 2016) interventions have helped decrease overall rates of smoking in the general population over the past two decades. Those who continue to smoke remain at elevated risk of morbidity and mortality, however (Jha et al., 2013; Morbidity and Mortality Weekly Report, 2013), with a large proportion of continuing smokers having a concurrent psychiatric illness. A recent study by Cook et al. (2014), reported a significantly lower decline in smoking rates amongst those with a psychiatric condition using data from a representative U.S. survey (falling from 25.3% to 24.9% between 2004-2011) compared to those in the general population. Several potential explanations exist as to why these individuals have more difficulty quitting (Kendler et al., 1993; Laje, Berman, & Glassman, 2001; Lyons et al., 2008). Sadly this significantly at-risk population is frequently excluded from clinical trials, severely limiting the generalizability of previous findings (Aubin et al., 2012). Moreover, to date only a handful of studies have examined the role played by cessation self-efficacy and its relation to smoking outcomes amongst smokers with a psychiatric illness (Greenfield et al., 2012; Haukkala, Uutela, Vartiainen, Mcalister, & Knekt, 2000; Mann-Wrobel, Bennett, Weiner, Buchanan, & Ball, 2011), in stark contrast to the literature which exists for non-psychiatric smokers. Sharing many of the same measurement limitations noted above, these studies frequently rely on cross-sectional designs (Haukkala et al., 2000), and restrict themselves to specific diagnoses/symptom profiles (Greenfield et al., 2012; Mann-Wrobel et al., 2011), once again limiting our ability to generalize their results and test theory.

In addition to self-efficacy, research has identified several other interpersonal-factors that impact smoking cessation outcomes (Piper et al., 2011; Shiffman, 2005) including nicotine dependence (Zhou et al., 2009), craving and withdrawal (Piper et al., 2011; Zhou et al., 2009),

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

and negative affect (Kassel, Stroud, & Paronis, 2003; Kenford et al., 2002; Vangeli, Stapleton, & West, 2010). Crucially, these factors are much more pronounced among psychiatric smokers, who are typically more nicotine dependent than individuals free of mental illness (Cynthia S. Pomerleau, Marks, & Pomerleau, 2000). As a result, when attempting to quit, they experience greater symptoms of withdrawal (Weinberger, Desai, & McKee, 2010) and negative affect (Leventhal, Piper, Japuntich, Baker, & Cook, 2014), as well as more positive expectations and greater relief of these symptoms once resuming smoking (Leventhal & Zvolensky, 2015). Taken together, this symptom profile contributes to the much poorer prognosis for smokers with concurrent mental illness attempting to remain abstinent (Piper et al., 2011).

To date, very few studies (Berndt et al., 2013; Castro et al., 2014; Cinciripini et al., 2003; Minnix, Blalock, Marani, Prokhorov, & Cinciripini, 2011) have investigated the potential for cessation self-efficacy to mediate the impact of other interpersonal-symptoms associated with a quit attempt. Cinciripini et al. (2003), for example, found that post-cessation self-efficacy mediated the impact of pre-cessation depressed mood on abstinence outcomes at 6-months. Similarly, Berndt and colleagues (2013) found self-efficacy to mediate the impact of craving, but only in individuals with low-to-moderate levels of anxiety. It is clear that more research needs to be conducted to better understand how symptoms of withdrawal, negative affect, and cessation self-efficacy interact with and differ from one another in order to enhance the development of more effective intervention strategies.

The objective of the present study was to investigate the association between measures of nicotine withdrawal, negative affect, and cessation self-efficacy across the course of a quit attempt in a group of treatment-seeking smokers with either a current, past, or no lifetime psychiatric diagnosis. More specifically, we investigated the association between these variables,

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

and their relationship to cessation outcomes at weeks 10, 22, and 52 weeks post-target quit date, using structural modeling while controlling for both initial scores and changes in these variables during the treatment-phase of our study. Furthermore, leveraging the longitudinal, repeated-measures design of our study, we investigated the overall contribution and effects of these variables using statistical analyses aimed at producing a population-averaged effect, in order to determine which factors had the highest predictive validity for cessation outcomes. We hypothesized that those with a current or past diagnosis would experience greater symptoms of nicotine withdrawal, negative affect, and lower cessation self-efficacy, when compared to those with no history of mental illness. We expected all measures to be related to cessation outcomes in our fully adjusted longitudinal model.

Methods

The “Flexible and extended dosing of nicotine replacement therapy (NRT) and varenicline in comparison to fixed-dose NRT for smoking cessation: *the FLEX trial*” was a randomized control trial whose primary aim was to investigate the effectiveness of three pharmacologic treatments for smoking cessation: 1) standard 10-week fixed dose nicotine replacement therapy (NRT); 2) titrated-dose and extended duration combination nicotine replacement therapy (NRT+); and, 3) titrated-dose and extended duration varenicline (VR). Written consent forms and study procedures were approved by the Ottawa Health Sciences Network Research Ethics Board, and the trial was registered on Clinical Trials.gov (identifier# NCT01623505). All participants provided voluntary informed consent. The trial was conducted at a single centre (the University of Ottawa Heart Institute; UOHI), a tertiary and quaternary cardiac care hospital, between June 2010 and July 2014.

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

Eligibility and Screening

Recruitment of participants was conducted via advertisements (i.e., radio, local newspaper, and posters), referrals from those presenting to the Quit Smoking Program at the UOHI, and referrals from local area health care professionals. Interested smokers contacted the study coordinator by phone and were screened for eligibility. A baseline visit was scheduled and eligibility was reconfirmed. To be eligible, participants had to be 18 years or older, smoke ≥ 10 cigarettes per day, and be willing to make a quit attempt in the subsequent 2-4 weeks. Exclusion criteria included having used either of the study medications (NRT or varenicline) for more than 72 consecutive hours in the previous month; any contraindications to the use of the study medications; a history of serious cardiac arrhythmias, or having experienced a myocardial infarction or cerebral vascular accident within the previous 10 days; severe or unstable angina pectoris; end-stage renal disease, or use of cimetidine; alcohol or substance abuse in the previous 3 months; unstable psychiatric symptoms precluding informed consent (i.e., active, untreated psychosis or suicidality); and, an inability to understand English or French. Women were excluded if pregnant, lactating, or attempting to become pregnant in the next year. Only one individual per household was eligible in order to avoid potential cross-contamination.

Procedures

Participants attended a baseline assessment, which included a structured clinical interview to assess for psychiatric conditions and completion of self-report questionnaires. Once eligibility was confirmed by one of the principal investigators (HT, AP), participants were randomized via computer-generated block randomization, stratified by psychiatric status (yes/no), and set a target-quit date. Follow-up visits were scheduled for weeks 1, 3, 5, 10, 22, and 52 post-target quit date; participant's reported their smoking status and completed self-report questionnaires assessing nicotine withdrawal, cessation self-efficacy, and mood-related

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

symptoms. During the treatment phase of the study (weeks 1, 3, 5, and 10), participants received 15-minute counseling sessions with nurses trained in smoking cessation treatment; these counselling sessions were based on best practice guidelines for smoking cessation (Fiore, 2008). A more detailed description of the study procedures has previously been published (H. Tulloch et al., 2014).

Measures

At baseline, participants completed self-report questionnaires aimed at assessing demographic (age, gender, ethnicity, marital status, employment status, education level) and smoking-related variables (age at first cigarette, years as a daily smoker, number of cigarettes smoked per day, previous quit attempts). At baseline and at each visit (weeks 1, 3, 5, 10, 22, 52 post-target quit-date), participants also completed self-report questionnaires assessing smoking cessation self-efficacy, nicotine withdrawal, and symptoms of depression.

Psychiatric diagnosis. Prior to assignment of treatment condition, participants were assessed for the presence of a lifetime psychiatric condition using the Mini International Psychiatric Interview (M.I.N.I 6.0.0; (Sheehan et al., 1998), a structured interview used to assess for a DSM-IV and/or ICD-10 psychiatric diagnosis. The M.I.N.I. has demonstrated high internal consistency and test-retest reliability, as well as construct validity when compared to other structured clinical interviews for DSM-IV diagnoses (Sheehan et al., 1998). Participants who did not meet any psychiatric diagnostic criteria in their lifetime were classified as no lifetime history, while individuals who met criteria were classified as having either a lifetime or current psychiatric diagnosis.

Cessation self-efficacy was assessed using the Smoking Cessation Self-Efficacy Questionnaire, a 12-item questionnaire with good reliability and validity compared to other

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

measures of smoking cessation self-efficacy (SEQ-12; Etter, Bergman, Humair, & Perneger, 2000). Each item asks participants to state how sure they are that they would be able to refrain from smoking across different situations (1 – not sure at all; 5 – absolutely sure). The SEQ-12 is comprised of two factors (6-items each) of smoking cessation self-efficacy: internal stimuli (e.g., ‘when I’m stressed’; ‘when I’m sad’) and external stimuli (e.g., ‘when I’m with other smokers’; ‘after a meal’) self-efficacy. The SEQ-12 has a total score of 60, with higher scores indicating higher self-efficacy.

Depression: Symptoms of depression were assessed using the Beck Depression Inventory-II (BDI-II; Beck A, Steer, & Brown, 1996). This 21-item scale is a widely used, psychometrically sound self-administered questionnaire (Beck A et al., 1996). Internal consistency is high ($\alpha = .92$) and content validity has been established with the DSM-IV (Dozois, Dobson, & Ahnberg, 1998). A total score was calculated by summing the participant’s responses to all items. Scores from 0-13 indicate minimal depression, 14-19 indicate mild depression, 20-28 indicate moderate depression, and 29-63 indicate severe depression.

Withdrawal symptoms. The Minnesota Nicotine Withdrawal Scale (MNWS; Hughes & Hatsukami, 1986) assessed withdrawal symptoms within the previous 24 hours (e.g., urge to smoke, psychological distress, concentration, restlessness, increased appetite, insomnia). Participants indicated on a 5-point scale (0=none, 4=severe) the severity of symptoms experienced, with total scores indicative of experiencing a higher degree of withdrawal symptoms. Evidence of the validity and reliability of the MNWS has been previously demonstrated (Etter & Hughes, 2006).

Nicotine dependence was assessed at baseline via the 6-item Fagerstrom Test for Nicotine Dependence (FTND; (Heatherton et al., 1991), a reliable measure of nicotine

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

dependence (Piper, McCarthy, & Baker, 2006). The total score, ranging from 0-10, was computed for all participants, with higher scores being indicative of greater nicotine dependence.

Smoking status was first determined via self-report by asking individuals if they smoked since their quit date and/or in the past week (7-day point prevalence). Among those who responded affirmatively smoking status was confirmed by measuring levels of exhaled carbon monoxide (CO) using the Russell Standard (West, Hajek, Stead, & Stapleton, 2005). For an individual to be considered abstinent, they needed to self-report not having smoked and needed to produce an exhaled CO (CO-confirmed) level of ≤ 9 ppm. Participants who missed or dropped out of the study were considered smokers.

Statistical Analyses

Statistical analyses were carried out via IBM SPSS version 22 and Mplus version 7. Because there was significant missingness for the interpersonal variables at later follow-ups, all subsequent analyses were conducted using imputed datasets. The multiple imputation procedure was conducted using SPSS Version 22; 5 datasets were imputed, and presented results are estimates derived from the pooled results from the analyses output. Baseline and demographic information were summarized and assessed for differences using ANOVA and Chi-Square; if significant differences were detected, these variables were controlled for in subsequent analyses. Repeated-measures ANOVA was used to identify within-subject variation across the study (variable: time) for our interpersonal-determinants of smoking cessation, with psychiatric status (none – past – current diagnosis) as the between subjects factor; we also specified the interaction term for time x psychiatric status. In order to account for the longitudinal and repeated-measures design, Generalized Estimating Equations (GEE) was used to fit a logistic regression (reference category: smokers) across the measurement points (within-subjects: time) of our study for

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

nicotine withdrawal, depression, and cessation self-efficacy measures. GEE is a tool used with longitudinal correlated response data, which accounts for the relationship in responses made by each individual (Hanley, Negassa, Edwardes, & Forrester, 2003). It is a robust technique which provides consistent parameter estimates regardless of the covariance structure of the data, that are population-averaged effects. In our GEE estimation of the overall sample, we controlled for psychiatric status, treatment condition, concurrent smoking (expired-CO levels for each week), and demographic variables previously identified in univariate analyses. We conducted analyses on the overall sample, with interaction terms specified, and also via subgroup analyses by stratifying by psychiatric status. To further elucidate the relationship between our interpersonal-determinants and smoking outcomes, a path analysis using maximum likelihood with robust standard errors (MLR) and Monte Carlo integration in the MPlus program was conducted. MLR is robust analysis method for data with categorical outcomes, while we used the Monte Carlo integration and bootstrapping features to account for missingness. The analysis was carried out for the overall sample, and then stratified in our sample by psychiatric status. We modeled all auto-regressive (same variables over time) and cross-lagged (between variables across measurement intervals) direct paths between our variables of interest (cessation self-efficacy, depression, and nicotine withdrawal) at weeks 1, 5 and 10. Finally, we used a weighted least squares mean- and variance-adjusted (WLMSV) estimator, a robust estimator for non-normally distributed data which allows for simultaneous use of both continuous and categorical variables, and used the INDIRECT command to investigate the indirect effects of all variables of interest (treatment phase) and abstinence (outcome: not-smoking), repeating analyses for outcomes at week 22 and 52.

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

Results

A total of 737 individuals met inclusion criteria for the FLEX trial. We had significant missing data at later weeks of the FLEX trial (week 22: 30.3%, missing week 52: 34.6%) for scales describing interpersonal-determinants; analyses were therefore conducted using imputed data (n=5 data imputations). Those missing at week 22 were more likely to be younger (mean = 46.5 (SD=11.5), $p < 0.01$), were more likely to be single (n=67 (41.6%), $p < 0.01$), be in the middle tier of annual household income (n=65 (44.2%), $p < 0.00$), smoked less cumulative years (m = 29.3 (12.5), $p < 0.01$), and had lower self-efficacy at week 1 (m = 38.9 (13.2), $p < 0.01$). No differences were observed for level of education, employment status, cigarettes smoked per day, past quit attempts, and symptoms of withdrawal or depression at week 1; the same patterns were observed for those missing at week 52. Overall, there were no differences by our psychiatric categories (subgroups) and treatment conditions within the study ($\chi^2 (4) = 4.586$, $p=0.332$; bottom table 1). In terms of quit rates, there were significant differences in outcomes at week 10 ($\chi^2 (2) = 12.94$, $p=0.002$; current diagnosis: n=41, 22.9%; past: n=98, 39.2%; no diagnosis n=111, 36.8%) and at week 22 outcomes ($\chi^2 (2) = 9.198$, $p=0.010$; current: n=25, 14.0%; past: n=60, 23.4%; none: n=77 25.5%). Differences were also observed for week 52 ($\chi^2 (2) = 4.873$, $p=0.087$; current: n=22, 12.3%; past: n=52, 20.3%; none: n=55, 18.2%), although these were not significant.

Baseline characteristics and comparisons of demographic and smoking-related variables by psychiatric status (subgroups) are summarized in table 1. Briefly, the majority of our sample had experienced a lifetime diagnosis of a psychiatric illness (n=435, 59.0%), with 179 (24.3%) and 256 (34.7%) meeting criteria for either a current or past diagnosis, respectively. Our sample was more likely to be male (n=395, 53.6%), had a mean age of 48.6 (SD=10.8), completed a

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

mean of 14.1 years of education (SD=2.9), were more likely to be married (n=340, 46.3%) and be employed full-time (381, 52.0%). On average, our sample smoked an average of 24.2 cigarettes per day (SD=10.8), had smoked for 31.0 years (SD=11.7), and had made at least one quit attempt in the past (Mean=1.15, SD=2.96). Levene's test for homogeneity of variances across our psychiatric categories (subgroups) were non-significant for all demographic and smoking-related variables of interest, except for cigarettes smoked per day ($F(4, 715) = 5.698, p < 0.001$).

Table 2 displays the means of our the three interpersonal-determinants of smoking (smoking cessation self-efficacy, depression, and nicotine withdrawal) for each week of our study as assessed via multivariate repeated-measures ANOVA. Mauchly's Tests of Sphericity (testing of equal variances across pairwise comparisons) was significant for all three variables ($p < 0.001$ in all cases); all subsequent p-values presented are using the Greenhouse-Geisser correction. Our sample had significant difference in scores for all three variables over time: self-efficacy ($F(3.84) = 26.23, p < 0.001$), depression ($F(4.14) = 7.28, p < 0.001$), and nicotine withdrawal ($F(3.99) = 38.74, p < 0.001$); the only significant interaction (time by psychiatric status) was for scores on the SEQ-12 ($F(7.68) = 2.02, p < 0.05$), and non-significant for depression ($F(8.28) = 1.56, p = 0.128$) and nicotine withdrawal ($F(7.97) = 0.73, p = 0.669$).

Table 3 & 4 display the results of the generalized estimating equation (logistic regression) for the overall averaged effects of nicotine withdrawal, symptoms of depression and cessation self-efficacy across all visits of the study. Table 3 displays the odds of being abstinent (reference category: smoking; outcome 7-day point prevalence), both for unadjusted (only variables of interest) and adjusted (adjusted for treatment condition, nicotine dependence, and expired-CO) models for our overall sample, as well as stratified by psychiatric subgroupings.

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

Table 4 shows the adjusted overall model with interaction terms included in the analyses. In both unadjusted and adjusted models, one consistent finding emerged: the association between cessation self-efficacy and outcomes was evident (Adjusted Odds Ratio (AOR) = 1.062, 95% Confidence Interval (COI) = 1.047-1.078, $p < 0.01$). This was true in our overall model, as well as by psychiatric status. In our overall sample, only self-efficacy, previous quit attempts (AOR = 1.00, COI = 1.00 – 1.01) and nicotine dependence (AOR = 0.92, COI = 0.85 – 0.98) were significantly associated with abstinence outcomes in on population averaged sample. Our stratified models yielded similar results: across all subgroups cessation self-efficacy was predictive of outcomes, although some additional results were intriguing. Amongst those with a past diagnosis, nicotine withdrawal was associated with decreased chance of being abstinent (AOR = 0.960, COI = 0.932 – 0.988). Although not statistically significant ($p = 0.051$), there was also a trend for those with a current diagnosis with higher symptoms of depression to have lower abstinence (AOR = 0.973, COI = 0.946 – 1.000).. There were no significant interaction effects (psychiatric subgroups by interpersonal determinants; psychiatric subgroups by treatment condition); however, once again cessation self-efficacy was significantly associated with abstinence outcomes (AOR = 1.060, COI = 1.038 - 1.083; see Table 4).

Figures 1 and 2 display the standardized coefficients (significant pathways only) for symptoms of depression, nicotine withdrawal, and self-efficacy at weeks 1, 5 and 10, and their association with week 22 ($n=162$) and 52 ($n=129$) outcomes (dichotomous, 7-day point prevalence). Prior to fitting our models, we investigated our variables of interested (BDI weeks 1, 5, and 10; SEQ-12 weeks 1, 5, and 10; MNWS weeks 1, 5 and 10) for associations and multicollinearity indexes using linear regression analyses. Variance Inflation Factors (VIFs) were computed to ascertain the level of multicollinearity in our multiple regression model, with

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

cutoffs of 5 employed as critical values (Becker, Ringle, Sarstedt, & Völckner, 2015). All of our VIF scores were within the range of acceptable values (ranges week 1: 1.147 – 1.934; week 5: 1.237 – 2.591; week 10: 1.263 – 3.372). For both 22- and 52-week abstinence rates, week 10 cessation self-efficacy was a significant predictor of outcomes, even after controlling for earlier scores of self-efficacy, nicotine withdrawal, and symptoms of depression. Our models for those with a lifetime or no diagnosis found nearly identical results: self-efficacy at week 10 was a significant predictor of abstinence at week 22 (no diagnosis: $b=0.353$, standard error (se)=0.121, $p < 0.01$; lifetime diagnosis: $b=0.415$, $se=0.107$, $p < 0.001$) and week 52 (no diagnosis: $b=0.183$, $se=0.059$, $p < 0.01$; lifetime diagnosis: $b=0.137$, $se=0.04$, $p < 0.001$). There was evidence of partial mediation at week 22: nicotine withdrawal at week 1 by week 5 self-efficacy ($b=0.38$, $se=0.040$, $p < 0.001$), as well as for depression at week 1 by self-efficacy at week 10 ($b=-0.039$, $se=0.012$, $p < 0.01$). Results for week 52 outcomes, although not-significant, were similar for indirect partial mediation: week 1 withdrawal by week 5 self-efficacy ($b=0.065$, $se=0.039$, $p = 0.097$).

Discussion

The present study utilized two statistical techniques aimed at elucidating the relationship between factors commonly associated with smoking cessation -- nicotine withdrawal, symptoms of depression, and cessation self-efficacy -- and abstinence outcomes. Using a longitudinal, repeated-measures design, one reliable and robust finding emerged: there was a consistent association between smoking cessation self-efficacy and abstinence. This was true even after controlling for symptoms of nicotine withdrawal and depression, as well as demographic, other smoking-related variables, and smoking cessation pharmacotherapy interventions. The autoregressive cross-lagged path-model echoed these results while accounting for previous scores on

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

the measures as well as associations between the variables across the intervention-phase of our smoking cessation trial. Taken together, our results highlight the dynamic and important role of cessation self-efficacy in achieving abstinence amongst our sample of treatment-seeking smokers. To our knowledge, this is the first study to investigate these associations and interactions in a large sample of smokers with or without a lifetime psychiatric diagnosis, while concurrently comparing across both groups.

Our primary finding, smoking cessation self-efficacy as a consistent predictor of abstinence outcomes, is not a surprise. Several studies have found similar results despite significant heterogeneity in their study designs, self-efficacy assessment instruments, and outcomes (Boardman, Catley, Mayo, & Ahluwalia, 2005; Cinciripini et al., 2003; Cupertino et al., 2012; Gwaltney, Shiffman, Balabanis, et al., 2005; Gwaltney, Shiffman, & Sayette, 2005; Kasten et al., 2015; Martinez et al., 2010). Our study adds significantly to the literature by highlighting this association in two different ways: 1) at a proximal-level/dynamic level, using a path model which investigated differences and interactions over time during the treatment phase; and, 2) at a more static/tonic population-averaged level, by leveraging the longitudinal and repeated-measures design of our investigation. Our results were consistent in both cases highlighting the strong association between self-efficacy and abstinence throughout the course of a quit-attempt and indicating its dynamic role in the abstinence process. Our results echo and extend previous reports (Berg, Sanderson Cox, Mahnken, Greiner, & Ellerbeck, 2008; Borland et al., 2010; Castro et al., 2014) in important ways. For example, Castro and colleagues (2014) using an auto-regressive cross-lagged path model, found that quit-day self-efficacy uniquely predicted abstinence at week 1. Our study extends this finding by modeling changes in scores on self-efficacy, depression, and nicotine withdrawal over the course of a quit attempt, and assesses

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

their association to both medium (6 month) and long-term (12 month) follow-up. Our results highlight the importance of continuing to monitor an individual's level of self-efficacy, as we found a significant association with confidence measured at week 10 to smoking status at week 52. Previous research has identified a reciprocal model in which minute changes day-to-day can lead to drops in self-efficacy and a potential lapse (Gwaltney, Shiffman, Balabanis, et al., 2005). Our findings, however, lend further credence to the concept that higher levels of self-efficacy across a quit-attempt are significantly associated with better abstinence outcomes. This underscores self-efficacy's dynamic role in navigating barriers to success during smoking cessation treatment (Bandura, 1999) and also in preventing subsequent relapse (Witkiewitz & Marlatt, 2004).

Smokers with a history of psychiatric illness remain an understudied population, particularly with regard to understanding how their results vary in contrast to an asymptomatic population during a quit attempt. In our sample, consistent with previous reports (Grant, Hasin, Chou, Stinson, & Dawson, 2004; Lasser et al., 2000; Leonard et al., 2001), those with either a lifetime or current psychiatric diagnosis were more nicotine dependent and smoked more cigarettes at baseline. Furthermore, throughout the course of the quit attempt, they presented with more symptoms of depression, experienced greater levels of withdrawal, and generally reported lower self-efficacy in the face of potential barriers to remaining abstinent. Despite these differences, two important findings emerged: first, although the magnitude of their self-efficacy scores were lower compared to individuals with no diagnosis, higher levels of self-efficacy in this population continued to predict abstinence. Second, although symptoms of depression and withdrawal were significant predictors in univariate analyses, only self-efficacy was consistently associated with outcomes when all 3 factors were entered simultaneously. In our stratified

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

longitudinal model, those with a psychiatric diagnosis (lifetime or current) had poorer outcomes as a result of symptoms of withdrawal; although not significant, there was also a trend for higher negative affect to impact abstinence among smokers with a current diagnosis. This may reflect more difficulty tolerating the negative affect during the course of a quit attempt for this at-risk population. (Leventhal et al., 2014). Previous investigations for this at-risk population have noted a tendency to manifest an overall lower level of self-esteem, as well as the endorsement of more self-defeating cognitions and attitudes (Strong, Brown, Kahler, Lloyd-Richardson, & Niaura, 2004). Others have found that this population may suffer from self-stigmatization (Corrigan, Larson, & Ruesch, 2009; Corrigan, Watson, & Barr, 2006), and, therefore, potentially be less likely to attempt changes in their behaviour. Indeed, a pervasive myth surrounding this population is that they are not motivated to stop using tobacco (Siru, Hulse, & Tait, 2009); more recent investigations have found this to be false (Prochaska, 2011). Our results highlight that in spite of lower confidence in their abilities, these individuals can benefit from enhanced levels of cessation self-efficacy. Further, there is a belief that smoking cessation can precipitate negative affect and more intense withdrawal in this population (Hall, 2007; Solway, 2011; Taylor et al., 2014), which may contribute to lower success rates. In our path model, there was evidence for partial mediation of self-efficacy. Although there are significant paths between nicotine withdrawal and depression to abstinence outcomes at weeks 22 and 52, there was also evidence of an indirect path between withdrawal (week 5) and cessation self-efficacy (week 10) onto abstinence outcomes, indicating a potential mediating effect of cessation self-efficacy on withdrawal. Previous studies have reported a mediation/moderation effect of cessation self-efficacy on symptoms of depression (Cinciripini et al., 2003), craving in moderately anxious patients (Berndt et al., 2013), and withdrawal symptoms (Schnoll et al., 2011). The findings from

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

these studies and our investigation are consistent with models of relapse in addictions (Witkiewitz & Marlatt, 2004) in which dynamic factors (e.g., physiologic response, psychological influences) can be mitigated depending on an individual's level of confidence. Research needs to continue assessing the impact of increased self-efficacy on physiological and psychological correlates of smoking lapses during a quit attempt.

Our study had several limitations. Our sample included motivated, treatment-seeking smokers; these results may not generalize to all smokers. While our study participants were recruited for a randomized control trial, all analyses presented were secondary post-hoc analyses using unplanned subgroups. There are several potential pitfalls to subgroup analyses (Schultz & Grimes 2005), including multiplicity and potentially unexplained outcomes due to subgroup analyses. In order to address some of these concerns, we specified interaction terms in our model, as well as ran all analyses in both the overall sample as well as by subgroups. Although all individuals received a series of counseling sessions with specialized cessation counsellors (behavioural intervention), the primary intervention was pharmacotherapeutic and did not overtly focus on interpersonal determinants. Finally, we excluded those with concurrent substance abuse (past 3 months), which may further impact the generalizability of our findings. Despite these limitations, our study had several strengths. We were able to recruit a large sample (737) of participants, all of whom were evaluated by psychology staff using structured clinical diagnostic interviews, considered the gold standard for diagnosing psychiatric illness. Our study population included a large number of individuals with psychiatric diagnoses. Finally, we employed advanced statistical techniques (autoregressive cross-lagged path models; generalized estimating equations) which leveraged our longitudinal, repeated-measures study design.

In conclusion, our results underscore the important, consistent, and dynamic role that

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

cessation self-efficacy plays in abstinence outcomes. This finding was true regardless of psychiatric status, and taking into account scores on measures of depression and nicotine withdrawal, as well as accounting for baseline smoking characteristics. Our results support those put forth in theoretical models of abstinence and relapse prevention (Niaura, 2000; Witkiewitz & Marlatt, 2004), and underscore the need for additional research into interventions designed to target self-efficacy. Previous research has shown that interventions aimed at increasing self-efficacy (Hyde et al., 2008) can be effective in stimulating health behaviour change. Interventions aimed at increasing confidence may in particular be beneficial for individuals with a history of psychiatric illness, as these individuals often present with lower levels of confidence and have demonstrated poorer outcomes in smoking cessation trials.

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

References

- Amodei, N., & Lamb, R. J. (2005). Predictors of initial abstinence in smokers enrolled in a smoking cessation program. *Subst Use Misuse, 40*(2), 141-149.
- Aubin, H.-J., Rollema, H., Svensson, T. H., & Winterer, G. (2012). Smoking, quitting, and psychiatric disease: A review. *Neuroscience & Biobehavioral Reviews, 36*(1), 271-284.
- Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychological Review, 84*(2), 191.
- Bandura, A. (1986). The explanatory and predictive scope of self-efficacy theory. *Journal of Social and Clinical Psychology, 4*(3), 359-373.
- Bandura, A. (1997). Self-efficacy: The exercise of self-control. *Gordonsville, VA: WH Freeman & Co.*
- Bandura, A. (1999). Self-efficacy: Toward a unifying theory of behavioral change. In *The self in social psychology* (pp. 285-298). New York, NY, US: Psychology Press.
- Bandura, A. (2004). Health Promotion by Social Cognitive Means. *Health Education & Behavior, 31*(2), 143-164. doi:10.1177/1090198104263660
- Beck A, Steer, R., & Brown, G. (1996). *Beck Depression Inventory-2nd edition*. San Antonio, Tx: Psychological Coporation.
- Becker, J.-M., Ringle, C. M., Sarstedt, M., & Völckner, F. (2015). How collinearity affects mixture regression results. *Marketing Letters, 26*(4), 643-659.
- Berg, C. J., Sanderson Cox, L., Mahnken, J. D., Greiner, K. A., & Ellerbeck, E. F. (2008). Correlates of Self-efficacy among Rural Smokers. *Journal of Health Psychology, 13*(3), 416-421. doi:10.1177/1359105307088144
- Berndt, N. C., Hayes, A. F., Verboon, P., Lechner, L., Bolman, C., & De Vries, H. (2013). Self-

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

- efficacy mediates the impact of craving on smoking abstinence in low to moderately anxious patients: Results of a moderated mediation approach. *Psychology of Addictive Behaviors*, 27(1), 113.
- Boardman, T., Catley, D., Mayo, M., & Ahluwalia, J. (2005). Self-efficacy and motivation to quit during participation in a smoking cessation program. *International Journal of Behavioral Medicine*, 12(4), 266-272. doi:10.1207/s15327558ijbm1204_7
- Boardman, T., Catley, D., Mayo, M. S., & Ahluwalia, J. S. (2005). Self-efficacy and motivation to quit during participation in a smoking cessation program. *Int J Behav Med*, 12(4), 266-272.
- Borland, R., Yong, H. H., Balmford, J., Cooper, J., Cummings, K. M., O'Connor, R. J., . . . Fong, G. T. (2010). Motivational factors predict quit attempts but not maintenance of smoking cessation: findings from the International Tobacco Control Four country project. *Nicotine Tob Res.*, 12(Suppl), S4-11. doi: 10.1093/ntr/ntq1050.
- Brandon, T. H., Vidrine, J. I., & Litvin, E. B. (2007). Relapse and relapse prevention. *Annu. Rev. Clin. Psychol.*, 3, 257-284.
- Brown, A., Moodie, C., & Hastings, G. (2009). A longitudinal study of policy effect (smoke-free legislation) on smoking norms: ITC Scotland/United Kingdom. *Nicotine & Tobacco Research*, ntp087.
- Castro, Y., Cano, M. Á., Businelle, M. S., Correa-Fernández, V., Heppner, W. L., Mazas, C. A., & Wetter, D. W. (2014). A Cross-Lagged Path Analysis of Five Intrapersonal Determinants of Smoking Cessation. *Drug and Alcohol Dependence*.
- Cinciripini, P. M., Wetter, D. W., Fouladi, R. T., Blalock, J. A., Carter, B. L., Cinciripini, L. G., & Baile, W. F. (2003). The effects of depressed mood on smoking cessation: Mediation

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

- by postcessation self-efficacy. *Journal of consulting and clinical psychology*, 71(2), 292-301. doi:10.1037/0022-006x.71.2.292
- Clark, N. M., & Dodge, J. A. (1999). Exploring self-efficacy as a predictor of disease management. *Health Education & Behavior*, 26(1), 72-89.
- Cook, B. L., Wayne, G. F., Kafali, E. N., Liu, Z., Shu, C., & Flores, M. (2014). Trends in smoking among adults with mental illness and association between mental health treatment and smoking cessation. *JAMA*, 311(2), 172-182.
- Corrigan, P. W., Larson, J. E., & Ruesch, N. (2009). Self-stigma and the “why try” effect: impact on life goals and evidence-based practices. *World Psychiatry*, 8(2), 75-81.
- Corrigan, P. W., Watson, A. C., & Barr, L. (2006). The self-stigma of mental illness: implications for self-esteem and self-efficacy. *Journal of Social and Clinical Psychology*, 25(8), 875-884.
- Cupertino, A.-P., Berg, C., Gajewski, B., Hui, S.-k. A., Richter, K., Catley, D., & Ellerbeck, E. F. (2012). Change in self-efficacy, autonomous and controlled motivation predicting smoking. *Journal of Health Psychology*, 17(5), 640-652.
- Deveci, S. E., Deveci, F., Açık, Y., & Ozan, A. T. (2004). The measurement of exhaled carbon monoxide in healthy smokers and non-smokers. *Respiratory Medicine*, 98(6), 551-556. doi:<http://dx.doi.org/10.1016/j.rmed.2003.11.018>
- DiClemente, C. C., Fairhurst, S. K., & Piotrowski, N. A. (1995). Self-efficacy and addictive behaviors. In *Self-efficacy, adaptation, and adjustment* (pp. 109-141): Springer.
- Diemert, L. M., Bondy, S. J., Brown, K. S., & Manske, S. (2013). Young adult smoking cessation: predictors of quit attempts and abstinence. *Am J Public Health.*, 103(3), 449-453. doi: 410.2105/AJPH.2012.300878. Epub 302013 Jan 300817.

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

- Dozois, D. J., Dobson, K. S., & Ahnberg, J. L. (1998). A psychometric evaluation of the Beck Depression Inventory—II. *Psychological Assessment, 10*(2), 83.
- Elfeddali, I., Bolman, C., Candell, M. J. J. M., Wiers, R. W., & De Vries, H. (2012). The role of self-efficacy, recovery self-efficacy, and preparatory planning in predicting short-term smoking relapse. *British journal of health psychology, 17*(1), 185-201.
doi:10.1111/j.2044-8287.2011.02032.x
- Etter, J.-F., Bergman, M. M., Humair, J.-P., & Perneger, T. V. (2000). Development and validation of a scale measuring self-efficacy of current and former smokers. *Addiction, 95*(6), 901-913. doi:10.1046/j.1360-0443.2000.9569017.x
- Etter, J. F., & Hughes, J. R. (2006). A comparison of the psychometric properties of three cigarette withdrawal scales. *Addiction, 101*(3), 362-372.
- Farrell, M., Howes, S., Bebbington, P., Brugha, T., Jenkins, R., Lewis, G., . . . Meltzer, H. (2003). Nicotine, alcohol and drug dependence, and psychiatric comorbidity--results of a national household survey. *Int Rev Psychiatry, 15*(1-2), 50-56.
doi:10.1080/0954026021000045949
- Fiore, M. (2008). *Treating tobacco use and dependence: 2008 update: Clinical practice guideline*: Diane Publishing.
- Godin, G., & Kok, G. (1996). The theory of planned behavior: a review of its applications to health-related behaviors. *American Journal of Health Promotion, 11*(2), 87-98.
- Grant, B. F., Hasin, D. S., Chou, S., Stinson, F. S., & Dawson, D. A. (2004). Nicotine dependence and psychiatric disorders in the united states: Results from the national epidemiologic survey on alcohol and related conditions. *Archives of General Psychiatry, 61*(11), 1107-1115. doi:10.1001/archpsyc.61.11.1107

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

- Green, E. C., & Murphy, E. (2014). Health belief model. *The Wiley Blackwell encyclopedia of health, illness, behavior, and society*.
- Greenfield, B. L., Venner, K. L., Kelly, J. F., Slaymaker, V., & Bryan, A. D. (2012). The impact of depression on abstinence self-efficacy and substance use outcomes among emerging adults in residential treatment. *Psychology of Addictive Behaviors, 26*(2), 246.
- Gwaltney, C. J., Metrik, J., Kahler, C. W., & Shiffman, S. (2009). Self-efficacy and smoking cessation: A meta-analysis. *Psychology of Addictive Behaviors, 23*(1), 56-66.
doi:10.1037/a0013529
- Gwaltney, C. J., Shiffman, S., Balabanis, M. H., & Paty, J. A. (2005). Dynamic Self-Efficacy and Outcome Expectancies: Prediction of Smoking Lapse and Relapse. *Journal of Abnormal Psychology, 114*(4), 661-675. doi:10.1037/0021-843x.114.4.661
- Gwaltney, C. J., Shiffman, S., Normal, G. J., Paty, J. A., Kassel, J. D., Gnys, M., . . . Balabanis, M. (2001). Does smoking abstinence self-efficacy vary across situations? Identifying context-specificity within the *Relapse Situation Efficacy Questionnaire*. *Journal of consulting and clinical psychology, 69*(3), 516-527. doi:10.1037/0022-006X.69.3.516
- Gwaltney, C. J., Shiffman, S., Paty, J. A., Liu, K. S., Kassel, J. D., Gnys, M., & Hickcox, M. (2002). Using self-efficacy judgments to predict characteristics of lapses to smoking. *Journal of consulting and clinical psychology, 70*(5), 1140-1149. doi:10.1037/0022-006x.70.5.1140
- Gwaltney, C. J., Shiffman, S., & Sayette, M. A. (2005). Situational Correlates of Abstinence Self-Efficacy. *Journal of Abnormal Psychology, 114*(4), 649-660. doi:10.1037/0021-843x.114.4.649

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

- Hall, S. M. (2007). Nicotine interventions with comorbid populations. *American journal of preventive medicine*, 33(6), S406-S413.
- Hanley, J. A., Negassa, A., Edwardes, M. D. d., & Forrester, J. E. (2003). Statistical Analysis of Correlated Data Using Generalized Estimating Equations: An Orientation. *American Journal of Epidemiology*, 157(4), 364-375. doi:10.1093/aje/kwf215
- Haukkala, A., Uutela, A., Vartiainen, E., Mcalister, A., & Knekt, P. (2000). Depression and smoking cessation: the role of motivation and self-efficacy. *Addictive behaviors*, 25(2), 311-316.
- Heatherton, T. F., Kozlowski, L. T., Frecker, R. C., & Fagerstrom, K.-O. (1991). The Fagerström Test for Nicotine Dependence: a revision of the Fagerstrom Tolerance Questionnaire. *British Journal of Addiction*, 86(9), 1119-1127. doi:10.1111/j.1360-0443.1991.tb01879.x
- Herd, N., Borland, R., & Hyland, A. (2009). Predictors of smoking relapse by duration of abstinence: findings from the International Tobacco Control (ITC) Four Country Survey. *Addiction*, 104(12), 2088-2099. doi:10.1111/j.1360-0443.2009.02732.x
- Hughes, J. R., & Hatsukami, D. (1986). Signs and symptoms of tobacco withdrawal. *Archives of General Psychiatry*, 43(3), 289.
- Hyde, J., Hankins, M., Deale, A., & Marteau, T. M. (2008). Interventions to Increase Self-efficacy in the Context of Addiction Behaviours: A Systematic Literature Review. *Journal of Health Psychology*, 13(5), 607-623. doi:10.1177/1359105308090933
- Jamal, A., Agaku, I. T., O'Connor, E., King, B. A., Kenemer, J. B., & Neff, L. (2014). Current cigarette smoking among adults—United States, 2005–2013. *MMWR Morb Mortal Wkly Rep*, 63(47), 1108-1112.
- Jha, P., & Peto, R. (2014). Global effects of smoking, of quitting, and of taxing tobacco. *New*

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

England Journal of Medicine, 370(1), 60-68.

Jha, P., Ramasundarahettige, C., Landsman, V., Rostron, B., Thun, M., Anderson, R. N., . . .

Peto, R. (2013). 21st-century hazards of smoking and benefits of cessation in the United States. *N Engl J Med*, 368(4), 341-350. doi:10.1056/NEJMsa1211128

Lasser, K., Boyd, J. W., Woolhandler, S., Himmelstein, D. U., McCormick, D., & Bor, D. H.

(2000). Smoking and mental illness: a population-based prevalence study. *Jama*, 284(20), 2606-2610.

Kang, S.-Y., Deren, S., Andia, J., Colon, H. M., & Robles, R. (2004). Effects of changes in perceived self-efficacy on HIV risk behaviors over time. *Addictive behaviors*, 29(3), 567-574.

Kassel, J. D., Stroud, L. R., & Paronis, C. A. (2003). Smoking, stress, and negative affect: correlation, causation, and context across stages of smoking. *Psychological bulletin*, 129(2), 270.

Kasten, S., Eggers, S., & de Vries, H. (2015). The importance of self-efficacy and action planning for smoking cessation. *European Health Psychologist*, 17(S), 694.

Kendler, K., Neale, M., Maclean, C., Heath, A., Eaves, L., & Kessler, R. (1993). Smoking and major depression: a causal analysis. *Arch Gen Psychiatry*, 50, 36 - 43.

Kenford, S. L., Smith, S. S., Wetter, D. W., Jorenby, D. E., Fiore, M. C., & Baker, T. B. (2002). Predicting relapse back to smoking: contrasting affective and physical models of dependence. *Journal of consulting and clinical psychology*, 70(1), 216.

Kirchner, T. R., Shiffman, S., & Wileyto, E. P. (2012). Relapse dynamics during smoking cessation: recurrent abstinence violation effects and lapse-relapse progression. *Journal of Abnormal Psychology*, 121(1), 187.

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

- Laje, R., Berman, J., & Glassman, A. (2001). Depression and nicotine: preclinical and clinical evidence for common mechanisms. *Curr Psychiatry Rep*, 3, 470 - 474.
- Lancaster, T., & Stead, L. F. (2017). Individual behavioural counselling for smoking cessation. *Cochrane Database of Systematic Reviews*(3). doi:10.1002/14651858.CD001292.pub3
- Leonard, S., Adler, L., Benhammou, K., Berger, R., Breese, C., Drebing, C., . . . Olincy, A. (2001). Smoking and mental illness. *Pharmacology Biochemistry and Behavior*, 70(4), 561-570.
- Leventhal, A. M., Piper, M. E., Japuntich, S. J., Baker, T. B., & Cook, J. W. (2014). Anhedonia, depressed mood, and smoking cessation outcome. *Journal of consulting and clinical psychology*, 82(1), 122.
- Leventhal, A. M., & Zvolensky, M. J. (2015). Anxiety, depression, and cigarette smoking: A transdiagnostic vulnerability framework to understanding emotion–smoking comorbidity. *Psychological bulletin*, 141(1), 176.
- Levy, D. T., & Friend, K. B. (2003). The effects of clean indoor air laws: what do we know and what do we need to know? *Health Education Research*, 18(5), 592-609.
doi:10.1093/her/cyf045
- Lyons, M., Hitsman, B., Xian, H., Panizzon, M. S., Jerskey, B. A., Santangelo, S., . . . Tsuang, M. T. (2008). A Twin Study of Smoking, Nicotine Dependence, and Major Depression in Men. *Nicotine & Tobacco Research*, 10(1), 97-108.
- Mann-Wrobel, M. C., Bennett, M. E., Weiner, E. E., Buchanan, R. W., & Ball, M. P. (2011). Smoking history and motivation to quit in smokers with schizophrenia in a smoking cessation program. *Schizophrenia research*, 126(1), 277-283.
- Marcus, B. H., Selby, V. C., Niaura, R. S., & Rossi, J. S. (1992). Self-efficacy and the stages of

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

- exercise behavior change. *Research quarterly for exercise and sport*, 63(1), 60-66.
- Marlatt, G. A., & George, W. H. (1984). Relapse prevention: introduction and overview of the model. *Br J Addict*, 79(3), 261-273.
- Martinez, E., Tatum, K. L., Glass, M., Bernath, A., Ferris, D., Reynolds, P., & Schnoll, R. A. (2010). Correlates of smoking cessation self-efficacy in a community sample of smokers. *Addictive behaviors*, 35(2), 175-178. doi:<http://dx.doi.org/10.1016/j.addbeh.2009.09.016>
- McCarthy, D. E., Ebssa, L., Witkiewitz, K., & Shiffman, S. (2015). Paths to tobacco abstinence: A repeated-measures latent class analysis. *Journal of consulting and clinical psychology*, 83(4), 696.
- Minnix, J. A., Blalock, J. A., Marani, S., Prokhorov, A. V., & Cinciripini, P. M. (2011). Self-Efficacy Mediates the Effect of Depression on Smoking Susceptibility in Adolescents. *Nicotine & Tobacco Research*, 13(8), 699-705.
- Morbidity and Mortality Weekly Report. (2013). Vital Signs - Current Cigarette Smoking Among Adults Aged \geq 18 Years with Mental Illness—United States, 2009–2011. *Morbidity and Mortality Weekly Report, Early Release*, 62.
- Ng, M., Freeman, M. K., Fleming, T. D., Robinson, M., Dwyer-Lindgren, L., Thomson, B., . . . Lopez, A. D. (2014). Smoking prevalence and cigarette consumption in 187 countries, 1980-2012. *JAMA*, 311(2), 183-192.
- Niaura, R. (2000). Cognitive social learning and related perspectives on drug craving. *Addiction*, 95(8s2), 155-163.
- Noar, S. M., & Zimmerman, R. S. (2005). Health Behavior Theory and cumulative knowledge regarding health behaviors: are we moving in the right direction? *Health Education Research*, 20(3), 275-290.

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

- Ockene, J. K., Emmons, K. M., Mermelstein, R. J., Perkins, K. A., Bonollo, D. S., Voorhees, C. C., & Hollis, J. F. (2000). Relapse and maintenance issues for smoking cessation. *Health Psychol., 19*(1 Suppl), 17-31.
- Ockene, J. K., Mermelstein, R. J., Bonollo, D. S., Emmons, K. M., Perkins, K. A., Voorhees, C. C., & Hollis, J. F. (2000). Relapse and maintenance issues for smoking cessation. *Health Psychology, 19*(1S), 17.
- Parrott, A. C., & Murphy, R. S. (2012). Explaining the stress-inducing effects of nicotine to cigarette smokers. *Human Psychopharmacology: Clinical and Experimental, 27*(2), 150-155. doi:10.1002/hup.1247
- Perkins, K. A., Parzynski, C., Mercincavage, M., Conklin, C. A., & Fonte, C. A. (2012). Is self-efficacy for smoking abstinence a cause of, or a reflection on, smoking behavior change? *Experimental and clinical psychopharmacology, 20*(1), 56.
- Piasecki, T. M. (2006). Relapse to smoking. *Clinical Psychology Review, 26*(2), 196-215. doi:<http://dx.doi.org/10.1016/j.cpr.2005.11.007>
- Piper, M. E., McCarthy, D. E., & Baker, T. B. (2006). Assessing tobacco dependence: a guide to measure evaluation and selection. *Nicotine & Tobacco Research, 8*(3), 339-351.
- Piper, M. E., Schlam, T. R., Cook, J. W., Sheffer, M. A., Smith, S. S., Loh, W.-Y., . . . Hefner, K. R. (2011). Tobacco withdrawal components and their relations with cessation success. *Psychopharmacology, 216*(4), 569-578.
- Pomerleau, C. S., Carton, S. M., Lutzke, M. L., Flessland, K. A., & Pomerleau, O. F. (1994). Reliability of the Fagerstrom tolerance questionnaire and the Fagerstrom test for nicotine dependence. *Addictive behaviors, 19*(1), 33-39.
- Pomerleau, C. S., Marks, J. L., & Pomerleau, O. F. (2000). Who gets what symptom? Effects of

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

- psychiatric cofactors and nicotine dependence on patterns of smoking withdrawal symptomatology. *Nicotine & Tobacco Research*, 2(3), 275-280.
doi:10.1080/14622200050147547
- Prochaska, J. J. (2010). Failure to treat tobacco use in mental health and addiction treatment settings: A form of harm reduction? *Drug and alcohol dependence*, 110(3), 177-182.
doi:<http://dx.doi.org/10.1016/j.drugalcdep.2010.03.002>
- Prochaska, J. J. (2011). Smoking and mental illness—breaking the link. *New England Journal of Medicine*, 365(3), 196-198.
- Romanowich, P., Mintz, J., & Lamb, R. J. (2009). The relationship between self-efficacy and reductions in smoking in a contingency management procedure. *Experimental and clinical psychopharmacology*, 17(3), 139-145. doi:10.1037/a0015842
- Schnoll, R. A., Martinez, E., Tatum, K. L., Glass, M., Bernath, A., Ferris, D., & Reynolds, P. (2011). Increased self-efficacy to quit and perceived control over withdrawal symptoms predict smoking cessation following nicotine dependence treatment. *Addictive behaviors*, 36(1–2), 144-147. doi:<http://dx.doi.org/10.1016/j.addbeh.2010.08.024>
- Schulz, K. F., & Grimes, D. A. (2005). Multiplicity in randomised trials II: subgroup and interim analyses. *The Lancet*, 365(9471), 1657-1661.
- Sheehan, D. V., Lecrubier, Y., Sheehan, K. H., Amorim, P., Janavs, J., Weiller, E., . . . Dunbar, G. C. (1998). The Mini-International Neuropsychiatric Interview (MINI): the development and validation of a structured diagnostic psychiatric interview for DSM-IV and ICD-10. *Journal of clinical psychiatry*, 59, 22-33.
- Shiffman, S. (2005). Dynamic Influences on Smoking Relapse Process. *Journal of personality*, 73(6), 1715-1748. doi:10.1111/j.0022-3506.2005.00364.x

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

Shiffman, S., Hickcox, M., Paty, J. A., Gnys, M., Kassel, J. D., & Richards, T. J. (1996).

Progression from a smoking lapse to relapse: prediction from abstinence violation effects, nicotine dependence, and lapse characteristics. *Journal of consulting and clinical psychology*, 64(5), 993.

Shiffman, S., Hickcox, M., Paty, J. A., Gnys, M., Kassel, J. D., & Richards, T. J. (1996).

Progression from a smoking lapse to relapse: prediction from abstinence violation effects, nicotine dependence, and lapse characteristics. *J Consult Clin Psychol.*, 64(5), 993-1002.

Shiffman, S., Stone, A. A., & Hufford, M. R. (2008). Ecological momentary assessment. *Annu. Rev. Clin. Psychol.*, 4, 1-32.

Siru, R., Hulse, G. K., & Tait, R. J. (2009). Assessing motivation to quit smoking in people with mental illness: a review. *Addiction*, 104(5), 719-733.

Hall, S. M. (2007). Nicotine interventions with comorbid populations. *American journal of preventive medicine*, 33(6), S406-S413.

Solway, E. S. (2011). The lived experiences of tobacco use, dependence, and cessation: insights and perspectives of people with mental illness. *Health & Social Work*, 36(1), 19-32.

Spaulding, A., Haley, D. R., & Zhao, M. (2014). Highly self-efficacious or simply delusional. *International Journal of Health Sciences*, 2(1), 01-17.

Spaulding, A., Haley, D. R., & Zhao, M. (2014). Highly Self-Efficacious or Simply Delusional? *International Journal of Health Sciences*, 2(1), 01-17.

Stead, L. F., Koilpillai, P., Fanshawe, T. R., & Lancaster, T. (2016). Combined pharmacotherapy and behavioural interventions for smoking cessation. *Cochrane Database of Systematic Reviews*(3). doi:10.1002/14651858.CD008286.pub3

Stead, L. F., Koilpillai, P., & Lancaster, T. (2015). Additional behavioural support as an adjunct

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

- to pharmacotherapy for smoking cessation. *The Cochrane database of systematic reviews*(10), CD009670.
- Strong, D. R., Brown, R. A., Kahler, C. W., Lloyd-Richardson, E. E., & Niaura, R. (2004). Depression proneness in treatment-seeking smokers: A taxometric analysis. *Personality and individual differences, 36*(5), 1155-1170.
- Taylor, G., McNeill, A., Girling, A., Farley, A., Lindson-Hawley, N., & Aveyard, P. (2014). Change in mental health after smoking cessation: systematic review and meta-analysis. *Bmj, 348*, g1151.
- Thomas, S., Fayter, D., Misso, K., Ogilvie, D., Petticrew, M., Sowden, A., . . . Worthy, G. (2008). Population tobacco control interventions and their effects on social inequalities in smoking: systematic review. *Tobacco Control, 17*(4), 230-237.
doi:10.1136/tc.2007.023911
- Tulloch, H., Pipe, A., Els, C., Aitken, D., Clyde, M., Corran, B., & Reid, R. D. (2014). Flexible and extended dosing of nicotine replacement therapy or varenicline in comparison to fixed dose nicotine replacement therapy for smoking cessation: Rationale, methods and participant characteristics of the FLEX trial. *Contemporary Clinical Trials, 38*(2), 304-313. doi:<http://dx.doi.org/10.1016/j.cct.2014.05.011>
- Tulloch, H. E., Pipe, A. L., Els, C., Clyde, M. J., & Reid, R. D. (2016). Flexible, dual-form nicotine replacement therapy or varenicline in comparison with nicotine patch for smoking cessation: a randomized controlled trial. *BMC medicine, 14*(1), 80.
- Vangeli, E., Stapleton, J., & West, R. (2010). Smoking intentions and mood preceding lapse after completion of treatment to aid smoking cessation. *Patient education and counseling, 81*(2), 267-271.

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

- Weinberger, A. H., Desai, R. A., & McKee, S. A. (2010). Nicotine withdrawal in US smokers with current mood, anxiety, alcohol use, and substance use disorders. *Drug and Alcohol Dependence, 108*(1), 7-12.
- West, R., Hajek, P., Stead, L., & Stapleton, J. (2005). Outcome criteria in smoking cessation trials: proposal for a common standard. *Addiction., 100*(3), 299-303.
- Williams, D. M., & Rhodes, R. E. (2014). The confounded self-efficacy construct: conceptual analysis and recommendations for future research. *Health Psychology Review, 1*-16.
doi:10.1080/17437199.2014.941998
- Witkiewitz, K., & Marlatt, G. A. (2004). Relapse Prevention for Alcohol and Drug Problems: That Was Zen, This Is Tao. *American psychologist, 59*(4), 224-235. doi:10.1037/0003-066X.59.4.224
- Witkiewitz, K., & Marlatt, G. A. (2004). Relapse prevention for alcohol and drug problems: that was Zen, this is Tao. *American Psychologist, 59*(4), 224.
- Wong, C. J., Anthony, S., Sigmon, S. C., Mongeon, J. A., Badger, G. J., & Higgins, S. T. (2004). Examining interrelationships between abstinence and coping self-efficacy in cocaine-dependent outpatients. *Experimental and clinical psychopharmacology, 12*(3), 190.
- Zhou, X., Nonnemaker, J., Sherrill, B., Gilsenan, A. W., Coste, F., & West, R. (2009). Attempts to quit smoking and relapse: Factors associated with success or failure from the ATTEMPT cohort study. *Addictive behaviors, 34*(4), 365-373.
doi:<http://dx.doi.org/10.1016/j.addbeh.2008.11.013>

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

Table 1 – Demographic Variables by psychiatric categories

	Overall	None (N=302)	Lifetime (N=256)	Current (N=179)	p
Study group					
<i>NRT</i>	245 (33.2)	101 (33.4)	82 (32.0)	62 (34.6)	0.332
<i>NRT+</i>	245 (33.2)	102 (33.8)	77 (30.1)	66 (36.9)	
<i>Varenicline (VR)</i>	247 (33.5)	99 (32.8)	97 (37.9)	51 (28.5)	
Demographics					
<i>Age</i>	48.61 (10.83)	48.57 (11.07)	49.33 (11.11)	47.64 (9.95)	0.276
<i>Education</i>	14.13 (2.95)	14.61 (2.81)	14.00 (2.99)	13.48 (3.01)	0.01
Gender					
<i>Male</i>	395 (53.6)	188 (62.3)	128 (50.0)	79 (44.1)	0.01
<i>Female</i>	342 (46.4)	114 (37.7)	128 (50.0)	100 (55.9)	
Marital Status					
<i>Single</i>	161 (22.0)	52 (17.3)	52 (20.4)	57 (32.0)	0.01
<i>Married</i>	340 (46.4)	172 (57.3)	99 (38.8)	69 (38.8)	
<i>Separated/ Divorced/ Widowed</i>	232 (31.7)	76 (25.3)	104 (40.8)	52 (29.2)	
Employment					
<i>Full/Part time</i>	449 (61.3)	226 (75.6)	146 (57.3)	77 (43.0)	0.001
<i>Disability</i>	126 (17.2)	13 (4.3)	46 (18.0)	67 (37.4)	
<i>Retired/ Unemployed</i>	158 (21.6)	60 (20.1)	63 (24.7)	35 (19.6)	
Smoking variables					
<i>Cigarettes per day</i>	23.24 (10.76)	21.9 (9.66)	23.09 (9.57)	25.68 (13.43)	0.001
<i>Quit attempts</i>	1.15 (2.96)	1.07 (3.21)	1.24 (3.23)	1.14 (1.95)	0.8
<i>Nicotine Dependence</i>	6.14 (2.22)	5.60 (2.19)	6.27 (2.20)	6.85 (2.07)	0.001
Abstinence rates					
<i>Week 10</i>	250 (33.9)	111 (36.8)	98 (39.2)	41 (22.9)	0.002
<i>Week 22</i>	162 (22.0)	77 (25.5)	60 (23.4)	25 (14.0)	0.010
<i>Week 52</i>	129 (17.5)	55 (18.2)	52 (20.3)	22 (12.3)	0.087
Note: Significance assessed using Chi-Square or ANOVA (age/education).					

Table 2 – Mean Scores for interpersonal-determinants by week

Table 2 – Mean scores for interpersonal-determinants by week								
	Week 1	Week 3	Week 5	Week 10	Week 22	Week 52	p-value within subjects	p-value within subjects
							Time	Time by Psychiatric status
SEQ-12							<0.001	0.044
<i>Overall</i>	41.05 (11.8)	41.92 (12.1)	43.29 (12.4)	44.00 (12.9)	39.26 (14.6)	39.38 (14.4)		
<i>No diagnosis</i>	42.67 (11.8)	44.15 (12.1)	45.62 (12.1)	45.53 (13.3)	41.49 (14.5)	39.63 (14.9)		
<i>Past diagnosis</i>	40.98 (11.3)	41.94 (11.7)	43.13 (11.9)	44.68 (12.5)	39.08 (14.2)	40.02 (14.1)		
<i>Current diagnosis</i>	38.41 (11.8)	38.14 (11.8)	39.59 (12.9)	40.45 (12.5)	35.73 (14.6)	38.04 (13.9)		
BDI							<0.001	0.128
<i>Overall</i>	9.43 (8.5)	9.44 (9.1)	9.27 (9.5)	8.18 (8.8)	9.57 (9.3)	9.61 (8.8)		
<i>No diagnosis</i>	6.41 (5.9)	6.59 (7.0)	5.94 (6.2)	5.14 (5.6)	6.53 (6.3)	7.09 (6.7)		
<i>Past diagnosis</i>	8.92 (7.3)	8.64 (7.9)	8.91 (8.7)	7.64 (7.9)	8.82 (8.2)	9.27 (8.5)		
<i>Current diagnosis</i>	15.26 (10.4)	15.40 (10.9)	15.38 (12.0)	14.08 (11.3)	15.77 (11.7)	14.34 (10.2)		
MNWS							<0.001	0.669
<i>Overall</i>	16.73 (9.7)	15.31 (9.8)	13.98 (10.2)	12.36 (9.4)	13.37 (10.2)	13.07 (10.2)		
<i>No diagnosis</i>	14.44 (9.0)	12.62 (9.1)	10.91 (9.2)	9.58 (8.2)	10.52 (8.7)	10.02 (8.7)		
<i>Past diagnosis</i>	15.90 (9.2)	14.82 (8.9)	14.11 (9.6)	11.89 (8.4)	12.89 (9.7)	12.61 (9.2)		
<i>Current diagnosis</i>	21.77 (9.9)	20.54 (9.9)	18.99 (10.5)	17.74 (10.5)	18.87 (10.9)	18.87 (11.3)		
<i>Note: Repeated-Measures MANCOVA; Between-subjects factors: Psychiatric Status; Within-subjects factors: Time</i>								

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

Table 3 – GEE Logistic Regression stratified by Psychiatric Category

		Unadjusted model	Adjusted Model
Measure		Odds Ratio (95% Confidence Interval)	Odds Ratio (95% Confidence Interval)
Overall sample	Beck Depression Inventory	0.988 (0.969 - 1.008)	0.994 (0.975 - 1.013)
	Minnesota Nicotine Withdrawal	0.974 (0.959 – 0.990)	0.975 (0.958 - 0.991)
	Cessation Self-efficacy	1.10 (1.087 – 1.115)	1.062 (1.047 - 1.078)
No diagnosis	Beck Depression Inventory	0.991 (0.948 - 1.036)	1.003 (0.963 - 1.045)
	Minnesota Nicotine Withdrawal	0.982 (0.957 - 1.009)	0.973 (0.943 - 1.003)
	Cessation Self-efficacy	1.11 (1.086 - 1.132)	1.066 (1.041 - 1.091)
Past diagnosis	Beck Depression Inventory	1.006 (0.973 - 1.040)	1.00 (0.968 - 1.032)
	Minnesota Nicotine Withdrawal	0.972 (0.946 - 0.998)	0.960 (0.932 - 0.988)
	Cessation Self-efficacy	1.051 (1.03 - 1.07)	1.061 (1.035 - 1.089)
Current diagnosis	Beck Depression Inventory	0.977 (0.943 - 1.011)	0.973 (0.946 – 1.000)
	Minnesota Nicotine Withdrawal	0.994 (0.966 - 1.024)	0.999 (0.967 - 1.032)
	Cessation Self-efficacy	1.091 (1.064 - 1.119)	1.071 (1.039 - 1.105)
<p>Note: Unadjusted model - only the three measures entered Adjusted model: Adjusting for Age, Gender, Marital & Employment Status, Treatment condition, Cigarettes Smoked Per day, Quit Attempts, Nicotine Dependence and Smoking Status (expired-CO)</p>			

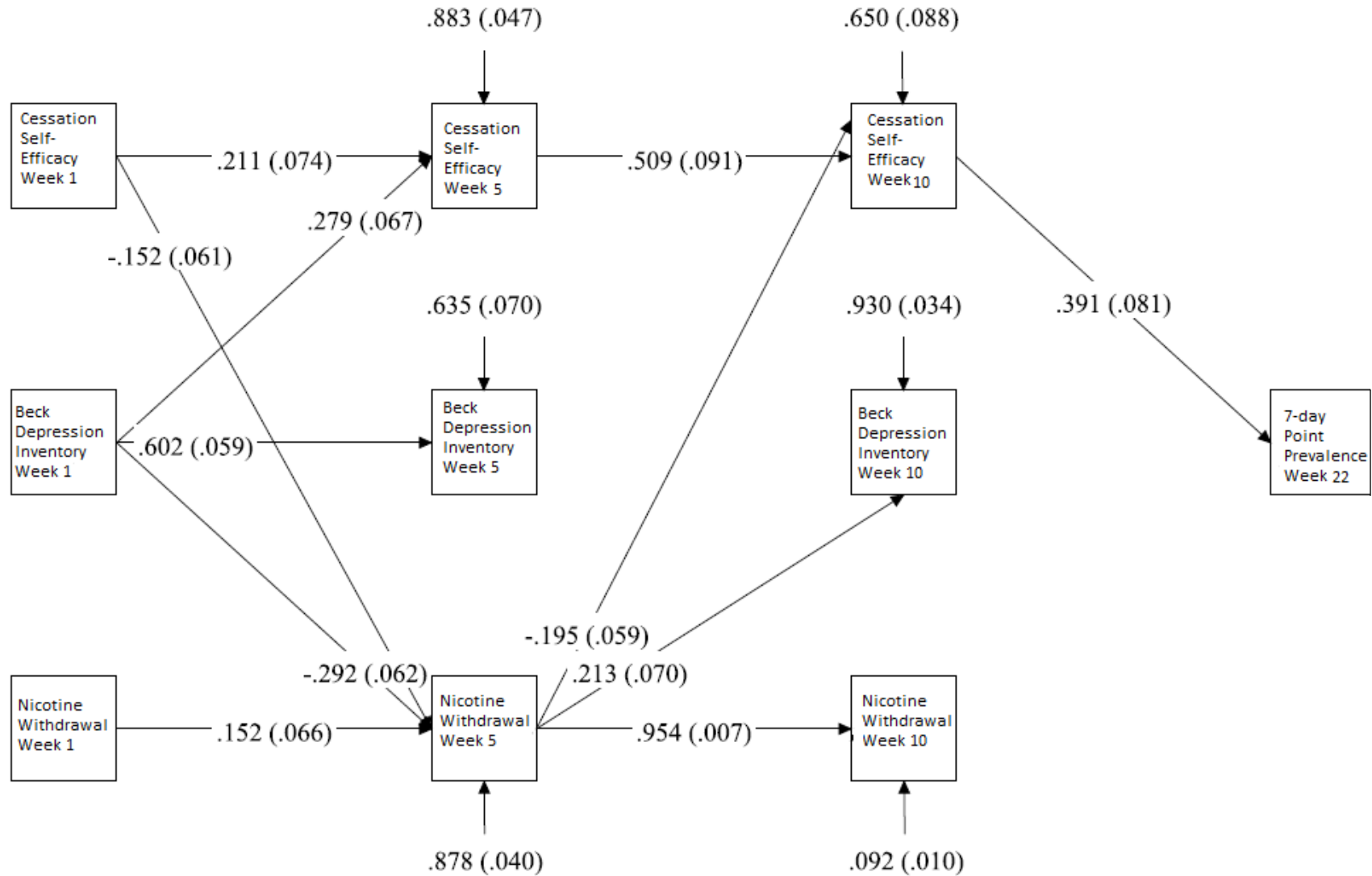
Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

Table 4 – Overall sample GEE with interaction effects

Variable	Odds Ratio (95% Confidence Interval)
Beck Depression Inventory (BDI)	1.002 (0.966 - 1.040)
Minnesota Nicotine Withdrawal (MNWS)	0.978 (0.951 - 1.006)
Cessation Self-efficacy (SEQ12)	1.060 (1.038 - 1.083)
Psychiatric Category	
No diagnosis	REF
Past Diagnosis	2.003 (0.323 - 12.436)
Current Diagnosis	1.149 (0.128 - 10.346)
Psychiatric category by determinants interactions	
No Diagnosis * Determinants	REF
Past Diagnosis * BDI	0.983 (0.038 - 1.030)
Past Diagnosis * MNWS	0.995 (0.955 - 1.036)
Past Diagnosis * SEQ12	1.000 (0.968 - 1.032)
Current Diagnosis * BDI	0.974 (0.929 - 1.021)
Current Diagnosis * MNWS	1.031 (0.987 - 1.078)
Current Diagnosis * SEQ12	1.002 (0.963 - 1.043)
Treatment Condition	
NRT	REF
NRT+	1.380 (0.342 - 5.567)
Varenicline (VR)	1.118 (0.253 - 4.947)
Treatment Condition by Psychiatric diagnosis interactions	
NRT * Treatment	REF
NRT+ * no diagnosis	1.348 (0.788 - 2.304)
NRT+ * past diagnosis	1.658 (0.986 - 2.787)
NRT+ * current diagnosis	1.231 (0.640 - 2.367)
VR * no diagnosis	1.451 (0.894 - 2.353)
VR * past diagnosis	1.024 (0.603 - 1.737)
VR * current diagnosis	0.367 (0.177 - 0.760)

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

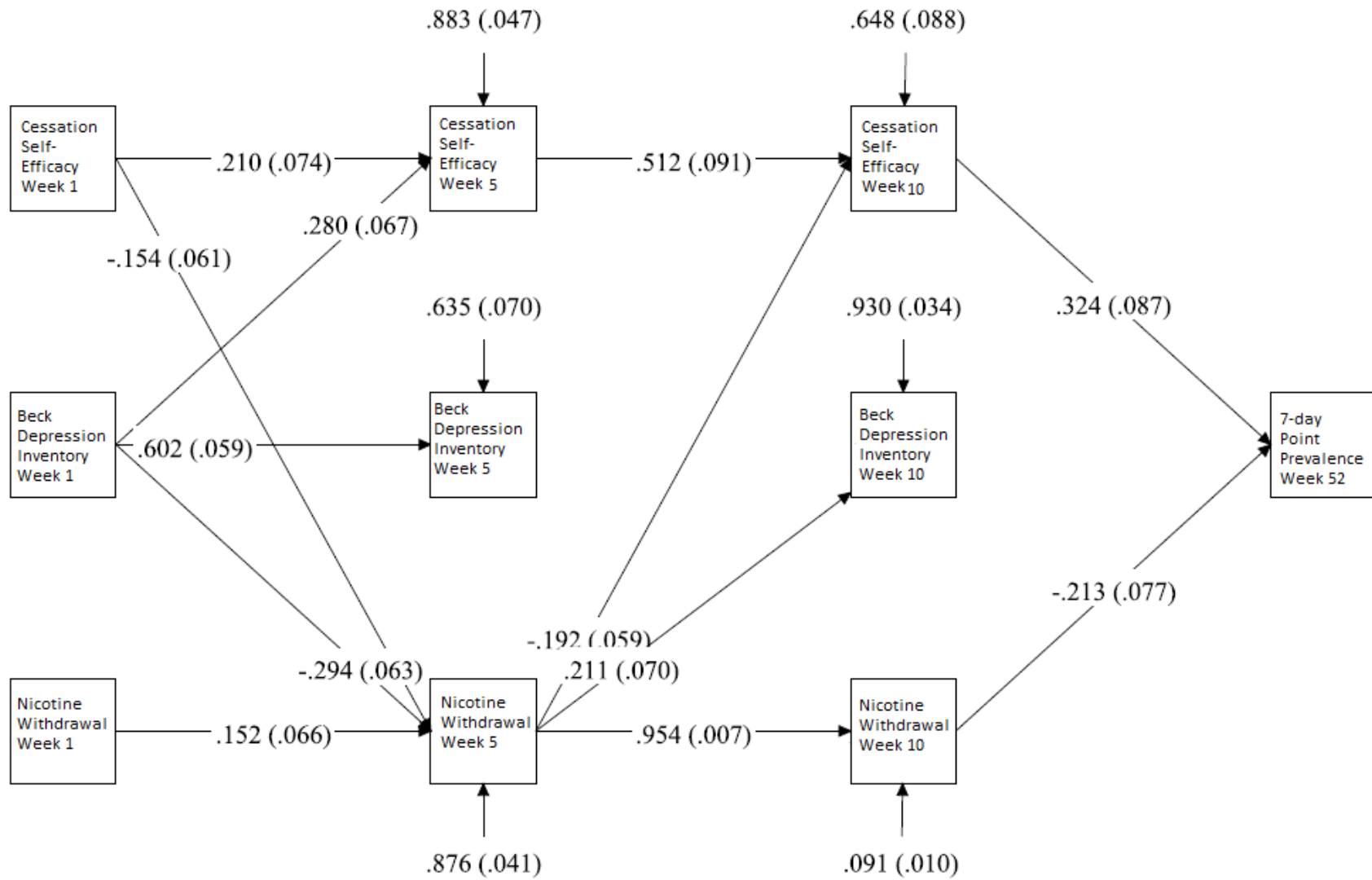
Figure 1 – All Significant pathways paths for interpersonal-factors onto week 22 abstinence (overall population)



Caption: All paths entered simultaneously; presented as β (standardized) with standard error (SE) in brackets.

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

Figure 2 – Significant pathways only for interpersonal-factors onto week 52 abstinence (overall population)



Caption: All paths entered simultaneously; presented as β (standardized) with standard error (SE) in brackets.

Part 3 – Discussion

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

This dissertation investigated the association of smoking cessation self-efficacy and abstinence outcomes over the course of a quit attempt, and, how this relationship is impacted by the presence of a comorbid psychiatric diagnosis. In order to accomplish this task, a series of analyses were conducted using data from a randomized control trial of pharmacological smoking cessation interventions, the *FLEX trial*. The first dissertation article, entitled “Task and barrier self-efficacy among treatment-seeking smokers with current, past or no psychiatric diagnosis”, published in *Addictive Behaviors*, focused on baseline measurement-related issues involving cessation self-efficacy and smoking-related variables. This study concurrently examined a single- and multi-item scale of cessation self-efficacy across psychiatric diagnostic categories, the intercorrelation of these measures, and their relationship to baseline smoking-related variables. Only a modest (small-to-moderate) level of correlation (r) between the two scales and to motivation to quit was observed. Only the single-item scale was correlated with baseline smoking-related characteristics (nicotine dependence, cigarettes per day; small magnitude r). Mean scores of the single-item measure did not differ by psychiatric diagnostic category; the multi-item scale, in contrast, showed additional variability. Total scores on the 12-item scale, as well as those on the internal-states subscale were significantly lower among individuals with a current diagnosis.

The second dissertation article, entitled “Factor Structure of the Smoking Cessation Self-Efficacy Questionnaire Among Smokers With and Without a Psychiatric Diagnosis,” published in *Psychology of Addictive Behaviors*, focused on the factor structure and validity of the SEQ-12 using responses from participants at week 1 (post-cessation). The primary objective was to investigate the psychometric properties of the 12-item measure by psychiatric classification. We confirmed measurement invariance across psychiatric status through confirmatory factor

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

analysis. We obtained good fit indices for not only the original two-factor structure (internal- and external-states) proposed by the original authors (Etter, Bergman, Humair, & Perneger, 2000), but also for a three-factor model (explained variance, 72.3% vs. 79.5%, respectively). Additional analyses found support for content validity (all three factors loaded very highly onto a universal global confidence factor), convergent validity (moderate-to-high correlation between these factors) and discriminant validity (with low-to-moderate correlations with other measures of smoking including measures of nicotine withdrawal and dependence). As different subfactors were more strongly associated with cessation outcomes (measured at week 10 in article 2) depending on the psychiatric status of the individual, we found evidence for divergent validity of the SEQ-12 measure. Our negative affect factor was more strongly linked to outcomes amongst those with a current and past diagnoses, while the conditioned cues factor was more strongly associated with outcomes in the overall sample and in those with no diagnosis. Results of articles 1 and 2 therefore provided support for a psychometrically sound self-efficacy multi-item measure.

The final two dissertation articles shifted focus from psychometric and measurement-related concerns to theoretical and practical aspects of smoking cessation self-efficacy. The third dissertation article, “A Bidirectional Path Analysis Model of Smoking Cessation Self-efficacy and Concurrent Smoking Status: Impact on Abstinence Outcomes,” published in *Addiction Biology*, employed structural equation modeling to investigate the relationship between cessation self-efficacy and concurrent smoking. The model investigated the degree to which scores on the cessation self-efficacy measure were auto-correlated with each other (i.e., the degree to which previous scores predicted subsequent scores), and did the same for expired-carbon monoxide (expired-CO) scores, which served as a proxy for concurrent smoking behaviour. Data from the

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

treatment phase (baseline to week 10) of the FLEX trial was used to model the relationship between these variables and cessation outcomes at week 10. Our model supported a dynamic and reciprocal relationship between cessation self-efficacy and concurrent smoking status, in which scores for the SEQ-12 and expired-CO were associated with each other at the subsequent measurement interval. Both variables were also associated with week 10 smoking outcomes as measured by 7-day point prevalence. These results support a model in which cessation self-efficacy is a predictor of smoking outcomes while interacting dynamically with concurrent smoking behaviour. Self-efficacy was therefore not simply a reflection of smoking status (most recent behaviour), but an active component in the process of quitting, supporting a framework for dynamic conceptions of abstinence and relapse as opposed to a static unidirectional model.

Finally, the 4th dissertation article, entitled “Interpersonal Determinants of Smoking Cessation in Treatment-Seeking Smokers With and Without Psychiatric illness: A Population and Cross-lagged Analysis”, currently in preparation for peer-review, sought to disentangle the relationship between cessation self-efficacy, symptoms of nicotine withdrawal, and negative affect, three important interpersonal-determinants of smoking cessation success. The article’s primary aim was to address the overlap in symptomatology between these aforementioned cessation indices by psychiatric diagnostic category. At the same time, we tested their criterion validity by investigating the direct and indirect associations between these interpersonal-determinants, and their association with smoking cessation outcomes to determine which measure was the strongest predictor of abstinence outcomes. To accomplish this, these interpersonal-determinants were investigated in several ways: 1) using repeated-measures ANOVA; 2) via a structural path-model which analyzed for all associations during the treatment phase of the study; and, 3) at an overall population-averaged level by employing generalized

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

estimating equations (GEE), a technique appropriate for longitudinal repeated-measures data. All investigations were conducted for the overall sample, as well as repeated and compared across groups (those with and without a psychiatric diagnosis; current, past, or no diagnosis). Results across analyses converged on one central finding: cessation self-efficacy was uniquely statistically significantly predictive of cessation outcomes, at 22- and 52-weeks. Results of the repeated measures analyses revealed several trends: 1) self-efficacy scores were lower for those with a current diagnosis at all timepoints (compared to those with no diagnosis); 2) self-efficacy scores increased across all psychiatric diagnoses during the treatment phase of the study (up to week 10); and, 3) scores on the MNWS and BDI were highest for those with a current diagnosis (at all timepoints).

More specifically, scores were highest at week 1 (immediately following quitting), and decreased at each subsequent measurement interval. The path-analysis found a main effect for: initial scores of depression (week 1), nicotine withdrawal (week 5), and cessation self-efficacy (week 10) to cessation outcomes at both week 22 and 52. When unpacking the indirect effects, self-efficacy (week 10) was found to partially mediate both the relationship of nicotine withdrawal (week 5), as well as negative affect (week 1) on week 22 outcomes. These relationships also approached significance for week 52 outcomes, although the indirect statistic was non-significant. Path-analyses results were replicated for our overall sample and by psychiatric category classification (current, past, and no diagnosis). These results were again extended in our population-averaged analyses (GEE), where only self-efficacy (overall/global self-efficacy at each time) was associated with cessation outcomes in the model where all interpersonal-determinants were entered simultaneously. These findings are all the more interesting given that we observed significant group differences by psychiatric classification

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

across all measures (lower overall cessation self-efficacy, higher withdrawal and negative affect scores at all time points for those with current diagnosis), and when controlling for concurrent smoking and treatment condition.

The collective findings across the 4 articles underscore the consistent, important, and dynamic relationship between cessation self-efficacy and smoking outcomes for individuals with and without a psychiatric diagnosis. The strengths, implications, and limitations of the studies will be discussed, followed by comments for potential future directions and concluding remarks.

Strengths of the studies

This dissertation had several important strengths. First, although conceived as a secondary analysis from an already active study, the overall study design was a significant strength. Data for all presented analyses came from the FLEX trial, a randomized control trial of pharmacotherapeutic interventions for smoking cessation. The FLEX trial recruited a large sample of treatment-seeking smokers ($n = 737$), and purposely used less restrictive inclusion and exclusion criteria than previous smoking cessation trials. A key objective of the FLEX trial was to ensure the recruitment of a representative sample of “real world” individuals who smoke. All participants were assessed for a psychiatric diagnosis using a structured clinical interview, the current gold standard for confirming a diagnosis, conducted by clinical psychology doctoral students under supervision of a licensed clinical psychologist. Given this objective, and our knowledge of the disproportionate number of individuals who smoke with concurrent mental health issues (Lasser et al., 2000), it should come as no surprise that a large proportion of our sample met criteria for a current or past psychiatric diagnosis. Specifically, many smokers ($n = 435$, 59.0%) met the diagnostic criteria for a lifetime diagnosis (current diagnosis $n = 179$, 24.3%; past diagnosis $n = 256$, 34.7%). In addition to recruiting a large number of individuals

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

from this marginalized population, the *FLEX trial* also incorporated rigorous study methodology. The longitudinal, repeated-measures RCT design, with several follow-up assessments over the course of the quit-attempt (up to 1 year), was therefore another significant strength. These assessments were conducted using empirically supported measures, including those assessing cessation self-efficacy (SEQ-12; Etter et al. 2000), nicotine withdrawal (MNWS; Hughes & Hatsukami, 1986), nicotine dependence (FTND; (Heatherton, Kozlowski, Frecker, & Fagerstrom, 1991), and negative affect (BDI-II; (Beck A, Steer, & Brown, 1996). Likewise, study outcomes (smoking status), while self-reported, were validated via a clinical biomarker (expired-CO). Overall, this design enabled us to simultaneously empirically test both the short- and long-term associations between these variables and smoking outcomes, providing an opportunity to discern a more complete picture of the smoking cessation process for individuals with and without a psychiatric diagnosis who smoke.

The use of advanced statistical analyses was another significant strength of the articles presented in this dissertation. These included: cross-sectional analyses (logistic regression, ANOVA, chi-square), repeated-measures ANOVA, confirmatory factor analyses, as well as advanced longitudinal analyses, such as structural equation modeling, path analyses, and generalized estimating equations. The analyses were supported by multiple imputation and sensitivity analyses when appropriate to account for missing data. These varied yet complementary analyses produced consistent results which enabled us to make important inferences about the role of cessation self-efficacy in the process of smoking cessation.

A novel contribution of this dissertation was to draw attention to the relationship between smoking cessation and self-efficacy during several timepoints during the course of a quit attempt. Using distinctive yet complementary statistical analyses, this dissertation was able to address

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

several specific shortcomings of the literature on cessation self-efficacy (Gwaltney, Metrik, Kahler, & Shiffman, 2009), addressing previously identified measurement limitations (Gwaltney et al., 2009; Gwaltney, Shiffman, Balabanis, & Paty, 2005; Perkins, Parzynski, Mercincavage, Conklin, & Fonte, 2012). Most previous studies have investigated cessation self-efficacy and smoking outcomes only in highly selected samples. These studies typically conceptualize cessation self-efficacy as either a stable/trait-like variable (Berg, Sanderson Cox, Mahnken, Greiner, & Ellerbeck, 2008; Blevins, Farris, Brown, Strong, & Abrantes, 2016; Herd, Borland, & Hyland, 2009; Ockene et al., 2000), assessed at one distal point to their outcome of interest. Others investigate self-efficacy dynamically, but fall short in their ability to explain the abstinence-relapse curve by focusing on small-scale timelines (i.e., immediately prior/following the quit attempt and/or lapse; (Amodei & Lamb, 2005; Castro et al., 2014; Greenfield, Venner, Kelly, Slaymaker, & Bryan, 2012; Hoepfner, Kahler, & Gwaltney, 2014; Morrell, Skarbek, & Cohen, 2011). Our results are amongst the first to combine both types of approaches and enable us to bridge together these contrasting theoretical conceptualizations. This helps us to provide a more complete picture of the impact of cessation self-efficacy on abstinence outcomes for a cohort of treatment-seeking smokers with and without comorbid psychiatric diagnoses.

Finally, it is important to highlight the research questions presented in the four articles, as they were novel in several ways. We were the first to concurrently compare cessation self-efficacy scores across psychiatric diagnoses. Likewise, we were the first to investigate multiple interpersonal-determinants of smoking cessation simultaneously within a large population of individuals who smoke with and without a psychiatric diagnosis. This allowed us to draw inferences as to the reliability, generalizability and magnitude of our results for this ignored and at-risk population. We investigated and confirmed the psychometric properties of a smoking

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

cessation self-efficacy measure and confirmed factor invariance across psychiatric diagnoses (current / lifetime / no diagnosis), which to our knowledge is the first attempt in the nearly two decades since the measures publication (Etter et al., 2000). Our results provided further insight regarding theoretical and practical applications of self-efficacy for smoking cessation.

Implications for theory and practice

The results presented across the articles of this dissertation have several theoretical and practical implications. Broadly speaking, the results of all four dissertation articles support Bandura's conceptualization of self-efficacy as a principal agent of behaviour change (Bandura, 1977, 1986). Our results show that smoking cessation self-efficacy is consistently and strongly associated with smoking cessation outcomes, and in line with the extensive extant literature published in this area (Berndt et al., 2013; Cupertino et al., 2012; Elfeddali, Bolman, Candel, Wiers, & De Vries, 2012; Gwaltney, Shiffman, Balabanis, et al., 2005; Herd et al., 2009; John, Meyer, Rumpf, & Hapke, 2004; Rami Azmi, Mohammed Ibrahim, Fadi Marwan, Zyad Taher, & Tareq Rateb, 2016; Schnoll et al., 2011). Our results are also in line with both qualitative (Kerr, Woods, Knussen, Watson, & Hunter, 2013; Pateman et al., 2016; Twyman, Bonevski, Paul, & Bryant, 2014) and quantitative reports (Berndt et al., 2013; Brodbeck, Bachmann, Brown, & Znoj, 2014; Cinciripini et al., 2003; Haukkala, Uutela, Vartiainen, Mcalister, & Knekt, 2000), which note that individuals with psychiatric symptoms suffer from worse overall cessation self-efficacy (Corrigan, Watson, & Barr, 2006; Peter S. Hendricks, Wood, & Hall, 2009; Lawn, Pols, & Barber, 2002) compared to those with no such psychiatric difficulties.

Theoretical implications: cessation self-efficacy

Although the purpose of this dissertation was not to explicitly test Self-Efficacy Theory (SET; Bandura, 1977, 1986) as a framework for smoking cessation, our primary objective was to

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

investigate the role of self-efficacy as a predictor of abstinence among treatment-seeking smokers with comorbid psychiatric diagnoses. Nonetheless, we were able to relate our results to the core psychological processes (e.g., cognitive, motivational, affective, and selection processes) which Bandura described as being central to SET (Bandura, 1997). The psychometric- and measurement-focus of articles 1 and 2 of this dissertation lend support to these to several of these concepts. The primary finding when comparing our single- and multi-item scales in article 1 was the added variability found only for SEQ-12 in our sample of smokers with a psychiatric history. This result was replicated and extended in article 2, in which psychiatric classifications had significantly different score profiles on separate subscales of the measure. The variability in self-efficacy responses across multi-item scales (article 1 and 2) supports Bandura's conceptualization of self-efficacy's reciprocal role in shaping the psychological processes of behaviour change. Both Bandura's cognitive- and affective-processes are reflected by these differences, as evidenced by variability on the internal-states (article 1) and negative-affect (article 2) subscales of the SEQ-12. In our results, those with current diagnoses scored significantly lower in both cases, similarly echoed by their lower overall score, and thus overall lower self-efficacy. Likewise, the conditioned cues factor (when with other smokers; urge to smoke, after a meal; with coffee; see article 2), while not different statistically for those with a current or past diagnosis, differed significantly from those with no psychiatric diagnosis, underscoring the selection process which Bandura identified as confidence driving the choice of environment an individual might favour. These differences are reflective of the different processes being given different weights and considerations by our study population, given their level of differing cessation self-efficacy. Also in support of the different psychological processes, another study by our research team using data from the FLEX trial investigated the past-quit

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

experiences of our sample (Tulloch et al. 2016). Similar disparities were identified as driving relapse situations across different diagnoses: those with either depression or anxiety identified negative affect as triggering a relapse, while those with no diagnosis identified a lack of willpower as a primary precipitating factor.

Of Bandura's four core-psychological processes, motivation was slightly more difficult to explain given our results. In article 1 and 2, we found only a small correlation between SEQ-12 scores and our measure of motivation (a 10-point likert scale). Some groups have attempted to argue that measures of self-efficacy only reflect what an individual is motivated to do (Williams & Rhodes, 2016); our results, however, support the notion that the SEQ-12 is measuring something independent of motivation to quit. One potential explanation for our results may be related to our sample. In discussing motivational processes, Bandura notes that self-efficacy beliefs, when high, motivate individuals to engage in action. Given that our study was comprised of treatment-seeking smokers only, it can be argued that our sample already met this threshold and were sufficiently motivated to enroll in our study.

Theoretical implications: self-efficacy as a cause or reflecting behaviour?

A second major theoretical point addressed by the dissertation articles is the relationship between concurrent smoking and cessation self-efficacy. A meta-analysis (Gwaltney et al., 2009) noted that very few prior studies controlled for concurrent smoking status at the time of the self-efficacy evaluation. In their analyses, they found that accounting for smoking status significantly reduced the effect size of the relationship between self-efficacy and smoking outcomes (Kirchner, Shiffman, & Wileyto, 2012; Danielle E McCarthy, Lemma Ebssa, Katie Witkiewitz, & Saul Shiffman, 2015; Perkins et al., 2012; Shiffman, 2005). Other subsequent studies have been equivocal; while accounting for smoking statistically did not completely wipe out the

predictive value of self-efficacy in one study (Perkins et al., 2012) which specifically tested these competing pathways, the measure itself has come under increased theoretical scrutiny (Spaulding, Haley, & Zhao, 2014; Williams & Rhodes, 2016) as lacking specificity and overlapping with other meaningful constructs (i.e., motivation). Our results presented in articles 3 and 4, strongly refute this notion: self-efficacy is a robust and consistent predictor of smoking outcomes, even after controlling for concurrent smoking status.

A major challenge to the relationship between self-efficacy and smoking outcomes has come from behavioural observations, with some positing that self-efficacy is simply a reflection of behaviour as opposed to a driving factor of change. Our results do not support this view, and lend support to more contemporary conceptualizations: the relationship between self-efficacy and smoking status is both dynamic and reciprocal, in that each exerts direct influence over the other (Gwaltney, Shiffman, Balabanis, et al., 2005; Morrell et al., 2011; Perkins et al., 2012; Shiffman et al., 2000; Shiyko, Lanza, Tan, Li, & Shiffman, 2012; Van Zundert, Ferguson, Shiffman, & Engels, 2010). Both Expired-CO measures and SEQ-12 scores for our study participants predicted those who would be successful abstainers at week 10, true across diagnostic categories. These results are consistent with and support Marlatt's Relapse Prevention model (RPM; Marlatt, Bowen, & Witkiewitz, 2009; Marlatt & George, 1984; Witkiewitz & Marlatt, 2004), an empirically derived and well-supported model in the addictions literature. This cognitive-behavioural model was the first to synthesize the addictions literature and develop a model that accounted for many contextual factors associated with relapse. The author's aim was to integrate interpersonal, social, environmental, biological/physiological, cognitive and affective processes and develop a model which identified those at risk of experiencing a lapse, those who relapse, and those able to recommit following a lapse (Hendershot, Witkiewitz, George, &

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

Marlatt, 2011; Witkiewitz & Marlatt, 2007). Within this model, self-efficacy is a prominent facet, linked not only to motivating an individual to make the initial quit attempt, but also in helping to both maintain and/or recommit to the quit attempt following a lapse. Our article 3 outcomes support this conceptualization: individuals high in self-efficacy were more likely to be smoke-free at the subsequent weeks, while those low in self-efficacy were more likely to be smoking. The reverse also proved to be true: those who smoked suffered decreases in subsequent self-efficacy scores, while those who were smoke-free experienced improved confidence.

Theoretical implication: Self-efficacy psychological processes and relapse models

From a theoretical framework, our results can be seen to support both Bandura's general SET and Marlatt's RPM. The original RPM was subsequently updated to better reflect dynamic aspects of behaviour change (Witkiewitz & Marlatt, 2004; Witkiewitz & Marlatt, 2007). The authors proposed the concepts of tonic (static/trait) and phasic (momentary/dynamic states) factors, which interacted dynamically with one another to drive the relapse/abstinence curve. Results from both the third and fourth dissertation article, which concurrently investigated across interpersonal-determinants of smoking cessation by psychiatric category, are consistent with this notion and provide insight into this tonic/phasic dichotomy. At a dynamic/phasic level, we saw evidence for reciprocal relationships between self-efficacy, nicotine withdrawal, and symptoms of depression, as demonstrated by their significant associations in our path-analyses. Moreover, there was evidence of partial mediation by cessation self-efficacy on both negative affect and nicotine withdrawal for outcomes at week 22 and 52. Thus, while affective and cognitive processes can affect self-efficacy and smoking outcomes, high self-efficacy helped enable our participants to navigate these high-risk states and situations and remain smoke free. This was directly reflected in our analyses of the treatment phase, in which week-to-week interactions

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

dynamically occurred (path models in article 3 and 4; phasic factors in RPM model).

At a more state-level, across those with and without a lifetime psychiatric diagnosis, we found self-efficacy was the strongest predictor of outcomes (7-day point prevalence at weeks 22 and 52) when investigating the population-averaged effects of these determinants using GEE. Results of our GEE analyses supported self-efficacy alone among our interpersonal-determinants as being significantly associated with outcomes (global/trait self-efficacy; tonic factor in the RPM). As the first to compare these interpersonal-determinants concurrently across psychiatric categories, our conclusion regarding the utility of cessation self-efficacy measures cannot be emphasized enough. This robust effect is impressive given our cohorts characteristics: individuals with a history of mental illness who experienced greater symptoms of depression and nicotine withdrawal and overall lower self-efficacy throughout the course of our trial. These results are in line with others who noted that self-efficacy can mediate both tonic (e.g., baseline levels of depression) and phasic affective states (Brodbeck et al., 2014; Greenfield et al., 2012), including those high in negative affect (Kassel, Stroud, & Paronis, 2003; Minnix, Blalock, Marani, Prokhorov, & Cinciripini, 2011; Shiffman, 2005), craving (Berndt et al., 2013; Hoepfner et al., 2014; Reese & Veilleux, 2016) and withdrawal symptoms (Morrell et al., 2011; Piper et al., 2011; Schnoll et al., 2011). Evaluating these concepts within the framework of theoretical models (e.g., SET, RPM), also serves to underscore the importance of using cessation self-efficacy to direct and drive interventions from a more theoretical point-of-view.

Practical implications: cessation self-efficacy measurement variability

Articles 1 and 2 of this dissertation focused primarily on measurement and psychometric properties of the SEQ-12. An important relationship that displayed discriminant validity was the association between our multi-item measure and motivation to quit. While some have found

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

significant associations between their self-efficacy scales and motivation to quit (Gwaltney et al., 2001; Haukkala et al., 2000; P. S. Hendricks, Wood, Baker, Delucchi, & Hall, 2011), in our sample there was only a small correlation, a finding shared with others (Spek et al., 2013). While motivation is theorized as an important process and linked to self-efficacy, there is growing evidence supporting differences between the two concepts, including results of several recent smoking cessation trials (Borland et al., 2010; Cupertino et al., 2012; Lee, Catley, & Harris, 2014; McCarthy, Ebssa, Witkiewitz, & Shiffman, 2015). For example, Borland et al. (2010) reported that while motivation was important for those making a quit attempt, self-efficacy and not motivation predicted those who would remain abstinent. Likewise, an experimental study by Cupertino et al. (2012) investigated a motivational interviewing intervention for smoking cessation, and reported that while the intervention was ineffective at increasing cessation self-efficacy, increases to cessation self-efficacy (generally) over the course of the trial (in both treatment and control group) predicted better cessation outcomes. Ultimately, as discussed previously in theoretical implications, our results are line with these studies, and support significant differences between measures of motivation and self-efficacy, refuting the “self-efficacy-as-motivation” argument put forth by some (Beauchamp, 2016; Williams & Rhodes, 2016). Moreover, as we will discuss later, self-efficacy scales can also provide additional information that can be practically applied.

A review of the smoking cessation self-efficacy literature (Gwaltney et al., 2009) noted that single-item measures tended to be more strongly associated with smoking outcomes as compared to multi-item scales. In our study, single- and multi-item measures were moderately correlated (ranging from 0.265 – 0.517), and only our multi-item scale was associated with week 10 outcomes. This may be due to the nature of our study population of treatment-seeking

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

smokers who were all motivated to quit, and well-supported throughout their quit attempt. In discussing differences in scale lengths, the authors (Gwaltney et al., 2009) also highlighted the additive benefits of using a multi-item scale, which includes the opportunity to obtain contextual information. This research group had conducted a series of studies prior to their systematic review (Gwaltney et al., 2001; Gwaltney et al., 2002; Gwaltney, Shiffman, & Sayette, 2005) and tested their own empirically derived cessation self-efficacy multi-item scale (Gwaltney et al., 2001). Following individuals across the early stages of quit attempt and using ecological momentary assessment, they found a significant association between situations identified by their scale (low scores) and the specific situations in which the individual ultimately lapsed. While their scale's total score (the unidimensional factor) was strongly associated with smoking outcomes, their scale provided valuable insight into potential "Achilles heel" situation of each individual (Gwaltney et al., 2002).

The second article of this dissertation confirmed measurement invariance of the SEQ-12 across psychiatric; the results substantiated our ability to identify variability in the scores on this measure and its subscales by psychiatric diagnosis. While it was not within the scope of our study to investigate, compare, or generalize the psychometric properties of different abstinence self-efficacy scales, we remain the first and to our knowledge only group to validate its use amongst for those with a psychiatric diagnosis. Our results are also in line with other measurement-related conceptualizations of cessation self-efficacy, including support for an overarching unidimensional level of confidence (Gwaltney et al., 2009; Gwaltney et al., 2001). Our finding of variability across those with current and lifetime diagnoses compared to those with no diagnoses, particularly for certain subscales of our measure, adds to the literature on the convergent of self-efficacy measures, which have identified significant differences in scale

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

construct and predictive validity depending on the questionnaire make-up (Dijkstra & Vries, 2000; Gwaltney et al., 2001; Hendricks et al., 2011). For example, Dijkstra and Vries (2000) noted that in their sample with low-motivation to quit, only one subscale (assessing confidence in *skills* related to quitting) was related to the initiation of smoking cessation. Likewise, Hendricks and colleagues (2011) found that self-efficacy was strongly associated to their measure of positive abstinence expectancies, while only weakly correlated for negative outcomes. In the SEQ-12, each item asked participants to rate their confidence in their ability to *remain abstinent*. As such, scores on the overall subscale and particularly for the subscales, reflected areas of either strength or weakness that can be used for relapse prevention planning by filtering situations and states.

With this information in mind, our results can be interpreted from two perspectives; 1) those with a lifetime (both current or past) diagnosis most likely to be abstinent were individuals with higher self-efficacy globally, and, 2) among these individuals, those with high self-efficacy for emotional-charged states/situations, in particular, were most likely to remain abstinent. Previous research has demonstrated that individual's with a psychiatric diagnosis in particular are more prone to experience negative affective states (Kassel et al., 2003; Kenford et al., 2002; Leventhal, Piper, Japuntich, Baker, & Cook, 2014; Leventhal & Zvolensky, 2015; Piper et al., 2011; Pomerleau, Marks, & Pomerleau, 2000; Judith J Prochaska, 2011; Weinberger, Desai, & McKee, 2010), and our sample were no different (article 4). Those with a current diagnosis experienced greater symptoms of depression and nicotine withdrawal throughout the course of their quit attempt, and the most pronounced symptoms occurred early during the quit attempt. Research supports that these individuals lack confidence in navigating these situations and may use smoking as a method to mitigate or control these symptom profiles (Aubin, 2009; Chaiton,

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

Cohen, O'Loughlin, & Rehm, 2010; Kerr et al., 2013; Khantzian, 1997; Pomerleau et al., 2000; Ziedonis et al., 2008). Clinically, employing multi-item scales can provide important information for both clinician and patient in identifying high-risk situations (or those self-efficacy beliefs related to Bandura's selection processes for choice of environment; (Gwaltney et al., 2002; Gwaltney, Shiffman, & Sayette, 2005), smoking beliefs (i.e., Bandura's cognitive processes; Siru, Hulse, & Tait, 2009; Weinberger, George, & McKee, 2011), and affective states that may precipitate relapse (Leventhal & Zvolensky, 2015; Pomerleau et al., 2000; Weinberger et al., 2010). Such information helps move beyond simply determining who might relapse, and towards understanding the specific contextual factors that play a role and lead to relapse (Gwaltney et al., 2002), and thus also in line with Marlatt's goal for the RPM. Past studies have noted that specifically targeting certain cognitions through psychoeducation can be effective at changing positive and negative outcome expectations and reinforcement beliefs around smoking (Parrott, 2004; Prochaska, 2010; Twyman et al., 2014; Weinberger et al., 2011).

Our results offer support for behavioural treatments which include components aimed specifically at increasing self-efficacy to improve cessation outcomes. For example, studies using cognitive behavioural therapy (CBT) for smoking cessation (Blevins et al., 2016; Hendricks, Delucchi, & Hall, 2010) found increased smoking cessation self-efficacy and, ultimately, positive abstinence outcomes. In one study, Hendricks and colleagues (2010) noted that cessation self-efficacy accounted for a large proportion (61-83%) of the total treatment effect, and that this effect was not mediated by negative affect, social support, or motivation to quit (Hendricks et al., 2010). Another systematic review on relapse prevention interventions found that behavioural interventions which both identified (anticipated) and planned (developed action plans) in advance of specific barriers was supported by high self-efficacy, which ensured

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

sustained effort and persistence in applying maintenance strategies (Kwasnicka, Preece, White, & Sniehotka, 2013). Cognitive Behavioural interventions can also be used to target maladaptive beliefs about smoking. Specific to individuals who smoke and who have a psychiatric diagnosis, evidence suggests that these individuals hold many positive expectations around smoking (i.e., smoking reduces negative affective states, boredom; (Kerr et al., 2013; Lawn et al., 2002), and report a reluctance to commit to a quit attempt. Clinicians and healthcare professionals should be prepared to counter such beliefs with the scientific evidence, which has consistently found that those who are able to quit and maintain their abstinence experience significant improved mood as a result (McDermott, Marteau, Hollands, Hankins, & Aveyard, 2013; Prochaska et al., 2008; Taylor et al., 2014). Practically speaking, employing measures of self-efficacy in the clinic can help pinpoint particular high-risk situations, help guide discussion and counselling, and can warn health professionals of potential lapses in patients through continued monitoring.

Practical and clinical implications for relapse prevention

From a practical perspective, does the evidence support assessments or interventions which included the continued evaluation of cessation self-efficacy over the course of a quit attempt? Moreover, is self-efficacy useful to assess once the individual has lapsed to smoking? As discussed previously, continued monitoring can provide valuable contextual information. This information, along with interventions that continue to monitor, engage, and build self-efficacy, may reduce the risk of lapses and the chance that the individual abandons their quit attempt altogether. Our reciprocal path model underscores this notion (article 3): even among those who had elevated co-scores (smoked) at week 1, 3 or 5, those with higher self-efficacy were ultimately able to recommit and were more likely to be abstinent by week 10. One recently published cessation trial provides additional insight and support for the long-term benefits of

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

continual interventions (Burns et al., 2016). In their trial, the team evaluated a longitudinal care model, which provided telephone-based counseling and NRT for a continuous 12-month period. They noted that individuals who were not immediately successful at abstaining (both at 21-day and 3-months post target-quit date) continued to experience increases in self-efficacy as a result of the intervention, even when not immediately meeting their goal of abstinence. In their secondary analyses, these increases were found to mediate treatment effect; individuals with the largest self-efficacy gains were most likely to be abstinent at 12-months. These results and others that highlight increases in self-efficacy over the course of a quit-attempt (Blevins et al., 2016; Cupertino et al., 2012; Greenfield et al., 2012; Shiyko et al., 2012; Smit, Hoving, Schelleman-Offermans, West, & de Vries, 2014) lead to better outcomes, making the case that the continued evaluation and discussion of self-efficacy can be clinically meaningful. Our finding of increased self-efficacy during the treatment phase of the study may also be reflective of the benefit of continued monitoring and discussion of confidence and trouble-shooting potential barriers. In the design of the FLEX trial, each follow-up was accompanied by a brief (15-minute) counselling session. While the counseling sessions were based on current cessation best-practice guidelines (including reviewing gains and set-backs, reviewing reasons to quit and recommitting to quitting; Fiore, 2008), specific topics (such as self-efficacy) were not overtly targeted or recorded for our study. We are unable to specifically comment how these interactions may have impacted cessation self-efficacy but can speculate that these visits likely helped reinforce abstinence expectancies and helped participants formulate strategies to quit and remain abstinent. In any event, research in this area suggests that several intervention modalities (i.e., pharmacotherapy, individual/group/phone counselling) can lead to increases in self-efficacy (Blevins et al., 2016; Hendricks et al., 2010; Pardavila-Belio et al., 2018; Schuck, Otten, Kleinjan, Bricker, & Engels,

2014), and thus all interventions may yield positive changes in self-efficacy scores.

From a clinical perspective, the consistency and robustness of our results support the conclusion that continued targeting and monitoring of an individual's cessation self-efficacy is crucial in order to maximize their chances of success. Research on health professional beliefs around treating individuals who smoke and have a concurrent psychiatric illness indicates that there is a reluctance to offer support due the perceived challenges for this group (i.e., stress, negative affect; lower motivation; (Allan, 2013; Ashton, Lawn, & Hosking, 2010; Els, Kunyk, & Sidhu, 2011). Our results argue that while these individuals do experience greater symptoms of withdrawal and depression, focusing explicitly on cessation self-efficacy can be an effective strategy in conjunction with standard interventions and current guidelines (Fiore, 2008). Our results underscore is the need for interventions aimed specifically at identifying and improving cessation self-efficacy (Kadden & Litt, 2011). Specific interventions targeting common high-risk situations (e.g., self-efficacy factors as outlined in articles 1 and 2 including negative affect situations, conditioned cues, alcohol-related, etc.) can also be tested to monitor changes in these processes. One smoking intervention study which employed telephone-delivered counselling from a CBT perspective found the intervention effect to be mediated by self-efficacy, which itself was increased by improving acceptance of craving (Schuck et al., 2014).

Studies directly targeting cessation self-efficacy (compared to those previously cited which investigate the relationship between treatment and self-efficacy) have been mixed. In an earlier study, Shadel and Cervone (2006) cognitively primed individuals by having them read words associated with abstinence, which the authors posited increased self-efficacy. In their manipulation, priming (vs. control) did increase subjective confidence scores, which subsequently were associated with reduced craving compared to those primed with control

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

words. In a follow-up study, treatment-seeking smokers were randomized to receive fake feedback (garnered after completing a computerized test) about their chances to quit prior to their target-quit date (William G. Shadel, Martino, Setodji, Cervone, & Witkiewitz, 2017). This feedback condition was hypothesized to artificially inflate an individual's belief in their chances of quitting, by indicating either a "high" or "average" chance at success. While the feedback condition did predict cessation outcomes, the manipulation did not directly impact cessation self-efficacy outcomes. These studies demonstrate some of the difficulty in developing experimental paradigms for evaluating empirically supported factors of smoking abstinence.

Limitations

There were several limitations to note for the studies presented. All data in the present analyses came from a large randomized control trial for smoking cessation; however, many analyses presented within this dissertation made use of unplanned secondary post-hoc subgroup analyses over multiple timepoints. There are several potential pitfalls to this type of analyses (Dijkman, Kooistra, & Bhandari, 2009; Rothwell, 2005; Schulz & Grimes, 2005). First and foremost, repeated analyses (across articles in the dissertation; by subgroup) may potentially lead to issues around multiplicity (Rothwell, 2005; Schulz & Grimes, 2005). In particular, reporting of unplanned subgroup analyses *only* can at times obfuscate negative or null findings for the overall sample. This dissertation presented outcomes for the overall sample in all our analytical procedures for transparency; moreover, the results (overall sample and by subgroup) were complementary despite different analytic strategies, supporting the link between cessation self-efficacy and smoking outcomes regardless of psychiatric category. When possible, the analyses presented herein also included interaction terms (for the overall regression models) in addition to stratifying by subgroups; this was done instead of employing statistical corrections (i.e.,

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

Bonferroni method; Cabin & Mitchell, 2000). In clinical trials, including secondary analyses of RCTs with multiple outcomes, statistical corrections, designed to reduce for the inflated type-1 error associated with multiple analyses, often leads to overcorrections. Moreover, this type of correction can be especially deleterious for longitudinal trials with multiple outcomes of interest, and many statisticians have concluded that whenever possible, interaction terms should be specified instead (Rothwell, 2005; Schulz & Grimes, 2005). In discussing the implications of the results, care was taken whenever possible to not overstate our outcomes – and as noted elsewhere (Schulz & Grimes, 2005; Sankoh, D'Agostino Sr, & Huque, 2003), results from unplanned posthoc analyses should be used primarily as hypothesis driving . Regarding the use of multiple outcomes, the FLEX trial was designed based on best practice guidelines (West et al. 2005), in which both short- and long-term outcomes are pre-specified, and therefore were preselected by the trial. This dissertation leveraged the longitudinal design of the study to complete analyses at various times during a quit attempt: at baseline (article 1), during the early (article 2) and end of treatment-phase (article 3), and at long-term follow-ups (article 4). While it is important to caution all readers as to the potential limitations of this design (i.e., repeated analyses and potential multiplicity / inflated type-1 error), all efforts were made to limit the impact of this choice. However, this approach provides important clinical information at various points during the quit attempt. Moreover, it should be noted that results were replicated across all articles, which is not in support of potential data dredging or unexplained outcome. Another possible limitation associated with the study design is a potential of overfitting regression models given the repeated analyses and multiple outcomes (Babyak, 2004). In general, we reported on the associations (correlations and variances) of our predictor variables, including investigating our predictors using variance inflation factor scores (VIFs; article 3 and 4). Results from these

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

analyses fell well within limits for potential overfitting (e.g., less than 5; Ringle et al. 2015). Furthermore, our large sample size, as well as our proportion of *events* (i.e., abstinent individuals) was large enough at all of our timepoints of interest (week 10: 250; week 22: 162; week 52: 129) and fell within the suggested limits to avoid overfitting (i.e., $n = 10$ events per predictor; Peng, Lee, & Ingersoll, 2002). Article 1 was cross-sectional, and thus not designed to infer causality. The results, however, were confirmed in our subsequent longitudinal studies which concurrently evaluated self-efficacy scores across different study timepoints. Please note that there was a minor error in article 2 (pg. 89) in which the term *discriminant validity* was used incorrectly; this should instead read convergent validity of the self-efficacy subscales. As the study did not have access to other scales to compare our measure of cessation self-efficacy, discriminant validity was unable to be assessed. In addition, in conducting the factor analyses for article 2, it may have been beneficial to have split our sample for validation. Given that subsequent analyses did not use these new factor loadings, and instead focused on the overall score of the measure, we opted against this, which may limit the generalizability of our results. Second, the participants recruited for the FLEX trial were highly motivated treatment-seeking smokers (baseline motivation mean 8.69 (SD = 1.47) on 10). While some caution should be taken in generalizing our findings to all smokers, especially those currently not motivated to quit, the literature suggests that self-efficacy scores remain strongly associated with cessation outcomes regardless of level of motivation. For example, previous reports have found high self-efficacy to be a significant predictor of quitting among those low in motivation (Dijkstra & Vries, 2000) and those who chose to spontaneously quit (Elfeddali et al., 2012; Li et al., 2015). Although the FLEX trial had inclusive recruitment criteria, we excluded individuals with past (3 month) substance abuse, which may limit the generalizability of our findings. The primary

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

intervention of the FLEX trial was pharmacotherapeutic and all individuals received 15-minute counselling sessions during each treatment-phase visit (weeks 1, 3, 5, 8 and 10). While the counselling sessions were based on best practice guidelines for smoking cessation (Fiore, 2008) and did not directly target self-efficacy, it is possible that the treatment and counseling had an effect on self-efficacy evaluations. The use of intention-to-treat (classifying all drop-outs as returning to smoking) may have negatively skewed our results. The sensitivity analyses demonstrated that those who dropped out during the treatment phase did not differ on baseline levels of self-efficacy ($F(1, 620) = 161.3, p = 0.265$; Completers $M=35.3$ ($SD=11.4$); Drop outs $M=34.0$ (12.2), but did differ on week 1 scores ($F(1, 521) = 604.2, p < 0.042$; Completers $M=42.4$ (11.8); Drop out $M=39.9$ (13.2)). Finally, while a significant strength of our study was the inclusion of a large proportion of individuals with a mental illness who smoke, our analyses involved collapsing diagnostic categories into those with a current, past or no diagnosis. This decision was made for a variety of reasons. There was large variation in terms of the number of individuals per category (Depression $n = 281, 38.4\%$; Anxiety $n = 93, 12.7\%$, Bipolar $n = 38, 5.2\%$, and Psychotic $n = 18, 2.5\%$), limiting our ability to compare across diagnoses. There was also a high degree of comorbidity in psychiatric diagnoses within our population. The option to simply compare across those with and without a diagnosis was a possibility, however ultimately the decision was made to classify individuals according to their current symptomatology (current, past, none), which, as noted previously, were unplanned subgroups for the FLEX trial. This was done as a compromise between statistical power (not wishing to exclude the groups with small N's and thus negate the advantage of the large sample size of the FLEX trial) and limitations within the literature (reliance on specific populations, simple comparisons). Ultimately, the clinical utility of this comparison (those with a current episode likely being more

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

severe/symptomatic compared to those with a past/remitted episode) aided in the decision to group the participants in this way. Moving forward, larger samples within each category may have allowed for more detailed analyses and comparisons, and could be a focus for future trials.

Future directions

Research in the area of smoking cessation faces many challenges moving forward. Despite significant drops in smoking prevalence in the preceding two decades, there remains a significant number of individuals who continue to smoke both in Western nations and worldwide. This area of research has been described as “in a rut” (Michie, Hyder, Walia, & West, 2011), particularly with regards to the development of new interventions and strategies to aid persistent smokers. As new trials are funded and progress, new theoretical frameworks are required (Michie & Abraham, 2004) to guide intervention development. These include trials using factorial designs that enable researchers to investigate patient characteristics for both main and interaction effects at multiple levels and are key for developing interventions that work for all smokers (Piper Megan et al., 2015). Moving forward, researchers need to move past factors considered as primary mediators or treatment moderators, and pay attention to the contextual and time-related factors within which they operate (Burns et al., 2016). The present dissertation can be seen as one which has taken some of these preliminary steps by evaluating a measure of self-efficacy across theoretical moderators (psychiatric status). We investigated at both micro- (path analyses of treatment phase) and macro-levels (population between-subjects averaged effects) and controlled for empirically supported interpersonal-determinants and smoking-related variables. One significant roadblock which remains, as previously noted, is the difficulty in designing studies to manipulate these specific factors (self-efficacy; nicotine dependence/withdrawal). This may be due in part to the significant overlap across constructs,

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

and potentially to the scales. For example, in their attempted manipulation of self-efficacy, Shadel and colleagues (2017) noted no increase in cessation self-efficacy in the treatment group (received positive feedback); however, those in the treatment condition did experience changes in outcome expectancies, another central facet of SCT.

There remain several crucial areas to address. While self-efficacy is a robust predictor of outcomes, the dynamic aspects of the measure make it difficult to interpret and generalize. As a starting point, there is the issue of how much confidence is enough? Should clinicians be focusing on helping individual's achieve a certain threshold of self-efficacy before and/or during a quit attempt? The variability in scores found in our study, as well as the myriad of self-efficacy measures which exist make this a daunting task. In addition, there is also some research that suggests that overly inflated self-efficacy may in fact be negative, insofar as individuals may be overinflating their chances (Aaron Spaulding, D Rob Haley, & Mei Zhao, 2014). Rather than focusing on hitting a certain theoretical threshold, future studies may benefit by analyzing changes in self-efficacy (either positive or negative fluctuations) given a baseline level. In doing so, we may be able to correlate movement in either direction as indicative of a potential lapse and/or relapse risk. While a similar concept has been investigated over a shorter-term timescale (e.g., through ecological momentary studies; Shiffman, 2005; Shiffman et al., 2000), better understanding this process over a longer course could be beneficial in helping individual's maintain longterm abstinence. Similarly, observing how these fluctuations correlate to smoking outcomes in an intervention study might help shed light on two other important unknowns: 1) what specific interventions exist to increase self-efficacy; and 2) when (temporally) should these interventions be put in place and accessed? So far, evidence suggests that both pharmacologic and behavioural interventions currently available *indirectly* lead to increases in self-efficacy, but

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

future research might attempt to break this information down into its component parts to better understand how this occurs. Interestingly, a simple introduction to the concept of self-efficacy (i.e., perceived self-efficacy; Bandura, 2000), and its continued monitoring, can be a powerful intervention in and of itself. Subsequent studies might randomize individuals to receive education around self-efficacy (and monitoring exercises), implemented at different stages of a quit attempt, in an effort to determine the temporal relationship between cessation self-efficacy and outcomes. Finally, as noted throughout this dissertation, is the at-risk population of psychiatric smokers, and their general lower level of self-efficacy. Future studies could focus on the potential mediating effect of self-efficacy on these individual's typically worse symptom profiles (i.e., increased withdrawal, negative affect, lower distress tolerance). Evidence from our studies suggests that by focusing on building and sustaining high self-efficacy, these individual's can achieve abstinence in spite of their propensity to experience more severe symptoms as a result of nicotine withdrawal. Both qualitative and quantitative studies would be beneficial in helping understand how self-confidence in their ability to quit impacts previously held beliefs around smoking, mitigates negative withdrawal symptoms, and potentially mitigate risk of relapse following lapse.

Conclusion

In conclusion, this dissertation evaluated cessation self-efficacy as a predictor of smoking cessation outcomes among individuals who smoke with and without a concurrent psychiatric diagnosis. Several research questions were investigated across 4 dissertation articles, with results converging on two central conclusions: 1) full support for the use and evaluation of cessation self-efficacy measures in smokers with a concurrent psychiatric illness was found, and 2) the importance of cessation self-efficacy in this population as a primary agent in cessation outcomes.

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

This first conclusion not only supports the use of cessation self-efficacy scales from a psychometric perspective, but also highlights and underscores the important and valuable contextual information derived from their use. In comparing across psychiatric diagnoses, there were significant differences regarding subscales and their relationship to smoking outcomes. Specifically, the negative affect subscale, in particular, was important for smokers with a current and lifetime diagnosis. Our second conclusion that cessation self-efficacy is consistently and robustly associated with cessation outcomes is important. Previous reports, particularly in trials that investigate individuals who smoke with a mental health disorder, have focused on withdrawal profiles of these smokers, highlighting their propensity to experience physiologic, affective and cognitive symptoms as a result. While these findings are consistent with our own cohort, we also noted that those with elevated cessation self-efficacy were more likely to be successful quitters, and found evidence that high self-efficacy scores can mediate the impact of these symptoms. Future research needs to continue investigating the dynamics of cessation self-efficacy as it relates to smoking (lapses) and withdrawal profiles of individuals attempting to quit smoking to fully understand the mechanisms by which it is associated with positive outcomes. This may help the development of new interventions which are able to target specific indicators of cessation at the appropriate times in order to maximize opportunities to remain smoke free.

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

References

- Allan, J. (2013). Smoking: time for the mental health system to confront its own ambivalence. *Australasian Psychiatry, 21*(3), 203-205.
- Amodei, N., & Lamb, R. J. (2005). Predictors of initial abstinence in smokers enrolled in a smoking cessation program. *Subst Use Misuse, 40*(2), 141-149.
- Ashton, M., Lawn, S., & Hosking, J. R. (2010). Mental health workers' views on addressing tobacco use. *Australian & New Zealand Journal of Psychiatry, 44*(9), 846-851.
- Aubin, H. J. (2009). Management of emergent psychiatric symptoms during smoking cessation. *Current Medical Research & Opinion, 25*(2), 519-525.
- Babyak, M. A. (2004). What you see may not be what you get: a brief, nontechnical introduction to overfitting in regression-type models. *Psychosomatic Medicine, 66*(3), 411-421.
- Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychological Review, 84*(2), 191.
- Bandura, A. (1986). The explanatory and predictive scope of self-efficacy theory. *Journal of Social and Clinical Psychology, 4*(3), 359-373.
- Bandura, A. (1997). Self-efficacy: The exercise of self-control. *Gordonville, VA: WH Freeman & Co.*
- Beauchamp, M. R. (2016). Disentangling motivation from self-efficacy: Implications for measurement, theory-development, and intervention. *Health Psychology Review, 10*(2), 129-132.
- Beck A, Steer, R., & Brown, G. (1996). *Beck Depression Inventory-2nd edition*. San Antonio, Tx: Psychological Coporation.
- Becker, J.-M., Ringle, C. M., Sarstedt, M., & Völckner, F. (2015). How collinearity affects

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

- mixture regression results. *Marketing Letters*, 26(4), 643-659.
- Berg, C. J., Sanderson Cox, L., Mahnken, J. D., Greiner, K. A., & Ellerbeck, E. F. (2008). Correlates of Self-efficacy among Rural Smokers. *Journal of Health Psychology*, 13(3), 416-421. doi:10.1177/1359105307088144
- Berndt, N. C., Hayes, A. F., Verboon, P., Lechner, L., Bolman, C., & De Vries, H. (2013). Self-efficacy mediates the impact of craving on smoking abstinence in low to moderately anxious patients: Results of a moderated mediation approach. *Psychology of Addictive Behaviors*, 27(1), 113.
- Blevins, C. E., Farris, S. G., Brown, R. A., Strong, D. R., & Abrantes, A. M. (2016). The role of self-efficacy, adaptive coping, and smoking urges in long-term cessation outcomes. *Addictive disorders & their treatment*, 15(4), 183.
- Borland, R., Yong, H. H., Balmford, J., Cooper, J., Cummings, K. M., O'Connor, R. J., . . . Fong, G. T. (2010). Motivational factors predict quit attempts but not maintenance of smoking cessation: findings from the International Tobacco Control Four country project. *Nicotine Tob Res.*, 12(Suppl), S4-11. doi: 10.1093/ntr/ntq1050.
- Brodbeck, J., Bachmann, M. S., Brown, A., & Znoj, H. J. (2014). Effects of depressive symptoms on antecedents of lapses during a smoking cessation attempt: an ecological momentary assessment study. *Addiction*, 109(8), 1363-1370.
- Burns, R. J., Rothman, A. J., Fu, S. S., Lindgren, B., Vock, D. M., & Joseph, A. M. (2016). Longitudinal Care Improves Cessation in Smokers Who Do Not Initially Respond to Treatment by Increasing Cessation Self-Efficacy, Satisfaction, and Readiness to Quit: A Mediated Moderation Analysis. *Annals of Behavioral Medicine*, 50(1), 58-69. doi:10.1007/s12160-015-9732-1

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

- Cabin, R. J., & Mitchell, R. J. (2000). To Bonferroni or not to Bonferroni: when and how are the questions. *Bulletin of the Ecological Society of America*, 81(3), 246-248.
- Castro, Y., Cano, M. Á., Businelle, M. S., Correa-Fernández, V., Heppner, W. L., Mazas, C. A., & Wetter, D. W. (2014). A Cross-Lagged Path Analysis of Five Intrapersonal Determinants of Smoking Cessation. *Drug and Alcohol Dependence*.
- Chaiton, M., Cohen, J., O'Loughlin, J., & Rehm, J. (2010). Use of cigarettes to improve affect and depressive symptoms in a longitudinal study of adolescents. *Addictive behaviors*, 35(12), 1054-1060.
- Cinciripini, P. M., Wetter, D. W., Fouladi, R. T., Blalock, J. A., Carter, B. L., Cinciripini, L. G., & Baile, W. F. (2003). The effects of depressed mood on smoking cessation: Mediation by postcessation self-efficacy. *Journal of consulting and clinical psychology*, 71(2), 292-301. doi:10.1037/0022-006x.71.2.292
- Corrigan, P. W., Watson, A. C., & Barr, L. (2006). The self-stigma of mental illness: implications for self-esteem and self-efficacy. *Journal of Social and Clinical Psychology*, 25(8), 875-884.
- Cupertino, A.-P., Berg, C., Gajewski, B., Hui, S.-k. A., Richter, K., Catley, D., & Ellerbeck, E. F. (2012). Change in self-efficacy, autonomous and controlled motivation predicting smoking. *Journal of Health Psychology*, 17(5), 640-652.
- Dijkman, B., Kooistra, B., & Bhandari, M. (2009). How to work with a subgroup analysis. *Canadian Journal of Surgery*, 52(6), 515.
- Dijkstra, A., & Vries, H. D. (2000). Self-efficacy expectations with regard to different tasks in smoking cessation. *Psychology & Health*, 15(4), 501-511.
doi:10.1080/08870440008402009

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

- Elfeddali, I., Bolman, C., Candel, M. J. J. M., Wiers, R. W., & De Vries, H. (2012). The role of self-efficacy, recovery self-efficacy, and preparatory planning in predicting short-term smoking relapse. *British journal of health psychology*, *17*(1), 185-201.
doi:10.1111/j.2044-8287.2011.02032.x
- Els, C., Kunyk, D., & Sidhu, H. (2011). Smoking cessation and neuropsychiatric adverse events: are family physicians caught between a rock and a hard place? *Canadian Family Physician*, *57*(6), 647-649, e194-647.
- Etter, J.-F., Bergman, M. M., Humair, J.-P., & Perneger, T. V. (2000). Development and validation of a scale measuring self-efficacy of current and former smokers. *Addiction*, *95*(6), 901-913. doi:10.1046/j.1360-0443.2000.9569017.x
- Fiore, M. (2008). *Treating tobacco use and dependence: 2008 update: Clinical practice guideline*: Diane Publishing.
- Greenfield, B. L., Venner, K. L., Kelly, J. F., Slaymaker, V., & Bryan, A. D. (2012). The impact of depression on abstinence self-efficacy and substance use outcomes among emerging adults in residential treatment. *Psychology of Addictive Behaviors*, *26*(2), 246.
- Gwaltney, C. J., Metrik, J., Kahler, C. W., & Shiffman, S. (2009). Self-efficacy and smoking cessation: A meta-analysis. *Psychology of Addictive Behaviors*, *23*(1), 56-66.
doi:10.1037/a0013529
- Gwaltney, C. J., Shiffman, S., Balabanis, M. H., & Paty, J. A. (2005). Dynamic Self-Efficacy and Outcome Expectancies: Prediction of Smoking Lapse and Relapse. *Journal of Abnormal Psychology*, *114*(4), 661-675. doi:10.1037/0021-843x.114.4.661
- Gwaltney, C. J., Shiffman, S., Normal, G. J., Paty, J. A., Kassel, J. D., Gnys, M., . . . Balabanis, M. (2001). Does smoking abstinence self-efficacy vary across situations? Identifying

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

- context-specificity within the Relapse Situation Efficacy Questionnaire. *Journal of consulting and clinical psychology*, 69(3), 516-527. doi:10.1037/0022-006X.69.3.516
- Gwaltney, C. J., Shiffman, S., Paty, J. A., Liu, K. S., Kassel, J. D., Gnys, M., & Hickcox, M. (2002). Using self-efficacy judgments to predict characteristics of lapses to smoking. *Journal of consulting and clinical psychology*, 70(5), 1140-1149. doi:10.1037/0022-006x.70.5.1140
- Gwaltney, C. J., Shiffman, S., & Sayette, M. A. (2005). Situational Correlates of Abstinence Self-Efficacy. *Journal of Abnormal Psychology*, 114(4), 649-660. doi:10.1037/0021-843x.114.4.649
- Haukkala, A., Uutela, A., Vartiainen, E., Mcalister, A., & Knekt, P. (2000). Depression and smoking cessation: the role of motivation and self-efficacy. *Addictive behaviors*, 25(2), 311-316.
- Heatherton, T. F., Kozlowski, L. T., Frecker, R. C., & Fagerstrom, K.-O. (1991). The Fagerström Test for Nicotine Dependence: a revision of the Fagerstrom Tolerance Questionnaire. *British Journal of Addiction*, 86(9), 1119-1127. doi:10.1111/j.1360-0443.1991.tb01879.x
- Hendershot, C. S., Witkiewitz, K., George, W. H., & Marlatt, G. A. (2011). Relapse prevention for addictive behaviors. *Substance Abuse Treatment, Prevention, and Policy*, 6(1), 1.
- Hendricks, P. S., Delucchi, K. L., & Hall, S. M. (2010). Mechanisms of change in extended cognitive behavioral treatment for tobacco dependence. *Drug Alcohol Depend.*, 109(1-3), 114-119. doi: 110.1016/j.drugalcdep.2009.1012.1021. Epub 2010 Jan 1021.
- Hendricks, P. S., Wood, S. B., Baker, M. R., Delucchi, K. L., & Hall, S. M. (2011). The Smoking Abstinence Questionnaire: measurement of smokers' abstinence-related

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

- expectancies. *Addiction*, *106*(4), 716-728. doi: 710.1111/j.1360-0443.2010.03338.x.
- Hendricks, P. S., Wood, S. B., & Hall, S. M. (2009). Smokers' expectancies for abstinence: Preliminary results from focus groups. *Psychology of Addictive Behaviors*, *23*(2), 380-385. doi:10.1037/a0015697
- Herd, N., Borland, R., & Hyland, A. (2009). Predictors of smoking relapse by duration of abstinence: findings from the International Tobacco Control (ITC) Four Country Survey. *Addiction*, *104*(12), 2088-2099. doi:10.1111/j.1360-0443.2009.02732.x
- Hoepfner, B. B., Kahler, C. W., & Gwaltney, C. J. (2014). Relationship between momentary affect states and self-efficacy in adolescent smokers. *Health Psychology*, *33*(12), 1507-1517. doi:10.1037/hea0000075
- Hughes, J. R., & Hatsukami, D. (1986). Signs and symptoms of tobacco withdrawal. *Archives of General Psychiatry*, *43*(3), 289.
- John, U., Meyer, C., Rumpf, H. J., & Hapke, U. (2004). Self-efficacy to refrain from smoking predicted by major depression and nicotine dependence. *Addictive behaviors*, *29*(5), 857-866. doi:<http://dx.doi.org/10.1016/j.addbeh.2004.02.053>
- Kadden, R. M., & Litt, M. D. (2011). The role of self-efficacy in the treatment of substance use disorders. *Addictive behaviors*, *36*(12), 1120-1126. doi:<http://dx.doi.org/10.1016/j.addbeh.2011.07.032>
- Kassel, J. D., Stroud, L. R., & Paronis, C. A. (2003). Smoking, stress, and negative affect: correlation, causation, and context across stages of smoking. *Psychological bulletin*, *129*(2), 270.
- Kenford, S. L., Smith, S. S., Wetter, D. W., Jorenby, D. E., Fiore, M. C., & Baker, T. B. (2002). Predicting relapse back to smoking: contrasting affective and physical models of

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

- dependence. *Journal of consulting and clinical psychology*, 70(1), 216.
- Kerr, S., Woods, C., Knussen, C., Watson, H., & Hunter, R. (2013). Breaking the habit: a qualitative exploration of barriers and facilitators to smoking cessation in people with enduring mental health problems. *BMC Public Health*, 13, 221.
- Khantzian, E. (1997). The self-medication hypothesis of substance use disorders: A reconsideration and recent applications. *Harv Rev Psychiatry*, 4, 231 - 244.
- Kirchner, T. R., Shiffman, S., & Wileyto, E. P. (2012). Relapse dynamics during smoking cessation: recurrent abstinence violation effects and lapse-relapse progression. *Journal of Abnormal Psychology*, 121(1), 187.
- Kwasnicka, D., Penseau, J., White, M., & Sniehotka, F. F. (2013). Does planning how to cope with anticipated barriers facilitate health-related behaviour change? A systematic review. *Health Psychology Review*, 7(2), 129-145.
- Lasser, K., Boyd, J., Woolhandler, S., Himmelstein, D. U., McCormick, D., & Bor, D. H. (2000). Smoking and mental illness: A population-based prevalence study. *JAMA*, 284(20), 2606-2610. doi:10.1001/jama.284.20.2606
- Lawn, S. J., Pols, R. G., & Barber, J. G. (2002). Smoking and quitting: a qualitative study with community-living psychiatric clients. *Social Science & Medicine*, 54(1), 93-104.
- Lee, H. S., Catley, D., & Harris, K. J. (2014). Improving Understanding of the Quitting Process: Psychological Predictors of Quit Attempts Versus Smoking Cessation Maintenance among College Students. *Substance use & misuse*, 49(10), 1332-1339. doi:10.3109/10826084.2014.901386
- Leventhal, A. M., Piper, M. E., Japuntich, S. J., Baker, T. B., & Cook, J. W. (2014). Anhedonia, depressed mood, and smoking cessation outcome. *Journal of consulting and clinical*

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

psychology, 82(1), 122.

Leventhal, A. M., & Zvolensky, M. J. (2015). Anxiety, depression, and cigarette smoking: A transdiagnostic vulnerability framework to understanding emotion–smoking comorbidity.

Psychological bulletin, 141(1), 176.

Li, S., Fang, L., Zhou, Y., Pan, L., Yang, X., Li, H., . . . Jia, C. (2015). Mediation of smoking abstinence self-efficacy on the association of nicotine dependence with smoking cessation. *European Journal of Public Health*, 25(2), 200-204.

doi:10.1093/eurpub/cku183

Marlatt, G. A., Bowen, S. W., & Witkiewitz, K. (2009). Relapse prevention: Evidence base and future directions. *Evidence-based addiction treatment*, 215-232.

Marlatt, G. A., & George, W. H. (1984). Relapse prevention: introduction and overview of the model. *Br J Addict*, 79(3), 261-273.

McCarthy, D. E., Ebssa, L., Witkiewitz, K., & Shiffman, S. (2015). Paths to tobacco abstinence: A repeated-measures latent class analysis. *Journal of consulting and clinical psychology*, 83(4), 696-708. doi:10.1037/ccp0000017

McCarthy, D. E., Ebssa, L., Witkiewitz, K., & Shiffman, S. (2015). Paths to tobacco abstinence: A repeated-measures latent class analysis. *Journal of consulting and clinical psychology*, 83(4), 696.

McDermott, M. S., Marteau, T. M., Hollands, G. J., Hankins, M., & Aveyard, P. (2013). Change in anxiety following successful and unsuccessful attempts at smoking cessation: cohort study. *British Journal of Psychiatry*, 202(1), 62-67.

Michie, S., & Abraham, C. (2004). Interventions to change health behaviours: evidence-based or evidence-inspired? *Psychology & Health*, 19(1), 29-49.

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

- Michie, S., Hyder, N., Walia, A., & West, R. (2011). Development of a taxonomy of behaviour change techniques used in individual behavioural support for smoking cessation. *Addictive behaviors, 36*(4), 315-319.
- Minnix, J. A., Blalock, J. A., Marani, S., Prokhorov, A. V., & Cinciripini, P. M. (2011). Self-Efficacy Mediates the Effect of Depression on Smoking Susceptibility in Adolescents. *Nicotine & Tobacco Research, 13*(8), 699-705.
- Morrell, H. E. R., Skarbek, E. A., & Cohen, L. M. (2011). The relationship between self-efficacy and nicotine withdrawal severity among adult smokers. *Addiction Research & Theory, 19*(6), 494-503. doi:10.3109/16066359.2011.562995
- Ockene, J. K., Emmons, K. M., Mermelstein, R. J., Perkins, K. A., Bonollo, D. S., Voorhees, C. C., & Hollis, J. F. (2000). Relapse and maintenance issues for smoking cessation. *Health Psychol., 19*(1 Suppl), 17-31.
- Pardavila-Belio, M. I., Canga-Armayor, A., Duaso, M. J., Pueyo-Garrigues, S., Pueyo-Garrigues, M., & Canga-Armayor, N. (2018). Understanding how a smoking cessation intervention changes beliefs, self-efficacy, and intention to quit: a secondary analysis of a pragmatic randomized controlled trial. *Translational Behavioral Medicine.*
- Parrott, A. C. (2004). Heightened stress and depression follow cigarette smoking. *Psychol Rep, 94*(1), 33-34.
- Pateman, K., Ford, P., Fitzgerald, L., Mutch, A., Yuke, K., Bonevski, B., & Gartner, C. (2016). Stuck in the catch 22: Attitudes towards smoking cessation among populations vulnerable to social disadvantage. *Addiction, 111*(6), 1048-1056.
- Perkins, K. A., Parzynski, C., Mercincavage, M., Conklin, C. A., & Fonte, C. A. (2012). Is self-efficacy for smoking abstinence a cause of, or a reflection on, smoking behavior change?

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

Experimental and clinical psychopharmacology, 20(1), 56.

Piper, M. E., Schlam, T. R., Cook, J. W., Sheffer, M. A., Smith, S. S., Loh, W.-Y., . . . Hefner, K. R. (2011). Tobacco withdrawal components and their relations with cessation success. *Psychopharmacology*, 216(4), 569-578.

Piper Megan, E., Fiore Michael, C., Smith Stevens, S., Fraser, D., Bolt Daniel, M., Collins Linda, M., . . . Baker Timothy, B. (2015). Identifying effective intervention components for smoking cessation: a factorial screening experiment. *Addiction*, 111(1), 129-141.
doi:10.1111/add.13162

Pomerleau, C. S., Marks, J. L., & Pomerleau, O. F. (2000). Who gets what symptom? Effects of psychiatric cofactors and nicotine dependence on patterns of smoking withdrawal symptomatology. *Nicotine & Tobacco Research*, 2(3), 275-280.
doi:10.1080/14622200050147547

Prochaska, J. J. (2010). Failure to treat tobacco use in mental health and addiction treatment settings: a form of harm reduction? *Drug and Alcohol Dependence*, 110(3), 177-182.

Prochaska, J. J. (2011). Smoking and mental illness—breaking the link. *New England Journal of Medicine*, 365(3), 196-198.

Prochaska, J. J., Hall, S. M., Tsoh, J. Y., Eisendrath, S., Rossi, J. S., Redding, C. A., . . . Gorecki, J. A. (2008). Treating tobacco dependence in clinically depressed smokers: effect of smoking cessation on mental health functioning. *American journal of public health*, 98(3), 446-448.

Rami Azmi, E., Mohammed Ibrahim, Y., Fadi Marwan, K., Ziyad Taher, S., & Tareq Rateb, A. (2016). Self-efficacy in treating tobacco use: A review article. *Proceedings of Singapore Healthcare*, 25(4), 243-248. doi:10.1177/2010105816667137

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

- Reese, E. D., & Veilleux, J. C. (2016). Relationships Between Craving Beliefs and Abstinence Self-Efficacy are Mediated by Smoking Motives and Moderated by Nicotine Dependence. *Nicotine & Tobacco Research, 18*(1), 48-55. doi:10.1093/ntr/ntv054
- Rothwell, P. M. (2005). Subgroup analysis in randomised controlled trials: importance, indications, and interpretation. *The Lancet, 365*(9454), 176-186.
- Sankoh, A. J., D'Agostino Sr, R. B., & Huque, M. F. (2003). Efficacy endpoint selection and multiplicity adjustment methods in clinical trials with inherent multiple endpoint issues. *Statistics in Medicine, 22*(20), 3133-3150.
- Schnoll, R. A., Martinez, E., Tatum, K. L., Glass, M., Bernath, A., Ferris, D., & Reynolds, P. (2011). Increased self-efficacy to quit and perceived control over withdrawal symptoms predict smoking cessation following nicotine dependence treatment. *Addictive behaviors, 36*(1-2), 144-147. doi:<http://dx.doi.org/10.1016/j.addbeh.2010.08.024>
- Schuck, K., Otten, R., Kleinjan, M., Bricker, J. B., & Engels, R. C. (2014). Self-efficacy and acceptance of cravings to smoke underlie the effectiveness of quitline counseling for smoking cessation. *Drug & Alcohol Dependence, 142*, 269-276.
- Schulz, K. F., & Grimes, D. A. (2005). Multiplicity in randomised trials II: subgroup and interim analyses. *The Lancet, 365*(9471), 1657-1661.
- Shadel, W. G., & Cervone, D. (2006). Evaluating social-cognitive mechanisms that regulate self-efficacy in response to provocative smoking cues: an experimental investigation. *Psychology of Addictive Behaviors, 20*(1), 91.
- Shadel, W. G., Martino, S. C., Setodji, C., Cervone, D., & Witkiewitz, K. (2017). Does self-efficacy causally influence initial smoking cessation? An experimental study. *Addictive behaviors, 73*, 199-203. doi:<https://doi.org/10.1016/j.addbeh.2017.05.018>

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

- Shiffman, S. (2005). Dynamic Influences on Smoking Relapse Process. *Journal of personality*, 73(6), 1715-1748. doi:10.1111/j.0022-3506.2005.00364.x
- Shiffman, S., Balabanis, M. H., Paty, J. A., Engberg, J., Gwaltney, C. J., Liu, K. S., . . . Paton, S. M. (2000). Dynamic effects of self-efficacy on smoking lapse and relapse. *Health Psychology*, 19(4), 315.
- Shiyko, M. P., Lanza, S. T., Tan, X., Li, R., & Shiffman, S. (2012). Using the time-varying effect model (TVEM) to examine dynamic associations between negative affect and self confidence on smoking urges: Differences between successful quitters and relapsers. *Prevention Science*, 13(3), 288-299.
- Siru, R., Hulse, G. K., & Tait, R. J. (2009). Assessing motivation to quit smoking in people with mental illness: a review. *Addiction*, 104(5), 719-733.
- Smit, E. S., Hoving, C., Schelleman-Offermans, K., West, R., & de Vries, H. (2014). Predictors of successful and unsuccessful quit attempts among smokers motivated to quit. *Addictive behaviors*, 39(9), 1318-1324. doi:<https://doi.org/10.1016/j.addbeh.2014.04.017>
- Spaulding, A., Haley, D. R., & Zhao, M. (2014). Highly Self-Efficacious or Simply Delusional? *International Journal of Health Sciences*, 2(1), 01-17.
- Spek, V., Lemmens, F., Chatrou, M., van Kempen, S., Pouwer, F., & Pop, V. (2013). Development of a smoking abstinence self-efficacy questionnaire. *Int J Behav Med.*, 20(3), 444-449. doi: 410.1007/s12529-12012-19229-12522.
- Taylor, G., McNeill, A., Girling, A., Farley, A., Lindson-Hawley, N., & Aveyard, P. (2014). Change in mental health after smoking cessation: systematic review and meta-analysis. *Bmj*, 348, g1151.
- Twyman, L., Bonevski, B., Paul, C., & Bryant, J. (2014). Perceived barriers to smoking cessation

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

- in selected vulnerable groups: a systematic review of the qualitative and quantitative literature. *BMJ open*, 4(12), e006414.
- Van Zundert, R. M., Ferguson, S. G., Shiffman, S., & Engels, R. C. (2010). Dynamic effects of self-efficacy on smoking lapses and relapse among adolescents. *Health Psychology*, 29(3), 246.
- Weinberger, A. H., Desai, R. A., & McKee, S. A. (2010). Nicotine withdrawal in US smokers with current mood, anxiety, alcohol use, and substance use disorders. *Drug and Alcohol Dependence*, 108(1), 7-12.
- Weinberger, A. H., George, T. P., & McKee, S. A. (2011). Differences in smoking expectancies in smokers with and without a history of major depression. *Addictive behaviors*, 36(4), 434-437.
- West, R., Hajek, P., Stead, L., & Stapleton, J. (2005). Outcome criteria in smoking cessation trials: proposal for a common standard. *Addiction*, 100(3), 299-303.
- Williams, D. M., & Rhodes, R. E. (2016). The confounded self-efficacy construct: conceptual analysis and recommendations for future research. *Health Psychology Review*, 10(2), 113-128. doi:10.1080/17437199.2014.941998
- Witkiewitz, K., & Marlatt, G. A. (2004). Relapse prevention for alcohol and drug problems: that was Zen, this is Tao. *American psychologist*, 59(4), 224.
- Witkiewitz, K., & Marlatt, G. A. (2007). 2 - High-Risk Situations: Relapse as a Dynamic Process *Therapist's Guide to Evidence-Based Relapse Prevention* (pp. 19-33). Burlington: Academic Press.
- Ziedonis, D., Hitsman, B., Beckham, J. C., Zvolensky, M., Adler, L. E., Audrain-McGovern, J., . . . Riley, W. T. (2008). Tobacco use and cessation in psychiatric disorders: National

Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

Institute of Mental Health report. *Nicotine & Tobacco Research*, 10(12), 1691-1715.

doi:10.1080/14622200802443569

Appendices

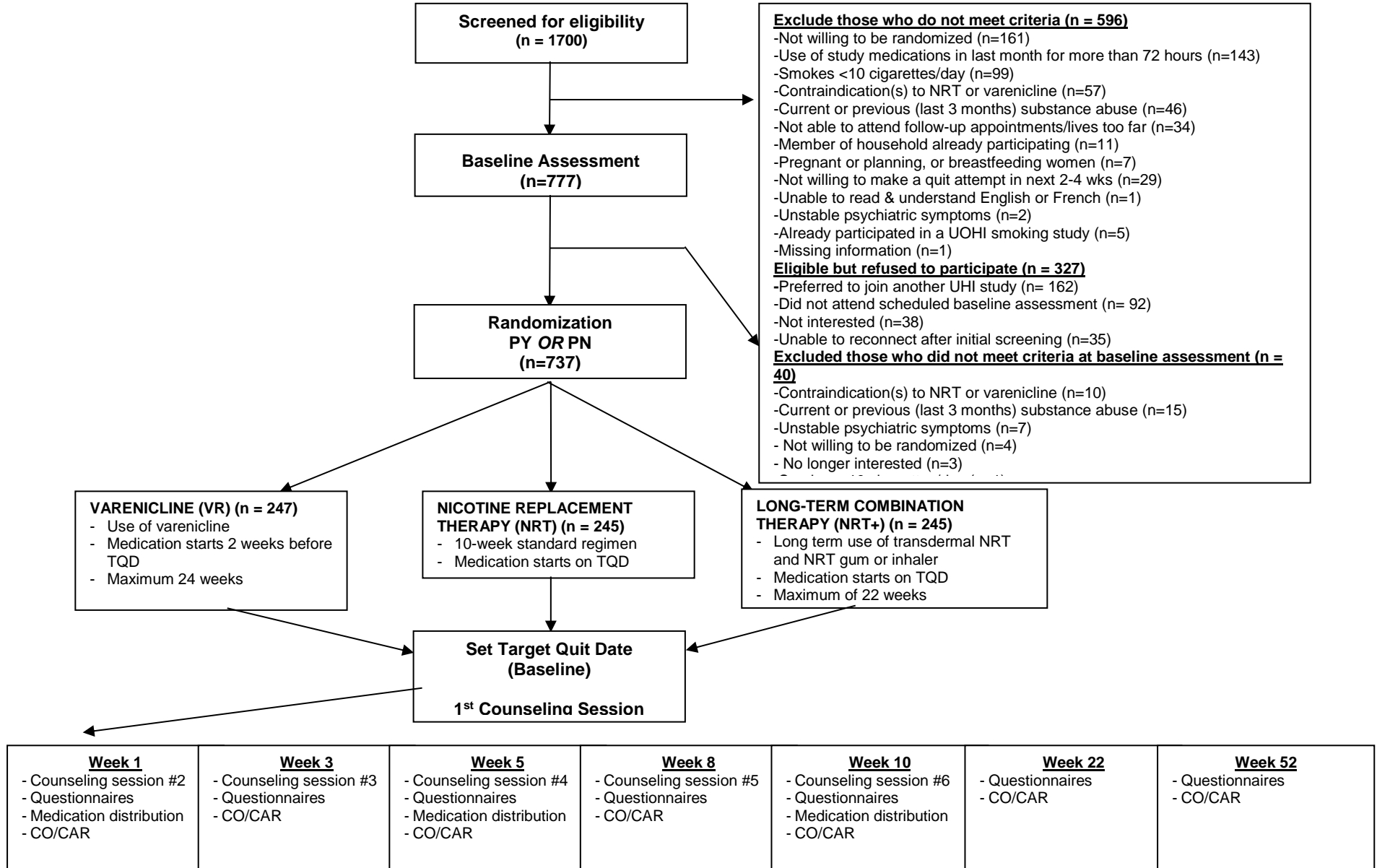
Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

Appendix 1 - Consort diagram for the FLEX trial

ENROLLMENT

ALLOCATION

FOLLOW UP



Smoking Cessation Self-Efficacy and Psychiatric Comorbidity

Appendix 2 - Timeline for measurements of the FLEX trial

Procedure	Initial Screen	Week - 2 BL	Week 0 TQD	Week 1	Week 3	Week 5	Week 8	Week 10	Week 22	Week 52
Eligibility criteria	✓	✓								
Informed consent		✓								
Demographics		✓								
Medical history		✓								
Smoking status		✓		✓	✓	✓	✓	✓	✓	✓
Smoking history		✓								
CO monitoring		✓		✓	✓	✓	✓	✓	✓	✓
Fagerström Test for Nicotine Dependence		✓								
MINI Plus (Past & Current psychiatric diagnoses)		✓								
Beck Depression Inventory (BDI-II)		✓		✓	✓	✓	✓	✓	✓	✓
State-Trait Anxiety Inventory (STAI)		✓		✓	✓	✓	✓	✓	✓	✓
State-Trait Anger Expression Inventory (STAXI)		✓		✓	✓	✓	✓	✓	✓	✓
Withdrawal symptoms (MNWS)		✓		✓	✓	✓	✓	✓	✓	✓
Randomization		✓								
Dispense medications		✓		✓	✓	✓	✓			
Counselling session		✓		✓	✓	✓	✓	✓		
VR group starts medication		✓								
NRT groups start medication			✓							
Use of cessation resources				✓	✓	✓	✓	✓	✓	✓

Appendix 3 - Consent Form

HI Protocol #2009562-01H

Consent to Participate in Research

I understand that I am being asked to participate in a research study to determine which quit smoking medication (varenicline/Champix®, nicotine replacement therapy (NRT) - the patch, or the patch plus other NRT products (e.g., inhaler, gum) is most effective in helping people quit smoking. This study has been explained to me by one of the project staff,

_____.

I have read this 6 page Patient Information Sheet and Consent Form. All my questions have been answered to my satisfaction. If I have any further questions about the study, I may contact the research coordinator, Evyanne Wooding, at 613-798-5555 x 17596.

I will receive a signed copy of this Patient Information Sheet and Consent Form. I voluntarily agree to participate in this study.

Patient's Name (Please Print)	
_____	_____
Patient's Signature	Date

Name of Investigator/Delegate (Please Print)	
_____	_____
Signature of Investigator/Delegate	Date

(valid until August 20, 2013)