Published in final edited form as:

Psychiatry Res. 2016 December 30; 246: 58–61. doi:10.1016/j.psychres.2016.09.008.

Is smoking tobacco associated with psychotic experiences across racial categories in the United States? Findings from the Collaborative Psychiatric Epidemiological Surveys

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Abstract

Smoking tobacco has been associated with psychosis, though research has yet to fully examine the extent to which this association reaches into the sub-threshold range of the psychosis continuum within the US, and whether this association persists after accounting for co-occurring disorders. We analyzed data from three large racially-diverse surveys of the US population and found that current smokers were more likely to report a lifetime psychotic experience when compared with never smokers after adjusting for socio-demographics. But after controlling for anxiety, mood, and substance use disorders, these effects only remained strong and statistically significant for Asian-Americans.

Keywords

smoking; tobacco; psychotic experiences; psychosis

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1. Introduction

The prevalence of smoking has reduced significantly in the US over the past few decades, yet the effects of smoking continue to result in cancers, cardiovascular and metabolic diseases, respiratory diseases, and preventable death (see Jha et al., 2013). The effects of smoking can also profoundly affect the brain (e.g. accelerated cortical thinning, see Karama et al., 2015), and increase risk for psychopathology. Recently, Gurillo and colleagues (2015) conducted a meta-analysis that showed smoking tobacco was associated with increased odds for psychosis, and suggested that the association could be causal.

In this context, most studies have examined the relationship between smoking and psychotic disorders (e.g. schizophrenia, see De Leon and Diaz, 2005). However, a growing number of studies have begun to examine the relationship between smoking and sub-threshold psychotic experiences. For example, Koyanagi and colleagues (2016) analyzed the World Health Survey data from 44 countries and found that current smoking increased the odds of reporting at least one psychotic symptom in the past year by approximately 35% when compared with non-smokers, after adjusting for age and sex. This association was only statistically significant at a conventional level in about a third of the countries, and effect sizes varied between 0.81 (95%CI 0.43–1.52) and 4.97 (95%CI 1.17–14.45), suggesting that context matters.

The current paper builds on these findings by being the first to examine the relationship between smoking status and psychotic experiences (PEs) in the United States, stratifying by race and adjusting for ethnicity in order to assess the extent to which effect sizes vary across subpopulations within the same country. The current paper also builds on previous work by using validated measures to assess the confounding role of cannabis use, as well as anxiety and mood disorders (Baker-Morissette et al., 2007; Jane-Llopis et al., 2006; DeVylder et al., 2014; Ksir and Hart, 2016), which are related to both smoking and PEs, but have not been adequately and consistently addressed in prior studies.

We analyzed data from three large surveys of the US general population, and we examined the association between smoking status and lifetime PEs, adjusting for socio-demographics, as well as DSM diagnoses of co-occurring substance use disorder, anxiety disorders, and mood disorders. We hypothesized that current smoking status would be associated with increased odds of reporting PEs, and that controlling for co-occurring disorders would diminish these effects.

2. Methods

2.1. Sample

We analyzed three population-level surveys in the US, which are: (1) the National Comorbidity Survey Replication (NCS-R; Kessler et al. 2004), (2) the National Latino and Asian American Study (NLAAS; Alegria et al. 2004) and (3) the National Survey of American Life (NSAL; Jackson et al. 2004), which together composed the Collaborative Psychiatric Epidemiology Surveys (CPES). The surveys were conducted between 2001 and 2003, and used similar methodology and sampling design. All surveys used multi-stage

sampling designs, drawing participants from households in the 48 contiguous states. The NCS-R is a nationally representative survey of 9282 individuals (predominantly Caucasian, reflecting the general population of the USA), of which a random subsample (n=2322) completed the psychosis screen. In order to make comparisons across racial samples, the NCS-R was restricted to White respondents only. The NLAAS is a survey of Latino Americans (n=2554) and Asian Americans (n=2095), which for the purposes of this paper were analyzed separately according to race. The NSAL is a nationally representative sample of African-American households (n=3570), with Afro-Caribbean (n=1621) and White (n=891) respondents drawn from the same source neighborhoods, although Whites were not assessed with the psychosis screen. Sampling methodology of the CPES are described in detail elsewhere (Heeringa et al., 2004). We excluded participants from the analysis who were missing data for any of the variables of interest. Since this study focused on sub-threshold psychotic experiences, we excluded 23 individuals who self-reported ever having received a diagnosis of schizophrenia from a medical professional.

2.2. Measures

2.2.1. Psychosis—PEs were assessed using the WHO-CIDI 3.0 Psychosis Screen (Kessler and Ustun, 2004), which is a validated measure used across the globe (see Kaymaz et al., 2012; McGrath et al., 2015). Respondents were asked to report the lifetime occurrence of six PE, including: (1) visual hallucinations, (2) auditory hallucinations, (3) thought insertion, (4) thought control, (5) telepathy, and (6) delusions of persecution. Endorsing at least one of these experiences constituted a positive endorsement of lifetime PE. Responses were not considered a PE if the experience took place in the context of falling asleep, dreaming, or substance use. Individuals who endorsed a lifetime PE were asked whether the PE occurred within the past year.

2.2.2. Smoking—In the NCS-R and the NLAAS, smoking status was measured by the categorical item: “Are you a current smoker, former smoker, or have you never smoked?” Respondents who only smoked a few times were considered to have never smoked. The smoking measure in the NSAL differed slightly such that smoking status was measured by a categorical item: current smoker, smoked more than 100 cigarettes in lifetime but not current smoker (i.e. some), and smoked fewer than 100 cigarettes in lifetime (i.e. little to none). The measures did not specify whether “current smokers” were daily smokers (who are more likely to have nicotine dependence) or occasional smokers.

2.2.3. Covariates—Self-reported socio-demographic variables that had the potential to confound the analyses were included as covariates. We adjusted for ethnicity in the NLAAS Latino sample (Puerto Rican, Mexican, Cuban, Other Hispanic), the NLAAS Asian sample (Filipino, Vietnamese, Chinese, Other Asian), and NSAL (African-American, Caribbean Black American). We only examined white respondents in the NCS-R. Other covariates included sex, age (18–29, 30–44, 45–59, 60+), education level (less than high school, high school, some college, college and beyond), and income-poverty ratio (0=poor, 1–2=near poor, 3+=non-poor). Since psychiatric disorders can covary with smoking status and psychosis (DeVylder et al., 2015), we adjusted for lifetime anxiety disorders (general anxiety, panic, panic attacks, social phobia, agoraphobia with and without panic attacks,

post-traumatic stress disorder), and mood disorders (major depressive disorder, depressive episode, dysthymia), and substance abuse disorder (abuse and dependence, illicit drugs including marijuana).

2.3. Analyses

Due to inconsistent measures across the three surveys, we analyzed each survey individually (see DeVyllder, 2014). We estimated standard errors through design-based analyses that used the Taylor series linearization method to account for the complex multistage clustered design, with US metropolitan statistical areas or counties as the primary sampling units. We used sampling weights for all statistical analyses to account for individual-level sampling factors (i.e. non-response and unequal probabilities of selection). Using STATA SE 13, we ran multivariable logistic regression models, and we examined the relation between smoking status and lifetime PE adjusting for potential socio-demographic confounders in the first block, adjusting for substance use disorder in the second block, adjusting for anxiety and mood disorders in the third block, and adjusting for all co-occurring disorders in the final block. We present our findings as odds ratios (ORs) with confidence intervals (CI), and we established significance at the $\alpha = .05$ level.

3. Results

Descriptive statistics for main explanatory, confounding, and outcome variables can be found in Table S1 in the supplemental materials. In the NCS-R, being a current smoker was associated with 92% greater odds of reporting a lifetime PE after adjusting for socio-demographics, but this association diminished and did not retain a conventional level of statistical significance after controlling for co-occurring disorders. Among Latinos in the NLAAS, being a current smoker and former smoker was each associated with about 64% greater odds of reporting a lifetime PE when compared with never smokers after adjusting for socio-demographic covariates. This relationship diminished slightly and did not retain a conventional level of statistical significance after the inclusion of substance use disorder, anxiety disorders, and mood disorders. Among Asians in the NLAAS, current smokers were 2.69 times more likely to report lifetime PE, and former smokers were 2.62 times more likely, when compared with never smokers, after adjusting for socio-demographics. These effects remained strong and statistically significant even after controlling for co-occurring disorders. In the NSAL, current smokers had about 39% greater odds of reporting a lifetime PE, and former smokers had about 50% greater odds, when compared with never smokers after adjusting for socio-demographics. However, these effects did not remain at a conventional level of statistical significance after adjusting for co-occurring disorders. As a sensitivity analysis for substance use, we re-ran models using an alternate measure that captured any lifetime use of marijuana; however, results did not vary dramatically. All analyses were repeated using past year psychotic experiences as the main outcome (see Table S2 in the supplemental materials).

4. Discussion

Across all samples, we found evidence in support of our hypothesis that current smokers had greater odds of reporting a lifetime PE when compared with never smokers after adjusting

for socio-demographics. However, the effects did not remain at a conventional level of statistical significance after controlling for co-occurring disorders, except among Asian-Americans in the NLAAS, who have lower prevalence of smoking and psychosis relative to other racial groups in these data. Given the cross-sectional nature of the present study, it is difficult to answer the question of why smoking and PE are consistently significant among Asian-Americans even with the inclusion of confounding variables. Asian-Americans have a low prevalence of substance use disorder, mood disorders, and anxiety disorders, and so controlling for these factors may not have affected the relationship between smoking and psychosis very much.

In general, Koyanagi and colleagues found that the strength and significance of the relationship between smoking and psychotic symptoms can vary across countries, and based on our work, the relationship can also vary across subpopulations within the same country. Smoking is not always associated with psychosis (Srinivasan and Thara, 2002; Wijesundera et al., 2014), and the heterogeneity of effect sizes across racial groups may implicate both biological and non-biological risk factors (e.g. urbanicity, affordability of tobacco products and availability of tobacco outlets in a given neighborhood, family history of psychosis, childhood trauma), as well as protective factors (e.g. social support, cultural practices, coping strategies for managing stress). Future studies should examine these moderating factors in order to explain differences in the association between smoking and PE.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Funding Source

Preparation of this publication was supported by grant T32AA014125 from *the National Institute on Alcohol Abuse and Alcoholism* (NIAAA) of the National Institutes of Health (NIH). The content is solely the responsibility of the authors and does not necessarily represent the official views of NIAAA or NIH.

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Highlights

- Current smokers were more likely to report a lifetime psychotic experience when compared with never smokers after controlling for socio-demographic variables.
- The association held true across White, Latino, Asian, and Black samples.
- The strength and statistical significance of the relationship between smoking and psychotic experiences diminished when controlling for substance use, anxiety, and mood disorders.
- The effect of smoking on psychotic experiences was pronounced among Asian-Americans.

Table 1

Associations between smoking status and lifetime psychotic experiences

	Model 1 Adjusted for Block 1 OR (95% CI)	Model 2 Adjusted for Blocks 1 & 2 OR (95% CI)	Model 3 Adjusted for Blocks 1 & 3 OR (95% CI)	Model 4 Adjusted for Blocks 1, 2, & 3 OR (95% CI)
NCS-R - White (n=1675)				
Current	1.92 (1.26–2.93)	1.63 (1.06–2.51)	1.50 (1.02–2.23)	1.38 (0.93–1.05)
Former	0.93 (0.56–1.53)	0.87 (0.53–1.41)	0.77 (0.45–1.31)	0.74 (0.43–1.26)
Never	1.0	1.0	1.0	1.0
NLAAS - Latino (n=2548)				
Current	1.64 (1.11–2.44)	1.45 (0.90–2.37)	1.48 (1.00–2.20)	1.37 (0.85–2.19)
Former	1.64 (1.13–2.38)	1.40 (0.92–2.15)	1.48 (0.99–2.21)	1.32 (0.83–2.09)
Never	1.0	1.0	1.0	1.0
NLAAS - Asian (n=2088)				
Current	2.69 (1.28–5.66)	2.84 (1.33–6.07)	2.40 (1.12–5.12)	2.56 (1.18–5.52)
Former	2.62 (1.34–5.09)	2.75 (1.39–5.43)	2.44 (1.23–4.83)	2.60 (1.29–5.23)
Never	1.0	1.0	1.0	1.0
NSAL - Black (n=4974)				
Current	1.39 (1.03–1.88)	1.25 (0.90–1.73)	1.22 (0.89–1.69)	1.16 (0.82–1.63)
Some	1.50 (1.01–2.23)	1.38 (0.92–2.06)	1.37 (0.93–2.01)	1.31 (0.88–1.93)
Little to none	1.0	1.0	1.0	1.0

Psychotic experience is defined as reporting at least one occurrence of hallucinatory (visual and/or auditory) experience or delusional ideation in one's lifetime.

In the NCS-R and NLAAS, the smoking categories were *Current*, *Former*, and *Never*. Individuals who smoked a few times in their lives were included in the *never* category.

In the NSAL, smoking categories were: *Current*, *Some* (more than 100 cigarettes in lifetime but not current smoker), and *Little to none* (fewer than 100 cigarettes in lifetime)

Block 1: Ethnicity, sex, age, education, poverty level

Block 2: Lifetime substance use disorder (illicit drugs including marijuana, abuse or dependence)

Block 3: Lifetime anxiety disorder (general anxiety, panic, panic attacks, social phobia, agoraphobia with and without panic attacks, post-traumatic stress disorder) and lifetime mood disorder (major depressive disorder, depressive episode, dysthymia)

p<0.05 indicated in bold