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A reduction in cigarette smoking improves health-related quality of life and does not worsen psychiatric symptoms in individuals with serious mental illness

Daniel J. Brady[a], **Peter L. Phalen**[b], **Daniel J.O. Roche**[a], **Tovah Cowan**[b], **Melanie E. Bennett**[b,*]

[a]Maryland Psychiatric Research Center, Department of Psychiatry, University of Maryland School of Medicine, 55 Wade Ave, Catonsville, MD 21228, United States

[b]Division of Psychiatric Services Research, Department of Psychiatry, University of Maryland School of Medicine, 737 West Lombard Street, Baltimore, MD 21201, United States

Abstract

Introduction: Individuals with serious mental illness (SMI) smoke cigarettes at a much higher rate than the general population, increasing their risk for medical illnesses and mortality. However, individuals with SMI do not get enough support to quit smoking, partially because of concerns from medical providers that reducing smoking may worsen their symptoms or quality of life.

Methods: Veterans with SMI and nicotine dependence (n = 178) completed a 12-week smoking cessation trial (parent trial dates: 2010–2014) including assessments of smoking status, psychiatric symptoms (Brief Psychiatric Rating Scale), and quality of life (Lehman Quality of Life Interview–Short Version) at up to four time points: baseline, post-treatment, three-month follow-up, and 9-month follow-up. Bayesian multilevel modeling estimated the impact of changes in the self-reported number of cigarettes per day in the past seven days on psychiatric symptoms and quality of life.

Results: Between subjects, each additional pack of cigarettes smoked per day was associated with a 0.83 point higher score (95%CI: 0.03 to 1.7) on a negative symptoms scale ranging from 0 to 35. Within subjects, each one-pack reduction in the number of cigarettes smoked per day was associated with an improvement of 0.32 (95%CI = 0.12 to 0.54) on the health-related quality of life scale, which ranges from 0 to 7 points. There were no other significant between- or within-subjects effects of smoking on psychiatric symptoms or quality of life.

Conclusions: Individuals with SMI and their providers should pursue smoking cessation without fear of worsening psychiatric symptoms or quality of life.

*Corresponding author at: 737 W. Lombard Street, Baltimore, MD 21201, United States. mbennett@som.umaryland.edu (M.E. Bennett).

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

CRediT authorship contribution statement

Daniel J. Brady: Writing – review & editing, Supervision, Conceptualization. **Peter L. Phalen:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis. **Daniel J.O. Roche:** Writing – review & editing, Supervision, Conceptualization. **Tovah Cowan:** Writing – review & editing. **Melanie E. Bennett:** Writing – review & editing, Supervision, Project administration, Investigation, Funding acquisition.

Keywords

Serious mental illness; Schizophrenia; Smoking; Self-medication hypothesis; Psychiatric symptoms; Quality of life

1. Introduction

1.1. High smoking rate in individuals with SMI[1]

Approximately 60% of people with schizophrenia currently smoke (de Leon & Diaz, 2005; Dickerson et al., 2018) compared to 15.5% of the general population (Jamal et al., 2018). Similarly, individuals with bipolar disorder are 3.5–5 times more likely to smoke than the general population (Diaz et al., 2009; Jackson et al., 2015). Additionally, in any given year, people with schizophrenia are at a 3.5 times greater risk of death than the general population (Olfson et al., 2015). This increased mortality risk is largely due to the deleterious effects of smoking, a modifiable risk factor for improved health. Despite the serious health risks that smoking poses, medical professionals often fail to provide adequate smoking cessation support to people with SMIs like schizophrenia (Duffy et al., 2012; Szatkowski & McNeill, 2013). This failure may be partly due to beliefs that patients with serious mental illnesses are not interested in treatment (Brown et al., 2015) and that smoking is an important coping mechanism for their condition (Ratschen et al., 2009). This lack of support from providers serves as an obstacle for individuals with SMI who want to quit smoking.

1.2. The self-medication hypothesis

The self-medication hypothesis posits that smoking positively impacts the experience and functioning of people with SMI, based on findings in some studies that smoking is associated with reduced psychiatric symptoms and improved cognition (Caldirola et al., 2013; Kumari & Postma, 2005; Zabala et al., 2008). Much research has shown no differences in psychiatric symptoms between smokers and non-smokers with SMI (Barnes et al., 2006). Evidence from epidemiological studies (Vermeulen et al., 2019), medication trials (Evins et al., 2019; George et al., 2008), and behavioral trials (Gilbody et al., 2019) finds that reductions in smoking do not worsen psychiatric health or quality of life (QoL) and even improve psychiatric symptoms and suicide risk (Sankaranarayanan et al., 2016; Taylor et al., 2014). Despite these findings, the self-medication hypothesis persists; it has even been used by the tobacco industry to support the idea that individuals with mental illness need nicotine in the form of cigarette smoking (Prochaska et al., 2008) and has led to a widely held belief that smoking reduction increases the risk for exacerbating psychiatric symptoms (Manzella et al., 2015). Further research on the association between smoking reduction and well-being in individuals with SMI may help persuade patients and providers who are still hesitant to pursue effective smoking cessation interventions.

[1]Abbreviations: SMI = serious mental illness, QoL = quality of life, HRQoL = health-related quality of life.

1.3. Present study

We previously reported the results of a 12-week trial comparing two psychosocial group interventions in people with SMI (Bennett et al., 2015). While few participants (11.8%) achieved abstinence after the 12-week intervention, the average number of cigarettes per day was reduced by almost 50%, and nicotine dependence levels decreased over time. This study presents a secondary analysis of the parent smoking cessation trial that tests the extension of the self-medication hypothesis by examining whether reduced cigarette use is associated with worsening psychiatric symptoms and/or QoL. Consistent with recent research (Evins et al., 2019; George et al., 2008; Gilbody et al., 2019; Vermeulen et al., 2019), we expect no relationship between cigarette reduction and psychiatric symptoms or QoL. Findings from this study have direct implications for the management of medical and psychiatric care of individuals with SMI.

2. Methods

This study was approved by the Institutional Review Boards at the University of Maryland, School of Medicine; the Washington DC Veterans Affairs Medical Center; and the VA Maryland Healthcare System Research and Development Committee.

2.1. Participants

Methods of the parent trial are fully described in Bennett et al. (2015). Veterans 18–75 years old with nicotine dependence (i.e., smoking ≥ 10 cigarettes/day or a Fagerstrom Test of Nicotine Dependence score ≥ 5 (Heatherton, Kozlowski, Frecker, & Fagerstrom, 1991) were recruited from outpatient mental health treatment programs at the Veterans Administration Medical Centers in Baltimore, MD; Perry Point, MD; and Washington, DC. Participants had a DSM-IV diagnosis, identified through medical records, of schizophrenia spectrum disorders, bipolar disorder, other psychotic disorders, major depression with psychotic features, or posttraumatic stress disorder with functional impairment (received disability payments for PTSD or were employed < 25% of the past year). Exclusion criteria included current problematic alcohol/substance use as measured by the Michigan Alcohol Screening Test (Selzer, 1971) and the Drug Abuse Screening Test (Skinner et al., 1982), history of serious neurological disorder or head trauma, and severe/profound intellectual disability. Participants continued all mental health treatments, including psychoactive medications. A total of 412 individuals were screened for preliminary eligibility via medical record review; 178 signed informed consent and completed baseline assessments, 136 completed post-treatment assessments, 133 completed 3-month follow-up assessments, and 125 completed 9-month follow-up assessments. See Table 1 for descriptive statistics.

2.2. Intervention

In the parent study, participants were randomized to either a behavioral group intervention focused on skills building and strategies for coping with stress without smoking (i.e., treatment condition) or a supportive group intervention focused on discussing shared experiences with smoking and quitting (control condition). Both interventions offered 12 weeks of biweekly group meetings.

2.3. Measures

Demographic information was collected via self-report at baseline. Participants completed the three measures described below at up to four time points: baseline, post-treatment (12 weeks), 3-month follow-up, and 9-month follow-up. A smoking history form recorded the number of cigarettes smoked on a typical day in the last seven days. The Brief Psychiatric Rating Scale (BPRS; Overall & Gorham, 1962; Overall et al., 1967) assessed psychiatric symptoms with 18 items, each rated on a scale from 1 to 7. The BPRS has four validated subscales which were analyzed in this study: Affect (i.e., Anxiety, Depressive Mood, Guilt Feelings, Somatic Concern, and Tension) is measured on a 5–35 scale, Positive Symptoms (i.e., Conceptual Disorganization, Grandiosity, Hallucinatory Behavior, and Unusual Thought Content) are measured on a 4–28 scale, Negative Symptoms (i.e., Emotional Withdrawal, Mannerisms and Posturing, Motor Retardation, Blunted Affect, and Disorientation) are measured on a 5–35 scale, and Resistance (i.e., Hostility, Suspiciousness, Uncooperativeness, and Excitement; Shafer, 2005) is measured on a 4–28 scale. This analysis used two items from the Lehman Quality of Life Interview–Self-administered Short Form (TL-30S; Lehman et al., 1996). QoL was assessed via the question “How do you feel about your life in general?” to which participants responded on a 1 (‘Terrible’) to 7 (‘Delighted’) Likert scale. Health-related QoL (HRQoL) was assessed via the question “Overall, how would you rate your health?” to which participants responded on a 1 (‘Poor’) to 5 (‘Excellent’) Likert scale. While this scale asks about QoL across a range of domains, we used in our analysis the two items (overall and health) that were relevant to our focus on tobacco cessation; we did not include items in domains that had a less direct relationship to tobacco (e.g., financial, family, and safety).

2.4. Analysis

For the primary outcomes, we used Bayesian multilevel modeling to estimate between-subjects and within-subjects changes in overall QoL, HRQoL, and psychiatric symptoms associated with changes in the number of packs of cigarettes smoked per day in the past week. Time points were nested within participants to account for the repeated measures design. For ease of interpretation, we calculated packs of cigarettes per day by dividing the self-reported number of cigarettes by 20. For each model, the number of packs of cigarettes per day was entered as both a between subject predictor and a within-subject predictor. Multilevel modeling was also used to capture the effect of smoking on the BPRS subscales validated by Shafer (2005): Affect, Positive Symptoms, Negative Symptoms, and Resistance. Adjustments for multiple comparisons were made, viz., by embedding BPRS scores within the four BPRS subscales in a single multilevel model (Gelman et al., 2012). In order to assess whether the primary analyses described above were moderated by intervention condition (treatment vs. control), we performed a sensitivity analysis by refitting the above models with interaction effects between cigarette smoking and intervention condition (both within and between-subjects) for all outcome variables.

3. Results

3.1. QoL

The model estimates suggested no statistically significant between- or within-subjects effects of smoking on QoL. While there was no between-subjects effect on HRQoL, each one-pack reduction in the number of cigarettes smoked per day was associated with an improvement of 0.32 (95%CI = 0.11 to 0.53) in HRQoL within subjects. The results of the multilevel models for (HR)QoL and psychiatric symptoms are presented in Table 2.

3.2. Psychiatric symptoms

For psychiatric symptoms, each additional pack of cigarettes per day across time points was associated with a 0.83 point higher score (95%CI: 0.03 to 1.7) on the BPRS negative symptoms subscale between subjects.[2] The within-subject effect of cigarettes on negative symptoms was not statistically significant. There were no statistically significant between- or within-subjects effects of cigarette smoking on any other BPRS subscale or the BPRS total score.

3.3. Sensitivity analysis

There were no significant interactions between intervention condition and cigarettes smoked for any of the BPRS subscales or for HRQoL. The only significant interaction indicated that within-subjects reductions in cigarettes smoked had a slightly more positive impact on overall QoL for participants in the control vs. treatment condition (95% CI: −0.06 - −0.003).

4. Discussion

4.1. Implications

This secondary analysis of data from a smoking cessation trial did not find support for one of the core tenets of the self-medication hypothesis, i.e., that psychiatric symptoms and/or QoL will worsen when individuals with SMI reduce or quit smoking (Manzella et al., 2015). These results corroborate prior findings (Evins et al., 2019; George et al., 2008; Gilbody et al., 2019; Sankaranarayanan et al., 2016; Vermeulen et al., 2019) and suggest that providers should not let fears about worsening psychiatric symptoms prevent them from providing tobacco treatment to individuals with mental illness. The positive relationship between cigarettes smoked and negative symptoms appearing between subjects, but not within subjects, may suggest that either smoking increases the risk for SMI (King et al., 2020) or a third variable, such as genetics, increases the risk for smoking and SMI (Reginsson et al., 2017). A small improvement in HRQoL suggests that reducing smoking may improve well-being in the short term in addition to its long-term health benefits.

A sensitivity analysis indicated that intervention condition did not moderate associations between smoking and psychiatric symptoms or HRQoL. However, participants receiving the control intervention received *more* overall QoL benefit from reduced smoking than

[2]The effect of packs per day was calculated by multiplying the posterior distribution of the effect of a single cigarette by 20, the number of cigarettes in a standard pack.

participants in the treatment intervention. Thus, our main findings, i.e., reductions in smoking did not worsen psychiatric symptoms and slightly improved HRQoL, were not driven by those receiving the treatment intervention.

4.2. Strengths and limitations

The present study efficiently explores the effects of smoking reductions on well-being in a clinically diverse sample of heavy-smoking individuals with SMI. An additional strength of this study is the tracking of well-being across multiple domains (psychiatric symptoms, QoL, and HRQoL) at multiple time points, collectively showing no worsening of well-being associated with smoking.

Our study has several limitations. While participants in the current study reduced their smoking, only 7.9 % achieved last 7-day abstinence. Even occasional smoking increases mortality risk (Inoue-Choi et al., 2020), so abstinence is an important treatment goal. It is possible that a worsening of symptoms or QoL might only become statistically detectable during abstinence, as even low levels of nicotine can ward off nicotine withdrawal symptoms (Fernando et al., 2006). Additionally, the self-medication hypothesis has several predictions. We tested one, i. e., smokers with SMI who quit/reduce smoking will experience an exacerbation of psychiatric symptoms. While it is possible that other tenets of this model would hold in this sample, the preponderance of evidence does not support most tobacco self-medication predictions (Manzella et al., 2015).

Some aspects of the study design limit our conclusions. First, participants may have begun and finished withdrawal during the 3–6 months between assessments. Thus, participants may have experienced a worsening of psychiatric symptoms or QoL that we did not detect. While short-term, such changes could still dissuade patients or providers from initiating smoking cessation. Second, observing participants for more than one year may have revealed larger effects, particularly for HRQoL, since some health benefits of reduced smoking can take time to appear. Third, because both intervention conditions provided structured social interaction and behavioral support, we cannot rule out that simply participating in the trial, independent of intervention type, may have caused increases in well-being that offset concurrent decreases in well-being associated with smoking reduction. Future studies without an active control will be better equipped to assess the degree to which treatment may reduce the impact of changes in cigarette smoking on QoL and psychiatric symptoms.

Finally, some features of our sample may limit generalizability. SMI, by definition, contains different psychiatric diagnoses, and our outcome measures may not have sufficiently captured meaningful symptoms across all disorders. Additionally, our sample was older (mean age of 54.8 years) and had a greater proportion of Black (70.8%) and male (89.3%) participants than is typical for a smoking cessation trial. This gender ratio is consistent with studies in VA populations (Harrington et al., 2019); due to the low number of female participants, we were unable to perform analyses based on gender.

4.3. Conclusion

In the present study, reductions in smoking were not associated with a worsening of psychiatric symptoms or QoL in individuals with SMI; in fact, participants reported a small

improvement in HRQoL when reducing smoking levels. Behavioral and pharmacological interventions for smoking cessation in individuals with SMI are efficacious (Siskind et al., 2020) and do not exacerbate psychiatric symptoms according to the present study and previous research (Evins et al., 2019; George et al., 2008; Gilbody et al., 2019). Given the heightened mortality risk that smoking poses, individuals with SMI and their medical providers should confidently pursue smoking cessation treatment.

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Data availability

The authors do not have permission to share data.

Data Availability Statement:

The datasets generated for the current study have not been approved for release by the Institutional Review Board, but interested individuals may contact the authors via email of possible collaborations.

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Table 1

Descriptive statistics.

	N	%
Gender		
Male	159	89.3
Female	19	10.7
Diagnosis		
Schizophrenia	50	28
Bipolar Disorder	49	27.5
PTSD	39	21.9
Schizoaffective Disorder	27	15.2
MDD with Psychotic Features	9	5.1
Other Psychotic Disorder	4	2.2
Race		
Black	126	70.8
White	40	22.5
Multiracial	7	3.9
American Indian	4	2.2
Not endorsed	1	0.6
Ethnicity		
Hispanic	2	1.1
Not Hispanic	176	98.9
Employed		
Yes	22	12.4
No	155	87.6
	Mean	SD
Age (at baseline)	54.8	7.2
Highest grade completed	13.0	1.7
Cigarettes per day	15.2	9.8
BPRS Score	34.2	8.2
Quality of life	4.68	1.55
Health-related quality of life	2.86	1.04

Table 2

Multilevel models of between-subjects and within-subjects effects of cigarettes smoked per day on QoL and psychiatric symptoms.

	QoL	HRQoL	BPRS - Affect	BPRS - Positive	BPRS - Negative	BPRS - Resistance
Intercept	4.8 (4.5–5.1)	2.9 (2.7–3.2)	11.3 (10.7–11.9)	5.6 (5.1–6.2)	6.7 (6.2–7.3)	6.8 (5.7–6.8)
Between-subjects Effect	− 0.01 (−0.03–0.01)	0.00 (−0.02–0.01)	0.01 (−0.03–0.05)	0.03 (−0.01–0.07)	0.04 * (0.01–0.09)	0.01 (−0.03–0.06)
Within-subjects Effect	0.00 (−0.01–0.02)	− 0.02 * (−0.03- − 0.01)	0.00 (−0.05–0.04)	0.01 (−0.03–0.06)	0.00 (−0.04–0.04)	0.04 (−0.003–0.1)

Note: All models include a varying intercept for participant ID to account for the repeated measures design. Reported coefficient estimates for each subscale are calculated from the posterior distribution to address the issue of multiple comparisons. 95% credible intervals are reported in parentheses.

* signifies that the 95% credible interval excludes zero.