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Title: Does smoking cause poor mental health? Implications for research and clinical practice.

Authors: Gemma M. J. Taylor, PhD 1; Marcus R. Munafò, PhD 2

Affiliations: 1) Addiction and Mental Health Group, Department of Psychology, 10 West, University of Bath, Bath, BA2 7AY, United Kingdom; 2) MRC Integrative Epidemiology Unit, UK Centre for Tobacco and Alcohol Studies, School of Psychological Science, University of Bristol, 12a Priory Road, Bristol, BS8 1TU, United Kingdom

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Many smokers and health care providers believe that smoking can reduce stress and other symptoms related to poor mental health. In this issue, Vermeulen and colleagues examined this self-medication hypothesis in a prospective cohort study of patients with a non-affective psychosis (n=1,094), unaffected siblings (n=1,047) and controls (n=579) (1). They measured multi-cross-sectional associations and the association between change in smoking status and number of cigarettes per day with positive, negative and depressive symptoms and quality of life at baseline and 3 and 6 year follow-up. Coefficients derived from multiple linear mixed-effects regression analyses indicated that starting to smoke was associated with an *increase* in psychotic and depressive symptoms in patients, compared to those who did not change their smoking status. Patients who quit smoking during the study period did not experience any change in their symptoms or quality of life, and siblings who quit smoking experienced a larger decrease in negative symptoms compared to those who did not change their smoking status. Similar findings were obtained for the changes in number of cigarettes smoked per day. These findings add to a growing body of evidence that smoking may be a causal risk factor for a range of psychiatric conditions, and that stopping smoking can improve mental health (2–4). Various studies using methods that support strong causal inference in observational data indicate that smoking increases risk of depression and schizophrenia (2), and that smoking cessation leads to a reduction in prescription of anti-depressants and anxiolytics (3).

Given this, why do smokers, in particular, continue to believe that smoking can ameliorate psychiatric symptoms? One possibility is that smokers misattribute the relief of tobacco-withdrawal symptoms for genuine symptomatic relief. Indeed, the constant fluctuation in withdrawal-induced psychological symptoms among smokers could even worsen mental health over time (5). Another is that smoking may have direct biological effects that increase the risk of adverse psychiatric outcomes. Tobacco addiction is a psychobiological stressor which damages the nervous system following chronic exposure. Critically, there is evidence some systems that are compromised during chronic tobacco exposure recover after smoking cessation (6). Of course, these two possible explanations are not mutually incompatible and collectively form the misattribution hypothesis (5) which counters the self-medication hypothesis.

Together, this suggests that both preventing smoking initiation and promoting smoking cessation should have beneficial effects on mental health. Indeed, a recent meta-analysis showed that smoking was associated with improved mental health comparable to taking anti-depressants (4). Given evidence of therapeutic nihilism among mental health care professionals (7), communicating this emerging evidence is critically important, not least because a substantial proportion of the premature mortality and morbidity associated with psychiatric illness is attributable to smoking (8), it is also likely that the impact of smoking on mental health, and the benefits of cessation, will differ across individuals depending on other biological and environmental risk factors (9,10). Vermeulen et al controlled for some of these confounding factors by including siblings and healthy controls in their analysis and adjusting for a variety of covariates in their models (i.e., covariates in all groups were age, sex, education in years, and cannabis use; patients with psychosis also had covariates of antipsychotic medication [yes/no] and level of functioning).

To-date these findings have been replicated across a variety of studies, populations and methods and appear to be robust. Vermeulen et al's study, taken together with others in the field, strongly implies that smoking cessation interventions should be part of routine mental health care. Smoking appears to be a risk factor for poor mental health, and quitting can help improve mental health. Therefore, by failing to discourage smoking in mental health settings, and offer adequate smoking cessation support, clinicians are missing a key ingredient in mental health treatment. Mental health care providers should be trained to understand that smoking is a risk factor in developing mental illness, and to deliver smoking cessation support to patients with mental illness as part of their everyday practice. Those delivering or receiving tobacco treatments can be reassured that mental health tends to improve after stopping smoking (4) and can reduce hostility in inpatient settings (11).

Public health campaigns and interventions should highlight smoking as a risk factor for developing poor mental health, and emphasise the likely benefits of stopping smoking. In the UK and Australia public health policies have been implemented that ban smoking on inpatient wards, but there haven't been any wide-reaching campaigns promoting the evidence that smoking is a mental health risk factor, and that stopping can benefit mental health. Future research should focus on identifying the factors that moderate the effects of smoking and smoking cessation on mental health, and on isolating the mechanisms through which smoking affects mental health. This last point is particularly important given the growth in popularity of e-cigarettes in recent years – whether it is nicotine or some other constituent of tobacco smoke that is causal will inform public health policy around the use of e-cigarettes in psychiatric populations.

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