Title: How can we reduce the high prevalence of cigarette smoking among persons with serious mental illnesses?

Authors:

1. Ratika Sharma  
   M.D.S  
   School of Public Health, The University of Queensland  
   Brisbane, Queensland, Australia

2. Coral E Gartner  
   PhD  
   School of Public Health and University of Queensland Centre for Clinical Research  
   The University of Queensland  
   Brisbane, Queensland, Australia

3. Wayne Hall  
   PhD  
   Centre for Youth Substance Abuse Research, University of Queensland, Brisbane, QLD, Australia; National Addiction Centre, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, UK

Corresponding author:  
Wayne Hall  
PhD  
Centre for Youth Substance Abuse Research, University of Queensland, Brisbane, QLD, Australia; National Addiction Centre, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, UK  
email: w.hall@uq.edu.au

Summary
High smoking rates in people with serious mental illness (SMI) contribute significantly to their disproportionately high morbidity and premature mortality. There is an urgent need to help people with SMI quit smoking. This paper critically discusses competing explanations for the high rates of smoking in persons with SMI and the effectiveness of available smoking cessation interventions. It argues for trialing harm reduction options, such as NRT and e-cigarettes as long term substitutes for cigarettes in smokers with SMI who are unable to quit. Smoke free psychiatry units should provide smoking cessation support on admission and after discharge.

Introduction

Serious mental illnesses (SMI) include diagnosable mental, behavioural or emotional disorders which cause serious functional impairment, and substantially interfere with or limit one or more major life activities. The prevalence of cigarette smoking in persons with SMI such as schizophrenia, schizoaffective disorders, bipolar disorder and, major depression, is much higher than in the general population. The association of smoking is strongest and most consistent in persons with schizophrenia who are 3-7 times more likely to smoke compared to general population, Those with bipolar disorder 3-4 times more likely and those with major depression are twice as likely to smoke, as people without these disorders. Tobacco smoking is a major contributor to the high premature mortality and severe morbidity in persons with SMI. Heavy daily smoking in combination with limited access to quality health care and dyslipidaemia produced by some antipsychotic medication increases the risk of cancers and heart disease and reduces life expectancy by 10-15 years compared to people without SMI. SMI is also associated with dependence on alcohol and other substances which further compounds their risk of adverse health outcomes.
What should be done to reduce smoking in persons with serious mental illnesses? The answer depends on answers to the following questions: What factors drive the high prevalence of smoking in this population? How easy or difficult it is for persons with SMI to quit smoking? Are smoke free psychiatric facilities an appropriate policy response? Should we consider tobacco harm reduction (THR), i.e. encouraging heavy smokers with SMI to use non-smoked nicotine products instead of smoking tobacco?

Smoking in SMI: Cause or effect?

A number of theories attempt to explain the high smoking prevalence in people with SMI, especially schizophrenia and major depression. These hypotheses are based on one of the following premises - SMI causes smoking (self-medication hypothesis), smoking causes SMI (causal hypothesis) and both smoking and SMI result from a common aetiology (shared vulnerability hypothesis). A summary of evidence for and against each of these hypotheses are presented in Table 1.

These three hypotheses have different implications for policies to reduce cigarette smoking in persons with SMI. The self-medication and the shared vulnerability hypotheses may be seen as favouring more lenient policies towards cigarette smoking in these persons. This could include THR using alternative non-combustible nicotine products such as pharmaceutical nicotine products, smokeless tobacco and nicotine vapourisers, such as, e-cigarettes. The causal hypothesis on the other hand may be seen as justifying an intensification of efforts to discourage smoking in persons with SMI (e.g. hospital smoking bans) with the aim of encouraging abstinence from all forms of nicotine. Evidence for causality should be weighed individually for different mental illnesses when deciding upon these tobacco control policies.
Smoking cessation in people with mental illness

Smoking uptake is higher and cessation rates are lower in people with SMI than without SMI.\textsuperscript{6,20} Persons with SMI are also often heavily dependent on nicotine\textsuperscript{21} and experience more severe withdrawal symptoms when they stop smoking than people without SMI.\textsuperscript{22} Co-existing alcohol and substance abuse may potentiate the reinforcing effects of nicotine, making quitting even more difficult for those with multiple dependence diagnoses.\textsuperscript{13,23} Despite these barriers, people with SMI report that they are as motivated to stop smoking as people without SMI.\textsuperscript{24} The low cessation rate among people with SMI has been attributed to a combination of a failure to promote smoking cessation in this population and the difficulty that they have in accessing smoking cessation services.\textsuperscript{9,25,26}

Smokers with SMI, like all smokers, can improve their physical and mental health by quitting.\textsuperscript{27} However, many of these smokers, and the mental health professionals who care for them, believe that their mental health will worsen if they quit smoking. For this reason staff may not encourage quit attempts.\textsuperscript{25} This belief is inconsistent with the evidence that smoking cessation reduces depression, anxiety and stress, people with SMI.\textsuperscript{27}

Smoking cessation guidelines for all smokers including those with SMI recommend pharmacotherapy in combination with behavioural interventions.\textsuperscript{28,29} The most effective pharmacotherapies include nicotine replacement therapy (NRT), the atypical anti-depressant bupropion and varenicline, a nicotinic receptor partial agonist.\textsuperscript{30} Behavioural interventions include brief advice, financial incentives for quitting, self-help material and counselling.\textsuperscript{28,29,31}

The effectiveness of these smoking cessation pharmacotherapies has been demonstrated in numerous clinical trials in the general population\textsuperscript{32–34} but it has not been extensively tested in
people with SMI. Concerns about the side effects of varenicline and bupropion have promoted caution in the use of these drugs in this people with SMI. A network meta-analysis of 14 RCTs of smoking cessation pharmacotherapies in smokers with SMI found that bupropion and varenicline were both effective and acceptable (OR= 4.51 and 5.17 respectively). However, the evidence base was rated as of very low in quality. Some studies suggest that NRT may be effective in reducing smoking and maintaining abstinence in the long term in smokers with SMI.

Behavioural support for smoking cessation in people with SMI is effective at long term follow up (RR 1.33, CI 0.96–1.8), so too is pharmacotherapy combined with counselling or motivational interviewing, or alone. Mobile phone based support and internet assisted cessation is effective in general population, but have not been well studied in smokers with SMI. It is unclear which smoking cessation options are best for people with SMI but the limited evidence suggests that those that work for smokers in the general population may also be effective for smokers with SMI with or without co-morbid substance abuse disorders. Abstinence from tobacco may also reduce relapse to substance abuse in people with co-morbid mental illness.

Smoking bans in psychiatric units

Public bans have reduced population smoking prevalence by de-normalising smoking and making it inconvenient to smoke. Similar bans have been adopted in healthcare settings for more than 20 years in the USA and 10 years in Australia but these bans have been slowly and inconsistently implemented in mental health facilities. The high prevalence of heavy smoking among the patients and staff sympathy for patients who have been denied the opportunity to smoke have probably played a role. (Table 2)
Smoking bans in psychiatric inpatient units in Australia have attracted a number of criticisms. One is that bans in secure psychiatric units are “cruel and inhumane” because they deny the “right to smoke” to patients who are involuntarily detained. These critics suggest that these patients should be allowed to smoke in designated smoking areas so as to protect non-smokers while allowing smokers with SMI the right to harm only themselves. Those who defend smoking bans in mental health facilities argue that designated smoking areas convey the message that smoking is acceptable for persons with SMI.

Critics of smoking bans have also blamed them for acts of violence against staff, often on the basis of very weak evidence. These critics place greater weight on rare acts of violence to staff and patients than on the far larger harms that smoking causes to patients.

Smoking bans have also been criticised as paternalistic violations of individual freedom that deprive patients with SMI of “one of their few remaining pleasures”. This claim assumes that smokers with SMI do not want to or cannot quit smoking when almost as many want to quit as smokers without mental illnesses. They simply find it more difficult to do so because they are not encouraged or adequately supported in quit attempts and they spend considerable periods of time being in a social environment which normalises and reinforces heavy smoking. For people with SMI in long-term residential care, smoking bans may represent enforced smoking cessation because smoking is not permitted on the premises and patients cannot leave the facility to smoke. This situation raises more ethical concerns but smoking is one of many freedoms that people living in these circumstances lose.

Cigarette smoking is highly addictive and quitting can be extremely challenging for very heavy smokers with SMI. Smoking bans may give these patients a chance to quit in the most favourable setting, without an opportunity to smoke, and with good access to medications and psychological support from health care professionals to manage their withdrawal.
These advantages may be partially offset if bans deter smoking patients from seeking treatment although it remains to be seen how commonly this occurs.58

Another concern is increased toxicity from anti-psychotic medications (for e.g. clozapine and olanzapine) if persons on these medications abruptly stop smoking. In such cases, treating psychiatrists should make appropriate adjustments in drug dosage, monitor the person while an in-patient and arrange for dosage review after discharge, if the person resumes smoking.61,62

Smoking bans alone will not produce long term abstinence.63 A humane policy would provide patients with access to nicotine while in hospital e.g. by providing NRT, counselling and other pharmacotherapy on admission. Cessation support should also be provided at discharge, and on return to the community.64 This approach has encouraged post discharge quit attempts in patients discharged from a smoke free psychiatric hospital.65 Government policies which subsidise pharmacotherapies and harm reduction options for people with SMI may be needed to help maintain abstinence. Training hospital staff in quit smoking and relapse prevention methods and correcting their misapprehensions about the effects of smoking bans could increase compliance with smoke free policies and reduce patient distress.49,66

**Tobacco harm reduction**

The most effective way to eliminate tobacco-related harm is to abstain from using any tobacco or nicotine products. This has long been the central aim of tobacco control policy. But should smokers who are unable to quit, or who take longer to quit, be encouraged to try THR, that is, to obtain nicotine in ways that are much less harmful than smoking cigarettes e.g. by using smokeless tobacco or e-cigarettes?
Contemporary public health discourse about THR is highly polarized, especially in the case of e-cigarettes. Opponents argue that e-cigarettes will deter smokers from quitting, serve as a gateway to tobacco smoking in adolescents and renormalize smoking. These concerns may only be properly assessed after years of observational research on the ways in which these products are used by smokers and non-smokers and their impact on smoking rates.

Opponents of THR believe that these potential risks are sufficiently severe to warrant preemptive bans on the sale of e-cigarettes. They would only allow their use for cessation if they are shown to be safe and effective for cessation. This approach is likely to limit smokers’ access to e-cigarettes produced by the tobacco and pharmaceutical industries, the commercial entities best able to meet the large regulatory costs. This is the current policy in Australia and Canada and a policy advocated elsewhere.

In countries that have banned e-cigarettes, it is important to examine how well e-cigarettes help heavily addicted smokers (such as those with SMI) to either quit all nicotine use, or to switch to using these as a safer long term alternative to cigarette smoking. There are very good reasons why heavy smokers with SMI should be a high priority group for assessing the value of THR approaches. These are summarised below.

1. Some people with SMI may be deterred from quitting smoking because they believe that smoking alleviates their depression and attentional-cognitive deficits and reduces the adverse effects of antipsychotic drugs. They may receive little support and encouragement from mental health personnel to quit because of unfounded fears about destabilising their mental condition.

2. Switching to non-smoked nicotine products could reduce the dose of some antipsychotic medicines required, because the non-nicotine components of tobacco
smoke increase the metabolism of some antipsychotic drugs which means that smokers need higher drug doses to achieve optimum plasma levels.\textsuperscript{70}

3. People with SMI are more often exposed to social environments that promote heavy smoking e.g. spending time with peers and family members who smoke tobacco. This makes abstinence difficult to maintain.\textsuperscript{71}

4. Smokers with SMI, especially those with psychotic illnesses are often socio-economically disadvantaged and spend a large proportion of their meagre income on cigarettes. Access to low cost or subsidised harm reduction products would not only be beneficial for their health by quitting cigarettes but would make more of their limited income available for living expenses.

5. People with SMI may struggle to quit smoking successfully because of their heavy dependence on nicotine.\textsuperscript{20} Previous failed quit attempts could reduce confidence in making future quit attempts.\textsuperscript{72,73} This may be expose them to smoking for much longer than other smokers. THR options used as an interim step towards quitting may reduce tobacco-related harms sooner and encourage quitting.

6. THR for smokers with SMI, would satisfy important bioethical principles of beneficence (doing good), non-maleficence (protecting from harm), autonomy (respecting individual freedoms) and justice.\textsuperscript{74} It may also reduce some of the ethical concerns about enforced cessation in smoke-free mental health facilities, if residents are permitted to use non-smoked nicotine products.

\textit{Potential tobacco harm reduction products}

Among the THR products that could be recommended are NRT, low nitrosamine smokeless tobacco products (for example snus) and e-cigarettes. NRT substantially reduces smoking in smokers with SMI.\textsuperscript{75} There is insufficient evidence to justify the routine use of other harm
reduction products but there is enough evidence to justify clinical trials. For example, one clinical trial found that e-cigarettes and nicotine patches were equally effective in achieving abstinence at 6 months and equally acceptable to smokers taking medications for mental illness.76 Another found that e-cigarettes significantly reduced smoking in smokers with schizophrenia.77 Other trials are underway to test the efficacy and acceptability of e-cigarettes for cessation in smokers with SMI.78,79(See Table 3)

E-cigarettes are considerably less harmful than tobacco cigarettes and may be more acceptable than NRT for both smoking cessation and THR because of their sensory and behavioural similarities to cigarettes.80–82 Switching to snus is associated with substantial population health gains in Sweden.83 It has not been tested as a harm reduction option among smokers with SMI, but a clinical trial of snus among general population smokers did not find it better than high dose nicotine gum.84 Sales bans on these products in many developed countries such as Australia, New Zealand and the European Union (apart from Sweden) make it more difficult to conduct trials of THR.85

There is a strong case for conducting pragmatic clinical trials of THR in smokers with serious mental illnesses. These should include trials of the use of e-cigarettes both for cessation from of all nicotine and as a long term alternative to smoking in those who are unable to stop using nicotine without relapsing to smoking. Conducting clinical trials among people with SMI can be challenging as their complex health and social needs can make recruitment, retention and monitoring more difficult than trials in general population samples.86 However, the extra investment and effort required to develop the evidence base for THR options for this population is warranted given the urgent need to reduce smoking among people with SMI.

Conclusions
Smoking prevalence is very high among persons with SMI. The reasons are not wholly clear but the main contenders are self-medication, shared vulnerability due to environmental (e.g. social determinants of health) and/or genetic risk factors and a possible causal role for smoking. These are not necessarily mutually exclusive: smoking may have positive effects on some symptoms of SMI but at the cost of worsening other symptoms and increasing premature mortality and severe morbidity.

Smokers with SMI appear to be as interested in quitting as smokers without these illnesses but find it difficult to quit and remain abstinent. Often, smokers with psychotic illnesses such as schizophrenia experience social isolation and stigma. This requires innovative approaches to improve their access to cessation methods that are effective in smokers in the general population.\textsuperscript{87} We need better evidence on whether these are as effective in persons with SMI. We also need more research on the effectiveness of delivering interventions via social media and smartphone apps and on long term relapse prevention in persons with SMI.\textsuperscript{88}

Questions have been raised about the ethics and effectiveness of smoking bans in mental health care facilities. These bans are often incompletely enforced because staff do not support them and are concerned about denying smokers who are treated involuntarily the “right to smoke”. The provision of NRT and other cessation aids during periods of hospitalisation should be an ethical minimum for the humane care of smokers with SMI. It should be accompanied by better efforts to encourage cessation after discharge. Comorbid alcohol and other substance abuse should not be considered a contraindication for smoking cessation in persons with SMI.

A good case can be made for evaluating the role of e-cigarettes in smokers with SMI who try and fail to quit smoking. Thought may also be given to allowing their use in designated areas within hospitals that have banned cigarette smoking.
Search strategy and selection criteria

Relevant literature was identified by searching prominent medical literature databases such as PubMed, Embase and CINAHL up to 7th March 2016 using the search terms “severe mental illness”, “mental disorder”, “psychiatric”, “Schizophrenia”, “psychosis”, “depression” and “bipolar disorder” alone and in combination with “smoking”, “tobacco”, “smoking cessation”, “quit smoking”, “harm reduction”, “tobacco harm reduction”, “smoking reduction” “electronic cigarette”, “e-cigarette”, “vaporiser”, “cannabis”, “snus”, “smoking ban” and “smoke free”. Papers were also identified from authors’ personal collections and from references cited in the included articles. More emphasis was placed on recent publications. We generated the final reference list on the basis of the articles’ relevance to this paper. Preference was given to RCTs and Metanalysis of trials of cessation and harm reduction aids; and prospective observational studies and meta-analyses of these studies on associations between cigarette smoking and serious mental illnesses and impact of smoking bans in psychiatric hospitals.

The site www.clinicaltrials.gov was searched using the search terms: Smoking AND (“mental illness” OR schizophrenia OR depression OR bipolar). Only those trials which had their trial completion date listed as on or after January 2015 have been included in this list (Table 2). Trials with unknown status were excluded.
All authors were involved in critically reviewing the literature. WH conceptualized the design and RS prepared the initial draft of the paper. All authors were involved in the subsequent writing and editing of the manuscript.

Declaration of interests

We declare no competing interests.

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ocurrence of cigarette smoking and bipolar disorder: phenomenology and treatment

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causal linkages using a longitudinal birth cohort. *British Journal of Psychiatry* 2010; 196:
440–6.

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suicidal behavior, and serotonin function in major psychiatric disorders. *Am J Psychiatry*

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255–6.


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Table 1: Hypotheses for relationship between SMI and smoking

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Examples of Evidence for Hypothesis</th>
<th>Examples of Evidence against Hypothesis</th>
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<tbody>
<tr>
<td><strong>Self-medication:</strong> People with SMI take up smoking to relieve their psychiatric symptoms</td>
<td><strong>Major Depression</strong>&lt;br&gt;- Nicotine stimulates nicotinic acetylcholine receptors (nAChRs) in the brain which act on the acetylcholine, dopamine, norepinephrine, serotonin and opioids systems to enhance cognition and improve attention, memory, and mood.(^8^9)&lt;br&gt;- Monoamine oxidase inhibitors in cigarette smoke may have an antidepressant effect by inhibiting the breakdown of dopamine and serotonin.(^9^0)&lt;br&gt;- People with depression experience stronger withdrawal symptoms and negative affect on stopping smoking and smoking cessation can result in relapse to depression.(^7,^9^1)&lt;br&gt;- Some antidepressants (bupropion and nortriptyline) are effective for smoking cessation.(^9^2,^9^3)</td>
<td><strong>Major Depression</strong>&lt;br&gt;- Evidence demonstrates longer term improvement in depression and anxiety symptoms after smoking cessation.(^2^7)&lt;br&gt;- Most antidepressant drugs do not assist smoking cessation.(^3^3)</td>
</tr>
<tr>
<td><strong>Schizophrenia</strong></td>
<td><strong>Major Depression</strong>&lt;br&gt;- Depressed mood is common in persons with schizophrenia; so any antidepressant effects of smoking are relevant to schizophrenia.(^9^4)&lt;br&gt;- Nicotine improves attention in people who experience deficits in filtering responses to sensory stimuli.(^9^0) Nicotine improves this deficit by activation of α 7 cholinoreceptors, releasing Gamma-Aminobutyric acid (GABA) and decreasing glutamate.(^9^5)&lt;br&gt;- Nicotine may improve other sensory gating deficits such as prepulse inhibition (PPI) deficit and mismatch negativity (MMN) potentially improving startle responses and memory processing.(^9^5,^9^7)&lt;br&gt;- Smoking relieves neuroleptic medication side effects such as</td>
<td><strong>Schizophrenia</strong>&lt;br&gt;- Smoking often starts before symptoms of schizophrenia appear.(^1^0^0)&lt;br&gt;- Nicotine does not have antipsychotic properties and treatment with antipsychotics does not aid in smoking cessation.(^1^0^1,^1^0^2)</td>
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</table>
parkinsonian symptoms and cognitive impairment.\(^{98,99}\)

| Shared vulnerability: Smoking and severe mental illnesses coexist because of shared genetic/environmental risk factors and neurobiological aetiologies | **Major Depression**  
- Twin studies suggest that the relationship between lifetime risks of smoking and major depression is solely due to shared genes that predispose to both conditions.\(^ {18}\)  

**Schizophrenia**  
- Genetic and environmentally based neuropathological abnormalities in the hippocampus and prefrontal cortex may increase vulnerability to the rewarding effects of addictive drugs and to experiencing psychotic symptoms.\(^ {103}\)  
- Genes such as CHRNA2, CHRB2, CHRNA7 have been associated with regions that increase the risk of schizophrenia.\(^ {104}\)  

**Bipolar disorder**  
- Common genes (COMT, SLC6A3, and SLC6A4) and gene networks have been associated with both tobacco use disorder and bipolar disorder.\(^ {105}\)  
- Epidemiologic studies show that nicotine dependence and bipolar disorder predict each other’s development.\(^ {106}\)  
- Shared environmental factors such as alcohol and illicit drug use and childhood adversity predict the development of both smoking and bipolar disorder.\(^ {107}\) |

| Causal: Smoking causes SMI | **Major Depression**  
- Epidemiological evidence indicates that cigarette smoking is associated with an increased risk of depression.\(^ {110,111}\)  
- A recent meta-analysis of 26 studies reported that smoking cessation is associated with reductions in depression and |

|  | **Major Depression**  
- Family study of smoking and major depression did not find an increased risk of smoking among relatives of person with depression.\(^ {108}\)  

**Schizophrenia**  
- Genes strongly associated with an increased risk of developing schizophrenia are not associated with nicotine dependence or number of cigarettes per day.\(^ {109}\) |
<table>
<thead>
<tr>
<th>Anxiety Symptoms</th>
<th>Schizophrenia</th>
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<tr>
<td>- Cigarette smoking may cause lower serotonin function in the hippocampus which may result in depression.(^\text{112})</td>
<td>- Nicotine increases dopamine release in the brain’s reward system.(^\text{113}) This is consistent with the hypothesis that psychotic symptoms are the result of increased levels of striatal dopamine.(^\text{114})</td>
</tr>
<tr>
<td>- Association may also be confounded by history of alcohol use.(^\text{116})</td>
<td>- A meta-analysis of epidemiological studies shows that smoking often precedes the onset of psychotic symptoms, persons with psychotic symptoms are heavier smokers than those without, and these associations persist after controlling for potential confounders.(^\text{115})</td>
</tr>
<tr>
<td>- A Mendelian randomization metaanalysis discounted a causal relationship as it did not find an association between a genetic marker for nicotine dependence (CHRNA5-A3-B4 variant) and depression.(^\text{117})</td>
<td>- There are few prospective studies testing this hypothesis(^\text{115}) and stronger longitudinal evidence and biological links are needed to establish a link between nicotine use and psychosis onset.(^\text{118}) The association between smoking and psychosis may be confounded by association between tobacco smoking and cannabis use.(^\text{119}) Cannabis use is associated with earlier onset of psychosis, has a dose response relationship with psychosis risk,(^\text{118}) and can produce psychotic symptoms in persons with and without psychoses.(^\text{120}) Only half of the prospective studies in the meta-analysis of tobacco use measured cannabis use.(^\text{115})</td>
</tr>
</tbody>
</table>
Table 2: Pros and cons of Smoking Bans

<table>
<thead>
<tr>
<th>Pros of smoking ban</th>
<th>Cons of smoking bans</th>
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<tbody>
<tr>
<td>Protection of patients from smoking related harms</td>
<td>Infringement of the “right to smoke” for involuntary patients and long term residents of psychiatric care facilities.</td>
</tr>
<tr>
<td>Opportunity to quit smoking under the care of professionals and with access to smoking cessation therapies.</td>
<td>Deterrent to seeking in-patient psychiatric treatment</td>
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<tr>
<td>Protection of non-smokers from second-hand smoke</td>
<td>Possibility of severe withdrawal symptoms mimicking exacerbation of mental illness</td>
</tr>
<tr>
<td>Improvement in mental health on stopping smoking</td>
<td>Some patients may leave the facility unaccompanied or discharge themselves early in order to smoke</td>
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<tr>
<td>Possible reduction in doses of some anti-psychotic medications e.g. clozapine</td>
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<td>Prevention of relapse in patients and staff who have quit smoking</td>
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Table 3: Interventional trials for smoking cessation in people with severe mental illness.

<table>
<thead>
<tr>
<th>Title of the study</th>
<th>Trial registry number</th>
<th>Psychiatric condition</th>
<th>Interventions</th>
<th>Completion date</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking Cessation for Depression and Anxiety Treatment</td>
<td>NCT020 02858</td>
<td>Depression and anxiety</td>
<td>Nicotine Patch, Depression and Anxiety Smoking Cessation Treatment and Educational-Support Psychotherapy</td>
<td>May 2016</td>
<td>Recruiting</td>
</tr>
<tr>
<td>Decision Support for Smoking Cessation in Young Adults With Severe Mental Illness</td>
<td>NCT017 79440</td>
<td>Severe mental illness</td>
<td>Varenicline and Placebo</td>
<td>December 2015</td>
<td>Active, not recruiting</td>
</tr>
<tr>
<td>Effects of Varenicline on Smoking Lapse in Smokers With and Without Schizophrenia</td>
<td>NCT018 50953</td>
<td>Schizophrenia</td>
<td>Varenicline and Placebo</td>
<td>May 2015</td>
<td>Completed</td>
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<tr>
<td>Trial of Integrated Smoking Cessation, Exercise and Weight Management in Serious Mental Illness: TRIUMPH</td>
<td>NCT024 24188</td>
<td>Serious mental illness</td>
<td>TRIUMPH Intervention</td>
<td>June 2019</td>
<td>Not yet recruiting</td>
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<tr>
<td>Smoking Cessation for Depressed Smokers</td>
<td>NCT004 94728</td>
<td>Major Depression</td>
<td>Smoking Cessation Treatment, Nicotine Replacement Therapy and Cognitive Behavioural Analysis System of Psychotherapy (CBASP)</td>
<td>December 2016</td>
<td>Active, not recruiting</td>
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<tr>
<td>Study Title</td>
<td>NCT Number</td>
<td>Condition</td>
<td>Interventions</td>
<td>Start Date</td>
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<tr>
<td>Effects of rTMS on Cigarette Smoking and Cognition in Schizophrenia</td>
<td>NCT01523730</td>
<td>Schizophrenia</td>
<td>Repetitive Transcranial Magnetic Stimulation (rTMS) and Sham Repetitive Transcranial Stimulation (rTMS)</td>
<td>September 2015</td>
<td>completed</td>
</tr>
<tr>
<td>Behavioural Activation and Varenicline for Smoking Cessation in Depression Smokers</td>
<td>NCT02378714</td>
<td>Depression</td>
<td>Varenicline; behavioural activation for smoking cessation (BASC) and Standard treatment</td>
<td>August 2020</td>
<td>Recruiting</td>
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<tr>
<td>Novel Smoking Cessation Drug for Schizophrenia</td>
<td>NCT02230384</td>
<td>Schizophrenia</td>
<td>A novel drug and a placebo</td>
<td>December 2016</td>
<td>Recruiting</td>
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<tr>
<td>Study Evaluating The Safety And Efficacy Of Varenicline and Bupropion For Smoking Cessation In Subjects With And Without A History Of Psychiatric Disorders (EAGLES)</td>
<td>NCT01456936</td>
<td>With and without psychiatric disorders</td>
<td>Placebo, varenicline, bupropion hydrochloride and Nicotine Replacement Therapy Patch</td>
<td>January 2015</td>
<td>Completed</td>
</tr>
<tr>
<td>Mobile Health Technology to Enhance Abstinence in Smokers With Schizophrenia</td>
<td>NCT02420015</td>
<td>Schizophrenia</td>
<td>Nicotine replacement therapy, Bupropion, cognitive-behavioural smoking cessation counselling, Mobile Contingency Management, Stay Quit Coach (smartphone application), SMS text messaging</td>
<td>March 2018</td>
<td>Not yet recruiting</td>
</tr>
<tr>
<td>Effects of Deep Breathing, Self-Help Book in Anxiety and depression</td>
<td>NCT02693561</td>
<td>Anxiety and depression</td>
<td>Deep Breathing Exercises and Self-Help Book</td>
<td>August 2016</td>
<td>Recruiting</td>
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</tbody>
</table>
Cigarette Consumption, Anxiety, Depression and Motivation to Stop Smoking

<table>
<thead>
<tr>
<th>Study Title</th>
<th>Trial Code(s)</th>
<th>Condition(s)</th>
<th>Intervention(s)</th>
<th>Start Date</th>
<th>Recruitment Status</th>
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<tbody>
<tr>
<td>Smoking Cessation Following Psychiatric Hospitalization</td>
<td>NCT02204956</td>
<td>Severe mental illness</td>
<td>Extended Care and Brief Education</td>
<td>June 2019</td>
<td>Not yet recruiting</td>
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<tr>
<td>Electronic Cigarettes in Smokers With Mental Illness</td>
<td>NCT02212041</td>
<td>Schizophrenia, Schizophreniform Disorder, Bipolar Disorder</td>
<td>Disposable electronic cigarettes</td>
<td>June 2016</td>
<td>Not yet recruiting</td>
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<tr>
<td>Telephone-based Smoking Cessation</td>
<td>NCT02500589</td>
<td>Depression</td>
<td>Behavioural mood management and Health education</td>
<td>June 2019</td>
<td>Not yet recruiting</td>
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<tr>
<td>Smoking Cessation And Reduction in Depression</td>
<td>NCT02124187</td>
<td>Depression</td>
<td>Ecig containing 24 mg nicotine, Ecig containing 0mg nicotine and Nicotine free inhalator</td>
<td>December 2017</td>
<td>Not yet recruiting</td>
</tr>
<tr>
<td>Acute Effects of Exercise in Smokers With Schizophrenia</td>
<td>NCT01635075</td>
<td>Schizophrenia</td>
<td>Exercise and passive control</td>
<td>January 2015</td>
<td>Completed</td>
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<tr>
<td>Transcranial Direct Current Stimulation (tDCS) As A Treatment For Cigarette Craving and Cognitive Deficits in Schizophrenic</td>
<td>NCT02128919</td>
<td>Schizophrenia</td>
<td>Device: tDCS</td>
<td>December 2017</td>
<td>Recruiting</td>
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<tr>
<td>Randomized Controlled Trial (RCT) of a Motivational Decision</td>
<td>NCT02086162</td>
<td>Schizophrenia</td>
<td>Web-based motivational decision support system; and NCI (national cancer)</td>
<td>March 2017</td>
<td>Recruiting</td>
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<tr>
<td>Support System</td>
<td>NCT Code</td>
<td>Disease</td>
<td>Intervention</td>
<td>Status</td>
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<tr>
<td>Vigorous Exercise for Depressed Smokers</td>
<td>NCT018 60924</td>
<td>Depression</td>
<td>Exercise and health education</td>
<td>December 2015</td>
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<tr>
<td>Exercise for Depressed Smokers</td>
<td>NCT020 86149</td>
<td>Depression</td>
<td>Aerobic Exercise and Health Education</td>
<td>September 2018</td>
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<tr>
<td>Nicotine Receptor Density &amp; Response to Nicotine Patch: Pt 2 Extended Treatment</td>
<td>NCT026 76375</td>
<td>Schizophrenia</td>
<td>Standard therapy of Nicotine patch or bupropion and extended treatment with combination drugs with and without home visits and phone calls.</td>
<td>February 2017</td>
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<tr>
<td>Effects of Varenicline on Plasticity in Schizophrenia</td>
<td>NCT019 34023</td>
<td>Schizophrenia</td>
<td>Varenicline and Placebo</td>
<td>August 2015</td>
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<tr>
<td>Efficacy of N-Acetyl-Cysteine in Bipolar Disorder and Tobacco Use Disorder</td>
<td>NCT022 52341</td>
<td>Bipolar disorder</td>
<td>Dietary Supplement: N-Acetyl-Cysteine</td>
<td>September 2015</td>
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<tr>
<td>Very Low Nicotine Cigarettes in Smokers With Schizophrenia</td>
<td>NCT020 19459</td>
<td>Schizophrenia</td>
<td>Very low nicotine content cigarettes and standard nicotine content cigarettes</td>
<td>August 2018</td>
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<tr>
<td>Contingency Management, Quitting Smoking, and ADHD</td>
<td>NCT022 66784</td>
<td>ADHD</td>
<td>Contingency Management (CM); Transdermal nicotine skin patches (i.e. Habitrol) and Supportive Counselling</td>
<td>October 2019</td>
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<tr>
<td>Behavioural Activation for Smoking Cessation in Veterans With PTSD</td>
<td>NCT019 47725</td>
<td>PTSD</td>
<td>Nicotine patch, Nicotine gum or nicotine lozenge, Standard Smoking Cessation</td>
<td>September 2018</td>
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</tr>
</tbody>
</table>

Author post print- please refer to published version:
<table>
<thead>
<tr>
<th>Study Title</th>
<th>Registration ID</th>
<th>Condition</th>
<th>Intervention</th>
<th>Status</th>
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</thead>
<tbody>
<tr>
<td>CPT and Smoking Cessation</td>
<td>NCT01901848</td>
<td>PTSD</td>
<td>Cognitive Processing Therapy (CPT), Bupropion, nicotine replacement therapy (NRT), Integrated Care for Smoking Cessation (ICSC), smokefreeVET program</td>
<td>April 2018</td>
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<tr>
<td>Integrated PTSD and Smoking Treatment</td>
<td>NCT01988935</td>
<td>PTSD</td>
<td>Prolonged Exposure and Smoking Cessation counselling</td>
<td>June 2018</td>
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<tr>
<td>Behavioural Activation for Smoking Cessation in PTSD</td>
<td>NCT01995123</td>
<td>PTSD</td>
<td>Behavioural Activation Therapy, Health and Smoking Education and Standard Smoking Cessation Therapy</td>
<td>December 2018</td>
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<tr>
<td>Improving Functional Outcomes of Veterans With PTSD and Tobacco Dependence</td>
<td>NCT02576899</td>
<td>PTSD</td>
<td>Acceptance and Commitment Therapy for PTSD and Tobacco Use; and Freedom From Smoking program</td>
<td>August 2017</td>
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</table>
Table 4: Pros and cons of using e-cigarettes for THR

<table>
<thead>
<tr>
<th>Pros of electronic cigarettes</th>
<th>Cons of electronic cigarettes</th>
</tr>
</thead>
<tbody>
<tr>
<td>A cleaner source of nicotine than cigarettes when use for self-medication</td>
<td>Limited research on the harms or benefits of their long term use</td>
</tr>
<tr>
<td>More economical than cigarettes in the long term</td>
<td>Initially an electronic cigarettes kit costs more than a pack of cigarettes.</td>
</tr>
<tr>
<td>Provides the socio-behavioural aspects of smoking on quitting.</td>
<td>Some electronic cigarettes might be difficult to use by people with severe mental illness</td>
</tr>
<tr>
<td>May result in smoking cessation/reduction because of diminished addiction potential of nicotine in the absence of any monoamine oxidase (MAO) inhibitors present in cigarette smoke.</td>
<td></td>
</tr>
</tbody>
</table>