Published in final edited form as:

J Subst Abuse Treat. 2018 July ; 90: 73–78. doi:10.1016/j.jsat.2018.04.013.

Smoking Outcome Expectancies Predict Smoking during Voucher-based Treatment for Smokers with Substance Use Disorders

Cara M. Murphy^a, Rosemarie A. Martin^a, Jennifer W. Tidey^a, Suzanne M. Colby^a, and Damaris J. Rohsenow^{a,b}

^aCenter for Alcohol and Addiction Studies, Brown University, Providence, RI USA

^bProvidence Veterans Affairs Medical Center, Providence, RI USA

Abstract

Objective: Strong expectations regarding positive effects of smoking may reduce the likelihood of successfully quitting. The *Smoking Effects Questionnaire (SEQ)* assesses the importance of seven expected positive and negative effects of smoking. SEQ was used to predict responses to contingent monetary rewards for smoking abstinence among smokers with substance use disorders (SUD).

Methods: Smokers (N=184) in residential (i.e., 24h/day) treatment for SUD received 19 consecutive days of either contingent vouchers (CV) for smoking abstinence (twice-daily carbon monoxide [CO] readings) or non-contingent vouchers (NV) plus counseling to motivate smoking cessation. Analyses investigated effects of smoking expectancies on days of smoking within-treatment and number of cigarettes/day at 1 month post-treatment.

Results: Higher positive expectancies for reduced negative affect, weight control, stimulation and positive social effects from smoking were related to more days of smoking during treatment only for participants in the CV condition. Post-treatment, expecting positive social and stimulating effects from smoking were related to more smoking only among CV participants. In both conditions, negative expectancies were largely unrelated to smoking outcomes.

Conclusions: The moderation of CV by positive smoking expectancies suggests that those who rate positive expectancies as more important may require a complementary treatment or different incentives to reduce smoking. The SEQ was probably unassociated with smoking in NV due to little reduction in smoking behavior. Helping smokers with SUD develop alternative ways to produce positive effects sought from smoking may be important to improve initial smoking outcomes.

Corresponding author: Damaris J. Rohsenow, Ph.D., Center for Alcohol and Addiction Studies, School of Public Health, Box G-S121-5 Brown University, Providence, RI 02912 USA, Phone: 401-863-6648; Fax: 401-863-6697; Email: Damaris_Rohsenow@brown.edu.

¹Analyses were repeated using number of readings with CO abstinence during the 14-day abstinence phase of voucher treatment with similar results obtained (not reported).

Keywords

nicotine dependence; smoking expectancies; smoking cessation; contingent vouchers

Introduction

Individuals with substance use disorders (SUD) are three times as likely to be dependent on nicotine than those without SUD (Compton et al. 2007), 78% of heavy substance users smoke cigarettes, and their quit rates are half that of non-substance users (Richter et al. 2002). Smokers in addiction treatment are more likely to die from tobacco-related causes than from alcohol or other drug-related causes (Hurt et al. 1996). Quitting smoking during the first year of SUD treatment significantly predicts better long-term abstinence from substances (Tsoh et al., 2011). Among illicit substance users, perceptions of smoking have a considerable influence on smoking behavior, with individuals who perceive smoking to be more risky being less likely to smoke (Richter et al., 2002). Thus, understanding and modifying smoking expectancies among individuals with SUD may have the potential to increase willingness to quit smoking and lead to better smoking cessation outcomes in this population.

The Smoking Effects Questionnaire (SEQ) was designed to assess positive and negative personal outcome expectancies from smoking (Rohsenow et al. 2003) based on decision theory (Edwards 1954) and social learning theory (Bandura 1977). It was developed and validated on a general adult population (Rohsenow et al. 2003), with 7th-grade reading level and only 33 items, to be easier for most patients to use than measures developed for use with college students. The SEQ consists of seven scales that fall on two higher-order factors (Rohsenow et al., 2003). The SEQ scales assess four positive (i.e., reduced negative affect, stimulation, positive social effects, weight control) and three negative (i.e., negative physical effects, negative psychosocial effects, future health concerns) expected effects of smoking, with scales largely demonstrating good or acceptable internal consistency reliabilities in general population smokers (Rohsenow et al. 2003; Tidey and Rohsenow 2009).

Prior work using the SEQ has found that expectancies were associated with many important aspects of smoking such as level of nicotine dependence, number of cigarettes smoked per day, cravings, and barriers and intentions to quit smoking. Among a general adult population, higher importance ratings for negative physical effects and positive stimulation effects from smoking were associated with greater nicotine dependence and daily smoking while positive expectancies were positively correlated with temptation to smoke (Rohsenow et al. 2003). Similarly, positive smoking expectancies were associated with greater craving severity and more catastrophic interpretations of cravings among individuals trying to quit (Nosen and Woody 2009). Among community smokers with schizophrenia, schizoaffective disorder, or without psychiatric illness, reduced negative affect was rated as the most important expected positive effect of smoking (Tidey and Rohsenow 2009). In all three groups, participants who intended to quit smoking rated the negative expectancies as more important than those who didn't.

Smoking expectancies have also shown to be important in studies of individuals with SUD and may interfere with smoking cessation. Endorsing more positive smoking expectancies was associated with more smoking to cope with substance urges among smokers in SUD treatment (Rohsenow et al. 2005). Similarly, greater severity of post-traumatic stress symptoms was indirectly associated with increased smoking and nicotine dependence via the positive smoking expectancy of reduced negative affect among trauma-exposed smokers with SUD (Hruska et al. 2014). Therefore, some individuals with SUD may use cigarettes as a way to ameliorate unwanted substance cravings and affective states. All SEQ expectancies were rated to be of some importance, with reduced negative affect rated as most important, among smokers in Alcoholics Anonymous, representing obstacles to overcome when encouraging smoking cessation (Reich et al. 2008). Indeed, alcohol dependent smokers who endorsed more positive expectancies from smoking also endorsed more perceived barriers to quitting smoking (Asher et al. 2003). Similarly, on a measure of expectancies for smoking abstinence, adverse expectancies of quitting (e.g., increased use of other drugs, not looking as cool or attractive) were associated with decreased motivation to quit smoking among drug-involved community smokers (Hendricks et al. 2014). Thus, expecting cigarettes to provide various important benefits is likely to contribute to a greater reliance on cigarettes, increased smoking and nicotine dependence, and may deter smoking quit attempts and contribute to the low quit rates observed among smokers with SUD.

Finding ways to counteract positive smoking expectancies in smokers with SUD may promote better smoking cessation outcomes in this population. A contingent voucher (CV) based treatment that incentivized expired carbon monoxide (CO) readings indicative of abstinence, compared to non-contingent vouchers (NV), increased smoking abstinence readings within-treatment, and interacted with motivational interviewing to increase point-prevalence abstinence over a year of follow-up among individuals in treatment for SUD (Rohsenow et al. 2015). It is possible that the provision of a financial incentive for abstinence could create a salient positive expectancy of not smoking (i.e., anticipated financial gain) that would compete with preexisting positive expectancies of smoking and facilitate changes in smoking behavior (i.e., fewer days with smoking, fewer cigarettes/day). Alternatively, if preexisting positive expectancies are reported to be of great importance, these expectancies may be more salient than temporary financial incentives, and impede change. This study can elucidate expectancy characteristics of those who have the greatest change in smoking behavior following receipt of CV and reveal how CV may interact with smoking expectancies to affect smoking behavior in a sample of smokers with comorbid SUD.

The aim of the current secondary analyses was to investigate the relationship of positive and negative smoking expectancies to smoking behavior during and just after smoking treatment among smokers with SUD assigned to CV-based smoking cessation treatment versus a control condition (NV), on a foundation of counseling. The *a priori* hypotheses were that greater importance of positive smoking expectancies and lower importance of negative smoking expectancies would predict more smoking in both conditions, but that the effects would be weaker in the CV condition due to monetary reward counteracting the effects of the expectancies. The relationships of the individual expectancy types to smoking outcome

were explored without hypothesizing differences among them to identify specific types of expectancies with stronger relationships to smoking.

Material and methods

Participants:

Participants were cigarette smokers with SUD ($N=184$) in a residential (i.e., 24 h/day) treatment program for SUD who consented to participate in a clinical trial aimed at motivating people with SUD to quit smoking (Rohsenow et al. 2015). Participants did not need to be motivated to quit smoking to enroll. Inclusion criteria included being 18 years old, meeting DSM-IV diagnostic criteria for SUD, and smoking 10 cigarettes per day for the past 6 months. Exclusion criteria were current smoking cessation treatment, psychosis, current suicidality, terminal illness, or inability to read or understand informed consent. Smoking was allowed outside the treatment facility during program breaks. Smoking cessation was not addressed by the program directly, and staff at the facility were supportive of the smoking intervention research.

Study design and procedures:

Participants were recruited to participate in the study during their first week in the treatment facility. Eligible and interested participants completed informed consent and baseline assessment. Afterward, they were urn randomized to one of four groups in a 2 X 2 between-groups factorial design: CV vs. NV and motivational interviewing (MI) vs. brief advice (BA) to quit smoking.

Intervention procedures:

Voucher procedures: Participants were randomized to 19 consecutive days of either CV or NV. In CV, the voucher period included a 5-day reduction phase followed by a 14-day abstinence phase. During the reduction phase, CV participants could earn vouchers for exhaled CO levels (measured once each morning) indicating reductions in smoking relative to baseline (\$2 per reading for a 25% reduction, \$4 for 50% reduction, and \$6 for a 75% or greater reduction). During the abstinence phase, CV participants earned vouchers for each of two daily (morning and evening) CO readings ≤ 6 ppm. The value of each voucher ranged from \$3 to \$16.50 and increased on an escalating schedule for consecutive abstinent readings. When individuals missed a CO reading or provided a CO reading > 6 ppm, the voucher value was reset to the lowest value, but was reset to the highest previously-achieved value after three consecutive CO readings ≤ 6 ppm. NV participants could earn the same payments per day as CV participants for providing breath samples, regardless of CO level, on the same schedule. The total possible amount earned was \$433 and vouchers were redeemable for merchandise certificates at local stores.

Counseling: The study MI and BA conditions have been described at length previously (Rohsenow et al. 2015). The first counseling session occurred after completing baseline assessments (the day before beginning vouchers) and the remaining occurred 7, 14, and 19 days afterward.

Assessments

Assessment procedures.—Assessments were conducted by research staff blinded to intervention condition. Participants were paid \$35 for completing a 1-month follow-up assessment.

Descriptive information.—Demographics include age, sex, education, race, and ethnicity. Fagerström Test for Nicotine Dependence (FTND; Heatherton et al. 1991) was used to assess nicotine dependence at baseline, scored from 0–10. Motivation to quit smoking was assessed using the Smoking Contemplation ladder (CL; Biener and Abrams 1991), scored from 1–10. The Structured Clinical Interview for DSM-IV–Patient version (First et al. 1995) was administered by trained research interviewers to obtain current SUD diagnoses.

Smoking expectancies.—The Smoking Effects Questionnaire (SEQ; Rohsenow et al. 2003) was collected at baseline. The 33 items were rated on 4-point Likert scales of importance (0 = statement does not apply to me to 3 = the statement does apply to me and is very important), with the mean rating calculated for each factor. Negative expectancy factor scales include: negative physical effects, negative psychosocial effects, and future health concerns. Positive expectancy factor scales include: reduced negative affect, stimulation, positive social effects, and weight control.

Smoking behavior during treatment.—The number of smoking days in the abstinence phase was the count of days for which participants did not provide two CO readings ≥ 6 ppm (range = 0–14). Number of days of smoking rather than number of readings abstinent was chosen for greater clinical relevance, since many CO readings ≥ 6 ppm were recorded in the morning only on days when smoking occurred later.

Smoking behavior at baseline and follow-up.—The timeline follow-back interview (TLFB; Robinson et al. 2014) was completed at baseline and follow-up to determine the number of cigarettes smoked per day in the last 7 days. At baseline, participants reported pre-admission smoking behavior. At the 1-month follow-up, only 4.4% ($n = 8$) of participants reported biochemically-confirmed abstinence during the past 7 days (Rohsenow et al. 2015), significantly limiting power to detect differences based on 7-day point-prevalence abstinence. Accordingly, number of cigarettes/day was used in follow-up analyses rather than number of days smoking.

Data Analysis Approach:

Preliminary analyses. Rohsenow et al. (2015) reported no significant effect of counseling type on number of CO readings ≥ 6 ppm within the abstinence phase of voucher treatment nor on number of cigarettes/day at follow-up. Correspondingly, the current analysis found no significant effect of counseling type or a counseling by voucher interaction on number of days of smoking during the voucher period (p s $> .05$). Therefore, all analyses are collapsed across counseling type. Analyses were conducted using IBM SPSS Statistics®; moderation analyses were run using PROCESS (Hayes 2017). All variables were checked for assumptions of normality and outlying values; all were normally distributed. The internal

consistency of SEQ scales was verified using Cronbach's alpha. Differences between voucher conditions in baseline characteristics, number of CO readings provided within-treatment, and follow-up rates were examined with t-tests and chi-square tests for continuous and dichotomous variables, respectively.

Primary analyses.—Rohsenow et al. (2015) reported significantly more within-treatment abstinent CO readings in CV vs. NV, but did not analyze number of days with both readings abstinent, so analyses of these data have not previously been reported.¹ The lack of significant main effects of voucher condition on 1-month smoking outcomes have previously been reported but the means and SDs are presented in Table 1 for information to readers.

The two overall factor scores were analyzed for the purpose of testing the hypothesis that higher positive and lower negative expectancy ratings would predict more smoking. Exploratory analyses of the seven SEQ scales were also conducted; since these analyses were exploratory rather than hypothesis testing (Areán and Kraemer 2013), and since Bonferroni corrections, used only for hypothesis testing, are known to overcorrect, (Perneger 1998), uncorrected *p* values were used. Independent samples t-tests were used to compare participants in the CV and NV groups on smoking outcomes within treatment (days with smoking) and at follow-up (cigarettes/day).

Correlations were used to 1) determine the relationship between SEQ scales and other potentially relevant baseline smoking variables (motivation to quit, nicotine dependence, cigarettes smoked per day) and 2) to assess the univariate strength of the relationships between SEQ scales and smoking outcomes in each condition. Significant associations between higher-order SEQ factors and smoking outcomes variable were followed-up with regression-based moderation analyses. These analyses examined the relative contributions of smoking expectancies and voucher type on smoking outcomes after controlling for variance attributed to baseline smoking variables with significant associations (cigarettes/day, nicotine dependence). The outcome variables used for the moderation analyses were number of days with smoking within treatment and number of cigarettes/day at follow-up. Path analysis-based moderation models were used with SEQ and condition entered in the first step and the two-way interaction of the SEQ factor and condition entered in the second step. Significant interactions were followed by simple slope tests.

Results

Sample description and baseline differences

Participants average age was 34.5 (*SD* = 8.2). Average educational attainment and annual income were 12.2 years (*SD* = 1.7) and \$9,487 (*SD* = \$13,618). The sample was 45% male, 83% White, 9% Black, 3% American Indian, 4% more than one race, and 7% Hispanic. SUD diagnoses included alcohol abuse or dependence (71%), cocaine abuse or dependence (74%), opiate abuse or dependence (53%), and marijuana abuse or dependence (37%). Baseline cigarettes/day was *M* = 22.3 (*SD* = 9.4); FTND score was *M* = 5.4 (*SD* = 2.3); CL score was *M* = 5.1 (*SD* = 1.4). (The mean CL score corresponded to the item "I often think about quitting smoking but I have no plans to quit".) On average, participants provided CO at 25.3 (*SD* = 10.9) of the 33 assessments during the 19-day voucher period including

providing two samples on 10.5 ($SD = 4.5$) of the 14 days of the abstinence phase. At 1-month follow-up, data were missing from 16 participants (8.7% of sample). Participants did not differ between conditions on baseline characteristics, number of CO readings provided during the voucher period, number of days that two readings were provided during the abstinence phase of the study, or rate of participation at 1-month follow-up (all $ps > .05$).

Table 1 shows mean baseline SEQ scores by voucher condition. Treatment conditions did not differ on any SEQ scale. Participants assigned to NV had significantly more days of smoking during treatment compared to those assigned to CV ($t(137.75) = 5.18, p < .001$). As previously reported (Rohsenow et al., 2015), conditions did not differ in average number of cigarettes/day smoked at 1 month follow-up.

Correlations and regressions of SEQ with smoking within-treatment and at follow-up

Table 2 shows the univariate associations between SEQ scores and baseline smoking variables and smoking outcomes by condition. As predicted, in the CV condition, the SEQ Positive factor was significantly associated with smoking within treatment and at 1-month follow-up. All four positive expectancy scales were positively associated with more smoking within treatment and two (positive social effects and stimulation) were associated with more smoking at follow-up. In the CV condition, the SEQ Negative factor was not significantly related to smoking outcomes within treatment or at follow-up, but the negative psychosocial effects scale was significantly associated with smoking within treatment. Contrary to prediction, in the NV condition, the SEQ was not significantly associated with smoking outcomes at either time point.

Given lack of associations with SEQ Negative expectancies, moderation analyses were conducted for only the SEQ Positive expectancies factor, displayed in Table 3. When controlling for variance due to baseline correlates, there was a significant interaction between SEQ Positive expectancies and voucher condition on smoking within treatment but not at follow-up. The simple slopes test showed that voucher conditions differed significantly on smoking within treatment based on positive smoking expectancy level, $p < .0001$ (see Fig. 1).

Discussion

This study sought to investigate the relationship between smoking expectancies and smoking behavior during and after treatment among smokers in residential treatment for SUD assigned to receive either CV for abstinence from smoking or NV. Baseline positive smoking expectancies moderated the effects of contingent vouchers on smoking behavior such that those with higher positive smoking expectancies were less responsive to voucher reinforcement than those with lower positive expectancies, only in the CV condition. Positive expectancies predicted amount of smoking within treatment even when controlling for variance shared with baseline cigarettes per day and cigarette dependence. Our findings suggest that abstinence incentives can counterbalance lower levels of positive smoking expectancies, but are not sufficient to outweigh higher levels of positive smoking expectancies. Past research on voucher-based reinforcement therapy has shown a direct relationship between changes in smoking behavior (CO levels) and the amount of money

offered to participants (e.g., Stitzer and Bigelow 1983; Stitzer and Bigelow 1984). It is possible that providing higher incentive amounts for abstinence might more effectively compete with higher positive smoking expectancies. Many other factors may influence change in smoking behavior (e.g., self-efficacy, treatment adherence, degree of cigarette dependence, intrinsic motivation) and it is important to consider how these modifying these factors may counter the effects of smoking expectancies to change smoking behavior. Future research is needed to determine whether changing incentive amounts or providing other adjunctive or complementary treatment successfully reduces the effects of positive smoking expectancies and results in greater abstinence among smokers with SUD.

Information about the specific types of expectancies was informative. Reducing negative affect was rated as the most important positive smoking expectancy and future health concerns and current negative physical effects were rated as the most important negative expectancies. In the CV condition, more smoking (i.e., less abstinence) during the voucher period was most strongly associated with expecting smoking to reduce negative affect or help to control one's weight. These positive expectancies may have made abstaining from smoking particularly challenging as withdrawal effects of abstinence, such as changes in appetite and negative affect, are at their peak during the first week (Hughes 2007). On the other hand, the other two positive smoking expectancies, social effects and stimulation, were associated with more smoking for CV participants both within-treatment and at the one-month follow-up. Thus, certain expectancies may be more important at different stages of the quitting process – the ones related to withdrawal symptoms may affect abstinence earlier on but then fade in importance. Contrary to hypotheses, there was a positive relationship between expecting more negative psychosocial effects and having more days of smoking within-treatment. Past work has shown that having a greater number of effects expected from smoking, whether positive or negative, is associated with having a great number of perceived barriers to quitting smoking (Asher et al. 2003) and this may account for the observed relationship.

Findings confirm past work that has suggested the importance of positive smoking expectancies, particularly reducing negative affect, in maintaining smoking in individuals with SUD (Hruska et al. 2014; Reich et al. 2008). Medications that reduce withdrawal-related negative mood, such as varenicline or bupropion (Jorenby et al. 2006), and psychosocial treatments designed to improve negative mood by simultaneously targeting smoking and depressive symptomatology (MacPherson et al. 2010) or by increasing non-drug related pleasant activities (Rogers et al. 2008) may be needed to increase smoking abstinence in smokers with higher negative-affect smoking expectancies. Treatments that reduce concerns surrounding smoking cessation-related weight gain (Perkins et al. 2001), offer a weight management program as an incentive for completing smoking cessation (Love et al. 2011), or provide pharmacological interventions that result in a significant reduction in weight gain at the end of treatment (albeit not long-term, Farley et al. 2012), may be needed to help offset the importance of weight control expectancies.

Limitations and strengths:

In the NV condition, vouchers had little impact on smoking behavior within treatment, reducing the ability to detect relationships between expectancies and smoking in this group. Given the low quit rates typically seen among smokers with SUDs (Richter et al. 2002) and no study requirement that participants be motivated to quit, it is not surprising that counseling in the absence of incentivized abstinence produced minimal abstinence in the NV condition. Although receipt of CV had more of an impact on smoking behavior than did NV, we thought it was important to include participants in both the active and control conditions in analyses and to examine the potential interactive effects of voucher condition with expectancies. However, the minimal abstinence in the NV condition constrains power to detect predictive relationships between expectancies and smoking outcomes in this condition. Additionally, as this study only assessed expected effects from smoking at baseline, it was not possible to test the extent to which the receipt of vouchers influenced smoking expectancies following quit day. It is logical to hypothesize that experiencing abstinence may alter smoking expectancies, just as abstinence during voucher-based reinforcement treatment has been found to increase self-efficacy for abstinence (Litt et al. 2008; Romanowich et al. 2009; Wong et al. 2004). Bidirectional associations in which self-efficacy predicts next-day abstinence and abstinence predicts next-day self-efficacy have also been reported (Perkins et al. 2012). While other studies have shown that smoking expectancies became less positive over treatment, particularly among those who were abstaining from smoking (Copeland et al. 1995; Gwaltney et al. 2005), demonstrating the impact of CV for doing so is an important future direction. Furthermore, data were missing for 16 participants at follow-up. While participants with missing data are assumed be smoking (Higgins and Green 2008), we did not impute number of cigarettes/day for missing participants. It is possible the smaller sample size reduced power to detect relationships of smoking behavior at follow-up with smoking expectancies. Despite these limitations, this current study had many strengths including use of group of individuals who are at high-risk for morbidity and mortality due to smoking and SUD, assessments conducted by assessors blind to condition, nearly 200 participants, the use of biochemically verified abstinence from smoking during the voucher period, and adjusting for potentially important baseline correlates.

Conclusions

To conclude, this study investigated the relationship between the importance of various expected effects of smoking and amount of smoking following receipt of CV or NV on a foundation of counseling in smokers with SUDs. Individuals in the NV had very little change in their smoking behavior and, thus, no relationship between expectancies and smoking was observed. In the CV condition, incentivizing abstinence was more effective among smokers with SUD who rated the positive expected effects of smoking as less important than among those who rated these expectancies as more important. Helping smokers with SUD to develop positive expectancies for the effects of abstaining from smoking or alternative ways to achieve the expected positive effects of smoking (e.g., ways to manage weight or negative affect) may be important to improve smoking outcomes.

Acknowledgements:

Appreciation is expressed to Suzanne Sales for conducting the statistical analyses. Preliminary results were presented at the annual meeting of the Society for Research on Nicotine and Tobacco, Chicago, IL, March 2016.

This research was supported by NIDA grants R01 DA13616, T32 DA016184, L30 DA042415, and by a Senior Research Career Scientist Award from the Department of Veterans (DJR). There are no conflicts of interest to disclose. The views expressed in this article are those of the authors and do not necessarily reflect the position or policy of the Department of Veterans Affairs nor the official views of the National Institutes of Health.

References

- Areán PA, Kraemer HC (2013) High quality psychotherapy research: From conception to piloting to national trials. Oxford University Press
- Asher MK, Martin RA, Rohsenow DJ, MacKinnon SV, Traficante R, Monti PM (2003) Perceived barriers to quitting smoking among alcohol dependent patients in treatment. *Journal of Substance Abuse Treatment* 24(2):169–174 doi:http://dx.doi.org/10.1016/S0740-5472(02)00354-9 [PubMed: 12745034]
- Bandura A (1977) Social learning theory. Prentice Hall, Englewood Cliffs, NJ
- Biener L, Abrams DB (1991) The contemplation ladder: Validation of a measure of readiness to consider smoking cessation. *Health Psychology* 10:360–365 [PubMed: 1935872]
- Compton WM, Thomas YF, Stinson FS, Grant BF (2007) Prevalence, correlates, disability, and comorbidity of DSM-IV drug abuse and dependence in the United States: results from the national epidemiologic survey on alcohol and related conditions. *Archives of general psychiatry* 64(5):566–576 [PubMed: 17485608]
- Copeland AL, Brandon TH, Quinn EP (1995) The Smoking Consequences Questionnaire-Adult: Measurement of smoking outcome expectancies of experienced smokers. *Psychological Assessment* 7(4):484
- Edwards W (1954) The theory of decision making. *Psychological bulletin* 51(4):380 [PubMed: 13177802]
- Farley AC, Hajek P, Lycett D, Aveyard P (2012) Interventions for preventing weight gain after smoking cessation *Cochrane Database of Systematic Reviews*. John Wiley & Sons, Ltd
- First MB, Williams JBW, Spitzer RL, Gibbon M (1995) User's guide for the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I, Version 2.0.). Biometrics Research Dept., New York State Psychiatric Institute, New York, NY
- Gwaltney CJ, Shiffman S, Balabanis MH, Paty JA (2005) Dynamic self-efficacy and outcome expectancies: prediction of smoking lapse and relapse. *Journal of abnormal psychology* 114(4):661 [PubMed: 16351387]
- Hayes AF (2017) Introduction to mediation, moderation, and conditional process analysis: A regression-based approach. Guilford Publications
- Heatherton TF, Kozlowski LT, Frecker RC, Fagerstrom KO (1991) The Fagerstrom Test for Nicotine Dependence: A revision of the Fagerstrom Tolerance Questionnaire. *British Journal of Addiction* 86:1119–1127 [PubMed: 1932883]
- Hendricks PS, Peters EN, Thorne CB, Delucchi KL, Hall SM (2014) Expectancies for smoking cessation among drug-involved smokers: Implications for clinical practice. *Journal of substance abuse treatment* 46(3):320–324 [PubMed: 24314605]
- Higgins J, Green S (2008) *Cochrane Handbook for Systematic Reviews of Interventions*. vol 5. Wiley-Blackwell, Chichester, p i–xxi
- Hruska B, Bernier J, Kenner F, et al. (2014) Examining the relationships between posttraumatic stress disorder symptoms, positive smoking outcome expectancies, and cigarette smoking in people with substance use disorders: A multiple mediator model. *Addictive behaviors* 39(1):273–281 [PubMed: 24144587]
- Hughes JR (2007) Effects of abstinence from tobacco: valid symptoms and time course. *Nicotine & Tobacco Research* 9(3):315–327 [PubMed: 17365764]

- Hurt RD, Offord KP, Croghan IT, et al. (1996) Mortality following inpatient addictions treatment: Role of tobacco use in a community-based cohort. *JAMA : the journal of the American Medical Association* 275(14):1097–1103 doi:10.1001/jama.1996.03530380039029 [PubMed: 8601929]
- Jorenby DE, Hays JT, Rigotti NA, et al. (2006) Efficacy of varenicline, an $\alpha 4\beta 2$ nicotinic acetylcholine receptor partial agonist, vs placebo or sustained-release bupropion for smoking cessation: a randomized controlled trial. *JAMA : the journal of the American Medical Association* 296(1):56–63 [PubMed: 16820547]
- Litt MD, Kadden RM, Kabela-Cormier E, Petry NM (2008) Coping skills training and contingency management treatments for marijuana dependence: exploring mechanisms of behavior change. *Addiction* 103(4):638–48 doi:10.1111/j.1360-0443.2008.02137.x [PubMed: 18339108]
- Love SJ, Sheffer CE, Bursac Z, Prewitt TE, Krukowski RA, West DS (2011) Offer of a Weight Management Program to Overweight and Obese Weight-Concerned Smokers Improves Tobacco Dependence Treatment Outcomes. *The American journal on addictions* 20(1):1–8 [PubMed: 21175914]
- MacPherson L, Tull MT, Matusiewicz AK, et al. (2010) Randomized controlled trial of behavioral activation smoking cessation treatment for smokers with elevated depressive symptoms. *Journal of consulting and clinical psychology* 78(1):55 [PubMed: 20099950]
- Nosen E, Woody SR (2009) Applying lessons learned from obsessions: Metacognitive processes in smoking cessation. *Cognitive Therapy and Research* 33(2):241–254
- Perkins KA, Marcus MD, Levine MD, et al. (2001) Cognitive-behavioral therapy to reduce weight concerns improves smoking cessation outcome in weight-concerned women. *Journal of consulting and clinical psychology* 69(4):604–13 [PubMed: 11550727]
- Perkins KA, Parzynski C, Mercincavage M, Conklin CA, Fonte CA (2012) Is self-efficacy for smoking abstinence a cause of, or a reflection on, smoking behavior change? *Experimental and clinical psychopharmacology* 20(1):56 [PubMed: 21910550]
- Perneger TV (1998) What's wrong with Bonferroni adjustments. *BMJ: British Medical Journal* 316(7139):1236 [PubMed: 9553006]
- Reich MS, Dietrich MS, Finlayson R, James A, Fischer EF, Martin PR (2008) Coffee and cigarette consumption and perceived effects in recovering alcoholics participating in Alcoholics Anonymous in Nashville, Tennessee. *Alcoholism: Clinical and Experimental Research* 32(10):1799–1806
- Richter KP, Ahluwalia HK, Mosier MC, Nazir N, Ahluwalia JS (2002) A population-based study of cigarette smoking among illicit drug users in the United States. *Addiction* 97(7):861–869 doi:10.1046/j.1360-0443.2002.00162.x [PubMed: 12133125]
- Robinson SM, Sobell LC, Sobell MB, Leo GI (2014) Reliability of the Timeline Followback for cocaine, cannabis, and cigarette use. *Psychology of addictive behaviors* 28(1):154 [PubMed: 23276315]
- Rogers RE, Higgins ST, Silverman K, et al. (2008) Abstinence-contingent reinforcement and engagement in non-drug-related activities among illicit drug abusers. *Psychology of Addictive Behaviors* 22(4):544 [PubMed: 19071979]
- Rohsenow DJ, Abrams DB, Monti PM, Colby SM, Martin R, Niaura RS (2003) The Smoking Effects Questionnaire for adult populations: Development and psychometric properties. *Addictive behaviors* 28(7):1257–1270 [PubMed: 12915167]
- Rohsenow DJ, Colby SM, Martin RA, Monti PM (2005) Nicotine and other substance interaction expectancies questionnaire: Relationship of expectancies to substance use. *Addictive Behaviors* 30(4):629–641 [PubMed: 15833569]
- Rohsenow DJ, Tidey JW, Martin RA, et al. (2015) Contingent vouchers and motivational interviewing for cigarette smokers in residential substance abuse treatment. *J Subst Abuse Treat* 55:29–38 doi:10.1016/j.jsat.2015.02.010 [PubMed: 25805668]
- Romanowich P, Mintz J, Lamb R (2009) The relationship between self-efficacy and reductions in smoking in a contingency management procedure. *Experimental and clinical psychopharmacology* 17(3):139 [PubMed: 19586228]
- Stitzer ML, Bigelow GE (1983) Contingent payment for carbon monoxide reduction: Effects of pay amount. *Behavior Therapy* 14(5):647–656

- Stitzer ML, Bigelow GE (1984) CONTINGENT REINFORCEMENT FOR CARBON MONOXIDE REDUCTION: WITHIN-SUBJECT EFFECTS OF PAY AMOUNT. *Journal of applied behavior analysis* 17(4):477–483 [PubMed: 6526768]
- Tidey JW, Rohsenow DJ (2009) Smoking expectancies and intention to quit in smokers with schizophrenia, schizoaffective disorder and non-psychiatric controls. *Schizophrenia research* 115(2):310–316 [PubMed: 19836210]
- Wong CJ, Anthony S, Sigmon SC, Mongeon JA, Badger GJ, Higgins ST (2004) Examining interrelationships between abstinence and coping self-efficacy in cocaine-dependent outpatients. *Experimental and clinical psychopharmacology* 12(3):190 [PubMed: 15301636]

Fig. 1.
Smoking Expectancies Moderating the Effect of Voucher Type on Smoking during the Voucher Period
Note. SEQ = The Smoking Effects Questionnaire; CV = contingent voucher condition; NV = non-contingent voucher condition

Table 1.

Mean (standard deviation) of the SEQ and smoking outcomes variables

	CV <i>n</i> = 97			NV <i>n</i> = 87		
	<i>M</i>	<i>SD</i>	<i>range</i>	<i>M</i>	<i>SD</i>	<i>range</i>
SEQ Positive Effects Total ($\alpha = .86$)	1.34	0.54		1.38	0.56	
Reduce negative affect ($\alpha = .72$)	2.45	0.55		2.41	0.56	
Stimulation ($\alpha = .71$)	0.92	0.72		1.01	0.72	
Social effects ($\alpha = .76$)	1.24	0.75		1.23	0.50	
Weight control ($\alpha = .79$)	0.75	0.84		0.84	0.88	
SEQ Negative Effects Total ($\alpha = .86$)	1.51	0.66		1.55	0.70	
Physical effects ($\alpha = .75$)	1.75	0.72		1.68	0.82	
Psychosocial effects ($\alpha = .74$)	1.02	0.80		1.12	0.79	
Future health concerns ($\alpha = .85$)	1.76	0.93		1.87	0.97	
# Days of smoking during treatment *	10.48	4.73	[0,14]	13.25	2.17	[0,14]
# Cigarettes smoked/day at 1-month follow-up †	9.76	7.28	[0,37]	10.80	5.42	[.5,30]

Note: SEQ = Smoking Effects Questionnaire – possible response range = 0–3; CV = contingent voucher condition; NV = non-contingent voucher condition;

* number of days in the abstinence phase of the voucher period for which participants did not provide two CO readings ≥ 6 ppm, $p < .001$;

† $n = 168$ due to missing data.

Table 2.

Correlations between SEQ scores and smoking variables at baseline, within treatment, and at follow-up

	FTND	CL	CPD	# days of smoking within treatment		# cigarettes/day at follow-up	
	Baseline n = 184			CV n = 97	NV n = 87	CV n = 86	NV n = 82
SEQ Positive Total	.30 **	-.01	.11	.29 **	.09	.21 *	.14
Reduce Negative Affect	.28 **	-.02	.17 *	.27 **	-.01	.11	.11
Stimulation	.30 **	-.06	.15 *	.20 *	-.09	.19 *	.15
Social	.23 **	-.03	.10	.17 *	.14	.18 *	.07
Weight Control	.12	.06	-.04	.24 **	.16	.12	.07
SEQ Negative Total	.02	.31 **	.02	.13	.10	-.04	.03
Physical	.02	.30 **	-.02	.02	.02	-.10	.06
Psychosocial	.04	.21 **	.01	.17 *	.08	.02	.03
Future Health Concerns	-.02	.24 **	.05	.11	.13	-.02	-.01

Note: SEQ = Smoking Effects Questionnaire; CV = contingent voucher condition; NV = non-contingent voucher condition; FTND = Fagerström Test for Nicotine Dependence; CL = Contemplation Ladder; CPD = Cigarettes/Day;

**
 $p < .01$ (one-tailed),

*
 $p < .05$ (one-tailed).

Table 3.

Smoking within treatment and at follow-up as predicted by positive smoking expectancies, condition, and interactions including smoking covariates

Predictor	<i>b</i>	<i>SE b</i>	<i>t</i>	<i>p</i>
<u># days of smoking within treatment</u>				
SEQ Positive Factor (SEQ Pos)	1.27	0.51	2.47	0.01
Voucher Condition (VC)	2.63	0.54	4.87	<0.01
SEQ Pos X VC Interaction	-2.41	0.98	-2.45	0.02
CPD	-0.02	0.36	-0.46	0.64
FTND	0.29	0.15	1.92	0.06
<u># of cigarettes/day at 1 month follow-up</u>				
SEQ Positive Factor (SEQ Pos)	1.37	0.92	1.49	0.14
Voucher Condition (VC)	1.12	0.98	1.15	0.25
SEQ Pos X VC Interaction	-1.91	1.78	-1.07	0.29
CPD	0.07	0.06	1.13	0.26
FTND	0.60	0.27	2.22	0.03

Note: SEQ = Smoking Effects Questionnaire; CPD = Baseline Cigarettes/Day; FTND = Baseline Fagerström Test for Nicotine Dependence.