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Smoking Cessation Among Persons With Co-Occurring Substance Use Disorder and Mental Illness

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Aims: A history of either a substance use disorder (SUD) or psychiatric disorder (PD) is associated with tobacco use. However, there is limited information available on tobacco dependence treatment outcomes among individuals with co-occurring SUD and PD. Methods: Data from 202 participants enrolled in a tobacco dependence treatment program in an outpatient clinic setting were analysed. Findings: In multivariate analysis, having a history of SUD only (OR = .11, 95% CI = .02-.76) and having a co-occurring SUD and PD (OR = .13, 95% CI = .02-.81), as compared to having neither, were significant predictors of a lower likelihood of achieving smoking abstinence. Conclusions: A history of SUD and PD is an important predictor of poor smoking cessation outcomes; however, using more intensive, tailored approaches to tobacco dependence treatment appears to be promising. Future studies may need to further address the nature of tobacco dependence treatment in settings were PDs and other SUDs are managed in order to achieve optimal outcomes.

Keywords: smoking cessation, psychiatric disorder, substance use disorder, co-occurring disorders, mental illness, addictions settings

The treatment of tobacco use among individuals with a history of substance use disorders (SUD) and psychiatric disorders (PD) is an area of growing interest (Kalman, Morissette, & George, 2005). Based on available estimates, alcohol, tobacco and illicit drug use contribute to 3.1%, 16.5% and 0.4%, respectively, of total mortality in Canada (Single, Rehm, Robson, & Van Truong, 2000). Based on recent 12-month estimates, 9.5% of Canadians reported problematic alcohol use or dependence, 3.0% reported problematic illicit drug use or dependence, 11% reported co-occurring problematic alcohol and drug use or dependence, 8.6% reported mood or anxiety disorders and 10.1% reported having both a SUD and PD (Rush et al., 2008). Among the general US population, estimates of tobacco use in those with co-occurring SUD or PD range from about 40% for all major PD to greater than 75% for co-occurring SUDs (George & Vessicchio, 2001; Khara & Okoli, 2009; Lasser et al., 2000). In a review of the comorbidity of smoking among individuals with psychiatric and substance use disorders, Kalman et al. (2005) presented estimated prevalence rates of smoking in clinical samples of up to 70% among individuals with schizophrenia, 60% among individuals with bipolar disorder, greater than 55% among individuals with major depressive disorder, 40% for individuals with panic disorder, 10% for individuals with obsessive-compulsive disorder, greater than 55% for individuals with posttraumatic stress disorder and greater than 80% for individuals with a history of alcohol, cocaine and opioid abuse, respectively. These high rates of tobacco use among individuals with SUD and PD suggest an increased risk for tobacco-related mortality and morbidity in these populations.

Several studies have found common biological (Barrett, Tichauer, Leyton, & Pihl, 2006; Bierut et al., 1998; Fowler et al., 1996; Koenen et al., 2005; True et al., 1999) and psychosocial (Clark, Kirisci, & Moss, 1998; Okoli, C.T.C., & Khara, M. (2011). Smoking cessation among persons with co-occurring substance use disorder and mental illness. Journal of Smoking Cessation, 6(1), 58-64. DOI 10.1375/jsc.6.1.58
SUDs have examined tobacco use among individuals with SUDs and PDs. Although the comorbidity of tobacco use with single SUDs (for example, smoking and alcohol use [Bien & Burge, 1996]) or PDs (for example smoking and schizophrenia [de Leon & Diaz, 2005]) or smoking and depression (Dierker, Avenevoli, Stolar, & Merikangas, 2002) has been the focus of extensive research, few studies have examined tobacco use among individuals with co-occurring SUDs and PDs. Due to the common factors underlying SUD, PD and tobacco use, tobacco dependence treatment approaches have been targeted towards different populations based on either their SUD or PD status. For example Prochaska et al., (2004) conducted a meta-analysis of 19 studies that addressed smoking cessation interventions among individuals in addictions treatment and recovery. Although there were significant end-of-treatment smoking cessation outcomes among individuals in both addictions treatment and recovery, only one study in the review identified co-morbid depression among participants (Prochaska et al., 2004). In fact, few studies assess the effects of co-occurring SUD and PD on tobacco cessation outcomes. Among individuals with alcohol abuse disorders, Grant et al., (2007) found no significant difference in smoking abstinence after quitting between those with and without an affective disorder (i.e., current, recurrent or remitting major depressive disorder, dysthymia, current or past manic episode, current or past hypomaniac episode, mood disorder with psychotic features) or anti-social personality disorder. An understanding of how co-occurring SUD and PD affects tobacco dependence treatment outcomes can provide valuable information for the delivery of integrated tobacco dependence treatment in substance use and mental health treatment settings (Kalman et al., 2005).

Given the lack of studies addressing the effect of co-occurring SUD and PD on smoking cessation outcomes, the purpose of this study was to assess the effects of a history of co-occurring SUD and PD on tobacco dependence treatment outcomes by:

- examining the smoking cessation outcomes of participants in an outpatient addiction treatment service by their co-occurring histories of SUD and PD status, and
- determining the extent to which a history of co-occurring SUD and PD is associated with smoking cessation when accounting for sociodemographics, smoking history, smoking cessation pharmacotherapy.

**Material and Methods**

**Setting and Participants**

The sample for this study was obtained from the Tobacco Dependence Clinic (TDC), a program provided through Addictions Services of the Vancouver Coastal Health Authority (VCH) in Vancouver, BC, Canada. Participants were referred to the TDC program either by their addictions case managers or by self-referral. Inclusion criteria for acceptance into the clinic were: (1) have a history of a substance use disorder and/or a mental illness, (2) 19 years or older, (3) tobacco dependent, (4) financially disadvantaged. The TDC treatment program consists of up to 26 weeks of smoking cessation treatment (i.e., 8 weeks of a syllabus-focused group followed by up to a further 18 weeks of a less structured 'after care' support group) supplemented by no-cost, individualised, smoking cessation pharmacotherapy, also for a period of up to 26 weeks, for adults already accessing outpatient drug treatment services. All clients are offered one (or more) of the six first-line medications (available in Canada) for the treatment of tobacco dependence (including nicotine replacement products, bupropion, and varenicline). These medications may be tailored to participants' individual needs and therefore used in an "off-label" manner in terms of dose, duration of treatment and simultaneous use of multiple products. A detailed description of the program has been reported elsewhere (O'koli & Khara, 2011). Data for this secondary analysis were obtained from the chart reviews of 202 participants enrolled in the TDC between September 2007 and March 2009. Ethics approval for this study was obtained from both the Vancouver Coastal Health Research Institute and the University of British Columbia Clinical Review Ethics Board.

**Measures**

Data obtained from participants' charts included sociodemographics (gender, age), tobacco use history (number of cigarettes smoked per day, age at smoking initiation), social supports for quitting (none, one, two, three or more), number of evidence-based modalities (i.e., nicotine replacement therapy, oral medications, or behavioural counselling) used to quit smoking in the past (none, one, two or more), Fagerstrom Test for Nicotine Dependence (FTND) scores (Heatherton, Kozlowski, Frecker, & Fagerstrom, 1991), importance and confidence in quitting smoking, on a scale of 1 to 10 (Burke, Ebbert, & Hays, 2008; Kahler et al., 2007), expired carbon monoxide (CO) level (Middleton & Morice, 2000), substance use history and psychiatric disorder history (none, mood disorder [major depressive disorder, bipolar disorder], anxiety disorder [anxiety disorder, post-traumatic stress disorder, panic disorder, social anxiety disorder], and psychotic disorder [schizophrenia, schizoaffective disorder, paranoid psychosis]). Furthermore, a record was kept of the total number of visits of each participant to the program, the amount of nicotine replacement therapy (NRT) participants received each week and the type of pharmacotherapy participants received (i.e., NRT only [nicotine patch, lozenge, inhaler or gum], oral medications only [i.e.,
We employed a two-step model-building procedure to determine variables to include in a logistic model predicting smoking cessation. In the first step, univariate logistic regression analyses were used to determine the unadjusted association between smoking cessation and all study variables. In the second step, only variables that were associated with smoking cessation (alpha < .05) were included in the final multivariate model. All analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 11.0.

**Results**

**Sample Characteristics**

The participants were mostly male (60.2%) with a mean age of 48.3 (SD = 11.1) years and the majority of participants had a co-occurring SUD and PD history (59.4%). The most prevalent co-occurring disorders were having a history of alcohol and mood disorder (19.3%) and a history of cocaine and mood disorder (10.9%). A description of co-occurring histories of SUD and PD is given in Table 1. On average, individuals with a SUD only and a co-occurring SUD and PD history were younger than individuals without any SUD or PD history; and individuals with a co-occurring SUD and PD history received a significantly greater amount of NRT during their participation in the TDC as compared to individuals without any SUD or PD history (see Table 2). Furthermore, there was a significant difference in smoking cessation by SUD and PD history (see Figure 1), with a greater proportion of individuals with neither a SUD or PD achieving abstinence compared to those with either a SUD only or a PD only, and those with a co-occurring SUD and PD history (none = 60% vs. SUD only = 26.7% vs. PD only = 58.3% vs. both SUD and PD only = 30.8%, p = .043).

**Co-occurring Substance Use, Mental Illness and Smoking Cessation**

In the intent-to-treat analysis (n = 202) including individuals who completed the program and those who did not (i.e., noncompleters were counted as treatment fail-

| Table 1 |
|---|
| Co-occurring Histories of Substance Use Disorder (SUD) and Psychiatric Disorder (PD) (N = 202) |

| SUD history | PD history |
|---|---|
| None | Mood | Anxiety | Psychosis | Total |
| None | 10 (5.0) | 7 (3.5) | 1 (0.5) | 4 (2.0) | 22 (10.9) |
| Alcohol | 16 (7.9) | 39 (19.3) | 10 (5.0) | 1 (0.5) | 66 (32.7) |
| Heroin and other opiates | 12 (5.9) | 7 (3.5) | 5 (2.5) | 3 (1.5) | 25 (12.4) |
| Cocaine | 24 (11.9) | 22 (10.9) | 8 (4.0) | 3 (1.5) | 55 (27.2) |
| Marijuana | 5 (2.5) | 11 (5.4) | 3 (1.5) | 2 (1.0) | 22 (10.9) |
| Methamphetamine | 3 (1.5) | 5 (2.5) | 2 (1.0) | 1 (0.5) | 12 (5.9) |
| Total | 70 (34.7) | 91 (45.0) | 29 (14.4) | 12 (5.9) | 202 (100) |

Note: * The 'None' group includes 10 individuals with tobacco addiction but no history of a substance use disorder or a mental illness.
ures), we employed a two-step model-building approach to determine predictors of smoking cessation. In the first step, among all study variables only SUD and/or PD history, initial CO at baseline, and the total number of visits to the TDC were significantly associated with smoking cessation (data not shown). In the second step (i.e., including all variables associated with smoking cessation in the first step), as compared to having neither a SUD or PD history, having a history of an SUD only was predictive of 14 times the likelihood (Odds ratio = .11; 95% CI = .02-.76) of failing to achieve cessation, and having a co-occurring history of a SUD and PD was predictive of 11 times the likelihood (Odds ratio = .13; 95% CI = .02-.81) of failing to achieve cessation. Similar results were found among program completers (see Table 3).

**Discussion**

The aim of this study was to assess smoking cessation outcomes for individuals in addiction treatment settings, specifically addressing their co-occurring SUD and PD status. Several studies have identified the comorbidity of SUD and PD (Kalman et al., 2005; RachBeisel, Scott, & Dixon, 1999) and found a high degree of co-occurrence. Our findings suggest that a history of co-occurring SUD and PD is a negative predictor of successful smoking cessation among individuals accessing tobacco treatment in an addiction services setting.

In our current study, individuals with a history of SUD alone and those with a history of both a SUD and PD were less likely to achieve cessation. This finding supports other studies that demonstrate worse smoking cessation outcomes for individuals with either a SUD or co-occurring SUD and PD. For example, Zimmerman et al. (1990) found that individuals with a history of alcohol use were less likely to achieve smoking cessation when compared to those without. Hays et al. (1999) also found that smokers with past or current history of alcohol problems were less likely to achieve abstinence at

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**Table 2**

Sample Characteristics by Substance Use Disorder (SUD), Psychiatric Disorder (PD) and Co-Occurring Disorders History (N = 202)

|                              | Total (n = 202) | None (n = 10) | SUD only (n = 60) | PD only (n = 12) | Co-occurring (n = 120) | Difference*  |
|------------------------------|----------------|---------------|------------------|-----------------|------------------------|--------------|
|                              | n %            | n %           | n %              | n %             | n %                    | p            |
| Gender (n = 201)             |                |               |                  |                 |                        | .204         |
| Female                       | 80 39.8        | 4 40          | 18 30            | 7 56.3          | 51 42.9                | .152         |
| Male                         | 121 60.2               | 6 60          | 42 70            | 5 41.7          | 68 57.1                | .068         |
| Evidence-based modalities    |                |               |                  |                 |                        | .058         |
| used                         |                |               |                  |                 |                        |             |
| to quit in the past (i.e.,  |                |               |                  |                 |                        |             |
| NRT, oral                    |                |               |                  |                 |                        |             |
| medications, counselling)   |                |               |                  |                 |                        |             |
| None                         | 88 43.6        | 3 60          | 27 45            | 3 25            | 52 43.3                |             |
| One                          | 84 41.6        | 3 60          | 24 40            | 3 33.3          | 52 43.3                |             |
| Two                          | 50 24.8        | 3 30          | 16 25            | 5 21.7          | 16 13.3                |             |
| Social support for           |                |               |                  |                 |                        | .29          |
| quitting (i.e., family,      |                |               |                  |                 |                        |             |
| friends)                     |                |               |                  |                 |                        |             |
| None                         | 32 15.8        | 4 30          | 12 30            | 4 25            | 7 11.7                 | .012         |
| One                          | 63 31.2        | 6 30          | 11 18.3          | 6 27.2          | 21 17.5                |             |
| Two                          | 63 31.2        | 6 30          | 11 18.3          | 6 27.2          | 21 17.5                |             |
| Three or more                | 44 21.8        | 6 30          | 11 18.3          | 6 27.2          | 21 17.5                |             |
| Pharmacotherapy              |                |               |                  |                 |                        | .29          |
| NRT only                     | 164 81.6       | 6 60          | 52 88.1          | 3 56.3          | 59 82.5                | .29          |
| NRT and oral medications    | 35 17.4        | 2 20          | 6 10.2           | 4 13.3          | 13 21.7                |             |
| Oral medications only        | 12 6           | 2 20          | 1 1.7            | 2 3.3           | 3 4.2                  |             |
| Age of participant in years  | 48.3 11.1      | 59.6 10.6     | 45.6 10.8        | 55.3 9.7        | 48 10.7                | < .0001      |
| (n = 200)                    |                |               |                  |                 |                        |             |
| Age at smoking initiation    | 14.2 4.1       | 14.9 3.3      | 13.9 3.9         | 16.3 4.9        | 14.1 4.1               |             |
| (n = 200)                    |                |               |                  |                 |                        |             |
| Importance of quitting       | 9 1.3          | 9.4 1.8       | 9.4 1.4          | 9.4 1.3         | 9.1 1.3                | .542         |
| (scale of 1 [low] to 10 [high]) (n = 191) | | | | | |
| Confidence in quitting       | 7.3 2.3        | 7.1 2.8       | 7.2 2.7          | 6.4 2.7         | 7.3 2.4                | .357         |
| (scale of 1 [low] to 10 [high]) (n = 188) | | | | | |
| Cigarettes smoked per day    | 21.6 10.3      | 22.8 11.9     | 21.7 11.9        | 24.8 10.5       | 21.1 9.4               | .681         |
| (n = 201)                    |                |               |                  |                 |                        |             |
| Fagerstrom Test (FTND)       | 6.4 1.8        | 6 2           | 6 2.5            | 6 2.6           | 6.6 1.6                | .29          |
| level at baseline            | 22.8 12.8      | 25.7 10.8     | 22.3 13.9        | 23.2 8.9        | 22.8 12.9              | .927         |
| (n = 190)                    |                |               |                  |                 |                        |             |
| Total number of visits to the TDC | 11.4 7.1  | 11.1 6.5  | 10.7 7         | 11.8 5.8        | 11.8 7.4               | .79          |
| NRT dose per visit           | 157.9 90.8     | 84.6 70.7     | 147.6 77         | 156.2 92.7      | 169.3 95.8             | .026         |

**Note:** FTND = Fagerstrom Test for Nicotine Dependence

* Differences are calculated using chi-square analyses for categorical and entered categorical values, and using Analysis of Variance (ANOVA) tests. For all ANOVA tests, Levene's test for equality of variance was applied and differences between groups were calculated post hoc using Bonferroni tests.
Table 3
Multivariate Associations for Smoking Cessation Within 26 Weeks

| Substance use and/or mental health history | Program completers (n = 143) | Intent-to-treat (n = 190) |
|-------------------------------------------|-----------------------------|--------------------------|
|                                          | Odds ratio 95% CI           | Odds Ratio 95% CI        |
| None (reference)                          |                             |                          |
| Substance use disorder only               | .07* .01-.86                | .11* .02-.76            |
| Mental illness only                       | .36 .03-.523                | .64 .08-.549            |
| Co-occurring                              | .09* .01-.94                | .13* .02-.81            |
| CO level at baseline                      | .96* .93-1.00               | .96* .93-1.00           |
| Total number of visits to the TDC         | 1.17*** 1.10-1.25           | 1.22*** 1.15-1.30       |

Note: a. Only variables which significantly predicted smoking cessation at > .05 in the univariate analyses were included in the multivariate analysis

*p < .05, ***p < .001

the end of 4 or 6 weeks of nicotine patch treatment. However, Kodl et al. (2008) found that though depressive symptoms were a significant negative prospective predictor of alcohol cessation, it was not a predictor of successful smoking cessation among individuals in alcohol use treatment. In our current study, having a history of SUD alone and a history of both SUD and PD was negatively predictive of smoking cessation; yet a history of a PD alone was not. It may be that having a history of a SUD compared to a history of PD is a more salient issue in achieving smoking cessation. Based on the self-medication hypothesis, substance use may be a means to cope with PD (Khantzian, 1997).

Moreover, we found that lower levels of expired CO at baseline and a longer duration of attendance (i.e., greater number of total visits) in the program were significant predictors of end-of-treatment smoking cessation. This finding is similar to that of a recent tailored smoking cessation intervention among individuals with schizophrenia in an outpatient treatment program (Selby, Voci, Zawertaiko, George, & Brands, 2010). These findings suggest individuals with SUD and/or PD may benefit from smoking cessation interventions with greater intensity (in terms of duration and combinations of pharmacotherapy and behavioural counselling) in outpatient treatment settings.

A few important limitations need to be considered in interpreting the findings of this study. First, other important sociodemographic variables such as ethnicity/culture, education level and income level may have contributed to the smoking cessation outcomes. However, this information was not consistently obtained among participants and so could not be included in the analyses. Yet, one inclusion criteria for the TDC program is that all individuals be financially disadvantaged,
placing most participants, more or less, within the same income level.

Second, since the data for our current study was obtained from patient records, the diagnosis of PD was based on patient self-report with a review of pharmacotherapy for psychiatric conditions. Substance use is often associated with mental health symptoms that may lead to an inappropriate diagnosis of PD (Brown, Suppes, Adinoff, & Rajan Thomas, 2001; Smith & Hucker, 1994). It is therefore possible that the history of PD recorded in the patient chart (particularly the diagnosis of mood and anxiety disorders) may have been related to their substance use. Moreover, the participants’ data contained information on the history of a SUD and/or PD but not on current substance use or PD. Studies have suggested better smoking cessation outcomes among individuals in addiction recovery when compared to those with current substance use (Prochaska et al., 2004). Therefore, the use of established criteria for PD diagnosis (i.e., DSM-IV) with information on current substance use may be employed in future studies.

Third, although the sample size was sufficiently large for analysis to examine main effects, it was insufficient for stratified analysis by individual effects of SUD and PD. As a result, we could not determine which SUDs and PDs, separately or combined (i.e., alcohol plus anxiety or cocaine plus psychosis) were predictive of smoking cessation. Nonetheless, grouping the data by general histories of SUD and PD yielded some valuable information. However, there may be discrete differences in the ways in which individuals with different PD diagnoses use and understand their tobacco use. For example, in a qualitative examination of smoking and smoking cessation among individuals with psychiatric disorders living in the community, Lawn, Pols, and Barber (2002) found distinct differences in smoking behaviour and perceptions of tobacco use among four diagnostic categories (i.e., individuals with schizophrenia, bipolar affective disorder, depression, and personality disorder). Their qualitative analysis of smoking behaviour yielded distinctions between the four diagnostic groups in the process of smoking, the psychological or physical nature of nicotine dependence, attitudes towards the process of smoking cessation and the meaning of smoking in relation to their psychiatric disorder (Lawn et al., 2002). Future studies with adequate sample sizes are warranted to further explore smoking cessation by individual SUD and PD diagnosis groups.

Fourth, the use of self-report measures verified by CO is commonly applied in pragmatic trials of smoking cessation interventions. Studies (Jarvis, Tunstall-Pedoe, Feyerabend, Vesey, & Salojece, 1987) have shown that an expired CO level of 8 ppm yields a sensitivity of 90% and a specificity of 89% in confirming abstinence. However, because CO monitoring can be influenced by several factors that affect its specificity to smoking (Steenland & Savitz, 1997) other markers of tobacco use, notably cotinine, may be more suitable as a measure of smoking abstinence (Cummings & Richard, 1988) in future studies.

Fifth, given the somewhat transient nature of the population, we could not obtain any follow-up data beyond end-of-treatment. Thus, it is not possible to know the sustained intervention effect with this existing data. However, as the TDC program is longer than most existing tobacco dependence treatment programs, the smoking cessation progress of participants can be tracked over a 26-week period. There was a trend towards greater smoking cessation with longer stay in the program.

In conclusion, this study offers some important considerations into the factors that are associated with smoking cessation among individuals in an addictions treatment setting. Our main findings are that a history of co-occurring SUD and PD is a salient factor for poor smoking cessation outcomes and that an intensive and tailored approach may offer promising results. Given these findings, it may be important for future programs to consider a similar approach to treating tobacco dependence in settings that manage SUDs and PD (Kalman et al., 2005). Furthermore, future studies with larger sample sizes will be required to assess the interactions between different SUDs with PDs (e.g., alcohol use X mood disorder, marijuana X psychotic disorders, etc.) in relation to tobacco use treatment and cessation outcomes. Such studies may be important in enhancing tailored approaches to tobacco dependence treatment and directing smoking cessation practice and policy in addictions and mental health settings.

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