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Population Based Prevalence of Smoking in Psychiatric Inpatients: A Focus on Acute Suicide Risk and Major Diagnostic Groups

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Introduction

Psychiatric illness, smoking, and suicide

The intersection between psychiatric illness and two complex multifactorial behaviors—cigarette smoking and suicide—has been a source of ongoing debate and research. Both behaviors have profound public health effects. Smoking is the leading modifiable cause of death in the United States.[1] In 2004, 32,439 individuals[2] died by suicide in the U.S. – the eleventh leading cause of death. Globally, Ezzati and Lopez[3] estimate there were 4.83 million smoking related premature deaths in 2000. The World Health Organization in 2002 estimated there were 900,000 suicides[4] and there are an estimated 9 to 36 million suicide attempts worldwide.[5] Smoking has also been implicated as an independent risk factor in suicide, suicide attempts, and thoughts of suicide.[6-10]

Smoking directly impacts disease burden via its toxic effects. Those diagnosed with psychiatric disorders are particularly effected. Patient's with schizophrenia are more likely to smoke and have higher levels of nicotine dependence than the general population.[11] Active psychiatric disorders predict an increased risk of the onset of daily smoking and nicotine dependence, with those with multiple disorders at even more risk.[12] A 2006 U.S. report [13] notes the seriously mentally ill live 25 years less than the general U.S. population. The report implicates lifestyle factors – smoking, obesity, and physical inactivity—and subsequent poor medical management of related illnesses as creating, and maintaining, this survival gap compared to the general population.

Why do those with psychiatric diagnoses smoke?

U.S. population research[14,15] estimates individuals with a psychiatric diagnosis are responsible for almost 50% of the United States' cigarette consumption. Substance dependence, psychotic disorders, anxiety disorders, bipolar disorder, and depression are all associated with smoking rates two to four times higher than the general U.S. population and less success stopping smoking. [14,15] How, and if, smoking and completed suicide, and smoking and suicide-related behaviors (for our discussion purposes, defined as suicidal ideation and suicide attempts) are associated is unclear.

First, we will address smoking and completed suicide. Smoking has been implicated as an independent risk factor for suicide in two large U.S. general population studies.[6,7] However,

based on the compelling underlying associations between smoking and psychiatric illness, the question of whether smoking represents a causal risk factor for completed suicide or only indirectly identifies those with mental illness remains.[16,17] Numerous critical risk factors are associated with both suicide and smoking including hostility, aggression, impulsivity, serotonergic and HPA axis abnormalities, and psychiatric illness.[18-25]

In international studies of suicide-related behavior (suicidal ideation and attempts), both in general population samples and in psychiatric cohorts, research has been contradictory and has tended to show direct associations with smoking, but after controlling for other factors this direct association may or may not remain.[10,20,25-39] The prevalence of smoking in a country's general population may be responsible for some of this confusion combined with different populations studied.

In clinical practice, patients judged at high risk for suicide are psychiatrically hospitalized to maintain their safety and provide stabilization and acute treatment. Meeting a threshold of illness severity necessitating hospitalization appears to differentiate those at highest risk for suicide[40,41] from the much larger general population with psychiatric illness. Psychiatric hospitalization is associated with a significantly higher suicide risk immediately after discharge and in the months following.[42,43]

Smoking rates and suicide risk are usually studied in specific psychiatric diagnostic groups. This is not representative of clinical practice in which practice setting has profound implications on risk and co-morbidity is typically the rule rather than the exception. A meta-analysis of lifetime suicide risk in affective disorders described a four-fold increase in those who were hospitalized and suicidal versus those treated as an outpatient.[40] There has been very limited research into smoking rates among psychiatric inpatients as a clinical population unto themselves.[10,44] Psychiatric inpatients have high rates of psychiatric comorbidity, [45] and substance abuse is a common comorbid diagnosis. Previous U.S. research[44] looked at diagnosis and smoking rates in psychiatric inpatients in San Francisco. Their population, defined by DSM-IV diagnoses but not by suicide risk as reason for admission, was not limited to a specific geographic cohort. There is not research we are aware of, looking at both smoking rates in a community-based sample by diagnosis and admission secondary to suicide risk. In order to better describe a psychiatric inpatient population and understand the extent of smoking in a clinical sample of psychiatric inpatients, we examined smoking rates by psychiatric diagnostic group and suicide risk as reason for admission to the Mayo Psychiatry and Psychology Treatment Center (MPPTC) in patients ages 18-65 hospitalized during 2004 and 2005.

METHODS

Subjects

This study was approved by the Mayo Clinic Institutional Review Board (Mayo IRB #06-003722) and was performed at the Mayo Clinic Rochester. Rochester is the county seat of Olmsted County, Minnesota. The county has a population of 137,521[46] and has been the basis of a vast array of population-based studies of medical illness. The Rochester Epidemiologic Project (REP) is based at the Mayo Clinic and has tracked disease prevalence and outcomes since 1966.[47] Due to a number of factors including Mayo Clinic's long-standing integrated medical record, patient and hospital cooperation, and the isolated nature of Olmsted County's geographic location from other treatment centers, it has been one of the few places in the United States where community based research looking at disease incidence, prevalence, natural course, and long-term outcomes in medicine can be conducted.

The MPPTC, during the study's timeframe, was the only psychiatric hospital in Olmsted County and serves both as a local, regional, and national center for psychiatric hospitalization. Our sample was obtained from an administrative database of MPPTC patients from 2004 and 2005. The MPPTC had 3,673 unique admissions aged 18-65 combined in 2004 and 2005. Of these, 1,582 admissions had their payer source addressed to Olmsted County. Nine-hundred and ninety-five individual patients accounted for the 1,582 admissions. Only patients who gave research authorization and whose billing address was within Olmsted County were eligible for the study. Two-hundred-nineteen (22%) of the unique patients did not provide research authorization and were eliminated from the sample. This left 776 (78%) of the original 995 individual patients.

Data analysis

To ensure consistency of approach and based on possible variations during the year in smoking status for patients admitted more than once, only the first admission during the entire 2004-2005 period was used for data analysis. Current smoking status was abstracted from the electronic medical record which was based on the patient's selfreport. Patients who reported smoking several times a week or daily were considered to be current smokers. Lifetime smoking status was defined by smoking 100 or more cigarettes in one's lifetime. Quit rates were assessed by subtracting current smokers from lifetime smokers.

Diagnosis was based on DSM-IV formulation collected from the discharge summary of a patient's first admission during the study period. All discharge diagnoses in the discharge summary for hospitalizations are made and finalized by a board-certified attending psychiatrist on staff at the Mayo Clinic. Electronic medical record data abstraction was performed by Josiah Allen (JA) and Jessica Nash (JN) after training by Timothy Lineberry (TL). Data elements including gender, age, current tobacco use, previous tobacco use, tobacco type, admission secondary to suicide concerns, and DSM-IV diagnosis were also abstracted.

Statistical analysis was performed with consultation from the Center for Translational Science Activities at the Mayo Clinic. Chi-square tests and Fisher's exact test were used when applicable in Microsoft JMP 6.0 to analyze smoking status across the various data categories within the inpatient sample with significance defined as $p \leq 0.05$. Multiple logistic regression models were used to examine the relationship between smoking and admission with suicidality after adjusting for age and sex.

RESULTS

Descriptive Characteristics

Our sample, broken down demographically by age and gender, had a slight preponderance of females (55.1%) compared to males. Patients aged 18-24 made up 24% of the sample, 25-44 made up 48.3%, and 45-65 made up 27.7%. As Table 1 depicts, 80.41% of our sample were hospitalized due to acute suicide risk. DSM-IV discharge diagnoses were affective disorders (80.3%), substance abuse disorders (36.1%), anxiety disorders (19%), psychotic disorders (16.4%), and personality disorders (10.3%). 72.2% of the sample had at least one comorbid disorder.

Current smoking

Three-hundred fifty-six of the seven-hundred seventy-six patients (45.9%) were current smokers. Only one patient's smoking status (0.12%) could not be definitively ascertained and they were considered a non-smoker for purpose of analysis. Males smoked at a significantly higher rate than females (<0.001). Over half (51.1%) of patients aged 18-24 were current

smokers, compared to the national average of 23.6% and the MN average of 28.7% for that age range (Figure 1).

Figure 2 illustrates current smoking rates across primary DSM-IV diagnostic categories in our inpatient sample. A diagnosis of substance abuse was most highly correlated with inpatient smoking status ($<.0001$). 77.1% of patients diagnosed with substance abuse disorders were current smokers. A further delineation of smoking rates by primary drug of abuse showed no significant difference based on drug of choice (77%-81.3%). Psychotic disorder was also highly correlated (.02), although this was not statistically significant at subgroup diagnoses, possibly due to small sample size. 55.9% of patients diagnosed with psychotic disorder were current smokers. Smoking rates also stayed fairly constant across subgroups (50%-60%). All 13 patients diagnosed with psychosis related to methamphetamine abuse were current smokers. Anxiety disorder and personality disorder were negatively correlated with smoking status in our inpatient sample, such that these patients were less likely to smoke than the aggregate inpatient population. 38.8% of patients diagnosed with anxiety disorder and 36.3% of patients diagnosed with personality disorder were current smokers – still over 1.5 times greater than the general population smoking rates. The categories for affective disorder and suicide risk reflected rates that were not significantly different compared to other diagnostic groups, but still smoked at two times the national average.

In a multiple regression model that included smoking, age, and sex, only sex remained significantly associated with suicide risk at admission where men were less likely to be admitted than women secondary to concerns about suicide risk (OR=0.56, 95% CI=0.39-0.81).

Quitting Smoking

Of our sample, only 24.7% of patients had quit smoking (reported lifetime smoking minus current smoking rates) at the index admission for data abstraction. Advancing age was highly correlated with quitting smoking across the entire inpatient sample ($<.0001$). Only 14.4% of patients aged 18-24 had stopped smoking, compared to 19.7% of patients aged 25-44 and 39.1% of patients aged 45-65. Gender was not significantly associated with quitting (.061), but seemed to suggest male inpatients may be less likely to quit than females.

Figure 3 below illustrates quit rates across different DSM-IV diagnostic categories. Inability to quit among current substance abusers was highly significant ($<.0001$) compared to the general inpatient sample with only 10.4% quitting. Quitting also negatively correlated (.016) among patients diagnosed with psychotic disorders--only 9.5% in the group. Specific subgroup quit rates ranged from 5%-11.8%. Of the 40 patients diagnosed with schizophrenia, only two had quit smoking at the time of data abstraction (5%).

Suicidality, affective disorder and personality disorder were all positively correlated with quitting smoking-- reflecting that patients with these diagnoses were more likely to quit smoking compared to other inpatients. Their quit percentages ranged from 15.7%-22.5%. Anxiety disorder was not significantly related to quitting compared to other diagnoses.

DISCUSSION

General findings

Our results clearly illustrate high cigarette smoking rates in psychiatric inpatients. We found high rates of both current and lifetime smoking in our Olmsted County sample with rates of current smoking across the entire sample twice that of the general population. Due to our large sample size, our study was able to describe and differentiate specific smoking patterns in diagnostic groups. Our data closely replicates and extends previous work done by Prochaska and colleagues in a different inpatient setting and geographic region in the United States.[44]

Their sample, set in a large urban area, utilized structured clinical interviews for diagnosis rather than clinical diagnosis. Our sample, consisting of a mid-west geographically bound population, using clinical diagnosis and hospital records, was very similar in comparative average smoking rates, 42% in their sample[44] versus 45.9% in our sample, and across general diagnostic groups.

We expected to find high rates of smoking associated with substance abuse diagnoses and severe difficulties with quit rates, and our data confirmed our hypothesis and is quite consistent with the literature. However, we also hypothesized that smoking rates in psychotic illness would be approximately 80% or greater and approach the same general rates seen in substance abuse. This hypothesis was based on our questions related to sampling bias with previous community studies[14,15,48] which showed smoking rates of approximately 60% of patients with psychotic illness compared to both clinical experience reflecting that the vast majority of patients with schizophrenia smoke and other reported literature rates of >70%.[49,50] Our findings disproved our hypothesis and were consistent with other community-based studies.

A strong argument can be made that psychotic patients may be less likely to allow research authorization and chart review based on their paranoia. This may be a factor influencing lower rates of smoking in psychotic illness than we expected to find in our study. However, a counter-argument can also be made that studies which are community-based and have a large sample size may be more representative. That said, our rates of stopping smoking in psychotic illness are quite consistent with the literature on schizophrenia and smoking cessation which reflects great difficulties in stopping smoking. Our 100% current smoking rate finding in the thirteen patients with methamphetamine psychosis may reflect the combined marked co-morbidity between substance abuse, psychosis, and smoking, but may also be a clinical illustration of recent animal research findings showing central nervous system receptor associations between nicotine and methamphetamine use.[51,52]

Suicide Risk

There are important additional findings beyond our confirming previous high rates of inpatient smoking and further describing differences in smoking based on diagnosis. Our research specifically focused on a complex behavior, suicide and suicide related behaviors, using clinical decision of admission for acute suicide risk to an inpatient unit as a general proxy for future suicide risk. This is based on the high future risk of completed suicide associated with inpatient admission and high levels of psychiatric co-morbidity – 72% of sample.

Though our study was not designed to control, define, and differentiate between the multitude of risk factors associated with suicide, some observations can be made based on our general findings. First, smoking rates in one of the most high risk populations, psychiatric inpatients, are twice the national average at a baseline. Single diagnoses which place patients into much higher risk categories for suicide – depression, bipolar disorder, psychosis, personality disorder, anxiety disorder – are frequently co-morbid with substance abuse. Thirty-six percent of our patients had co-morbid substance abuse. Contextually, it is important to note that this is a United States sample and based on present-day national reimbursement policies, substance abuse detoxification alone is not a basis for psychiatric admission. Therefore, those admitted with substance abuse diagnoses were typically admitted due to concerns about suicide risk. Psychiatric inpatients diagnosed with substance abuse smoke at almost four times the U.S. national smoking rate.

Smoking has been recently identified as one of six powerful independent factors in generating clinical prognostic models predicting future suicide attempts in psychiatric patients.[53] However, as we noted, in our intergroup comparisons of psychiatric inpatients, we did not find differences between smoking status in those admitted for suicide risk. We believe this is related

to the high baseline smoking prevalence of psychiatric inpatients. As we described earlier, clinically meeting a threshold of psychiatric illness severity requiring hospitalization places patients at markedly higher risk.[40] Our findings raise questions about the generalizability of this model for the subset of psychiatric inpatients. However, our study was not designed to measure future suicide attempts or completed suicides in our population. Future research looking at the usefulness of the clinical prognostic model described for inpatients would be helpful.[53]

Limitations

Our use of clinical diagnoses by board certified psychiatrists may have resulted in inaccurate diagnoses and influenced our results. Clinicians may have neglected to diagnose other co-morbid psychiatric disorders and focused on primary diagnosis felt responsible for admission. Our baseline population is not as diverse racially as other communities and may not be reflective of other U.S. and international populations. We may have a sample selection bias due to the influence of patients who refused medical record research authorization. This bias may have influenced larger sample and sub-sample results. Our definitions of smoking status were clinically obtained from patients and do not reflect total pack years and quit attempts.

Summary

Our findings clearly demonstrate stratification of smoking in diagnostic groups by substance abuse, psychotic disorders, affective disorders, and then anxiety and personality disorders. Though all groups smoke higher than national averages, those smokers with current alcohol or drug abuse smoked at an extremely high rate and had pronounced difficulty stopping smoking. Patients with a psychotic disorder separated out from other inpatients next by current smoking rates and also had profound difficulty stopping smoking. In comparison, patients with depression and suicide risk were able to stop smoking, but consistent with already existing literature, do not have the same quit rates as the general population.

Importantly, our findings further identify future public health targets for smoking cessation interventions. As expected, we found patients were more likely to stop smoking as they aged. In our sample, patients aged 18-24 smoked at double the general population rates. Doll and colleagues have shown decided reductions in morbidity and mortality associated with patients stopping smoking earlier in life.[54] In their research, stopping smoking at age thirty avoided almost all effects on mortality while stopping by age 50 decreased mortality ratios by half. Further recent work by Prochaska[55] reflects minimal success for inpatients stopping smoking after discharge from smoke-free inpatient psychiatric hospitalizations, but also noted that support and smoking cessation treatment efforts were not intensive. However, with emphasis now on smoke-free treatment settings along with additional medication treatment options, psychiatric hospitalization may offer an opportunity for patients to both build confidence in being able to not smoke and to manage withdrawal systems. This needs to be combined with improved integration with smoking cessation programs outside the hospital. A systematic inpatient and outpatient clinical focus on smoking cessation in younger patients with psychiatric illness may strongly mitigate morbidity and mortality. This focus is essential in order to address the growing gap in survival[13] of those with serious mental illness.

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Figure 1.
inpatient smoking Rates by Age Compared to U.S and Minnesota Smoking Rates

Figure 2.
Current Smokers by Diagnosis

Figure 3.
Quit Percentage by Inpatient Diagnostic Group (Lifetime Smoking minus Current Smoking)

Table 1

Lifetime, Current Smoking Status and Quit Percentage by Diagnosis

DIAGNOSIS	% of Total Patients (776)	% of Lifetime Smokers Total= 60,95 (473)	p Value	% of Current Smokers Total=45,9 (356)	p Value	% of Quitters Total=24,7 (473-356=117/473)	p Value
Current Substance Abuse Diagnosis							
Alcohol abuse/dependence	36.13 (280)	87.5 (245) ¹	<.0001	77.1 (216) ¹	<.0001	10.4 (29) ¹	<.0001
Drug abuse/dependence	25.81 (200)	86 (172) ¹	<.0001	77 (154) ¹	<.0001	9 (18) ¹	<.0001
Affective Disorder							
Depression	20.65 (160)	90.6 (145) ¹	<.0001	81.3 (130) ¹	<.0001	9.4 (15) ¹	<.0001
Bipolar Disorder	80.26 (622)	61.3 (381)	-----	45.3 (282)	-----	15.9 (99) ^{1,2}	.018
Other Depressive Disorder	10.84 (84)	66.7 (56)	-----	48.8 (41)	-----	17.9 (15)	-----
Admission Secondary to Concerns About Suicide							
Anxiety Disorder	69.42 (538)	60.4 (325)	-----	44.8 (241)	-----	15.6 (84)	-----
Personality Disorder	80.41 (624)	61.4 (383)	-----	45.7 (285)	-----	15.7 (98) ^{1,2}	.047
Psychotic Disorder	18.97 (147)	53.7 (79) ^{1,2}	.046	38.8 (57) ^{1,2}	.037	15 (22)	-----
Schizoaffective Disorder	10.32 (80)	58.8 (47)	-----	36.3 (29) ^{1,2}	.034	22.5 (18) ^{1,2}	.015
Schizophrenia	16.39 (127)	65.4 (83) ¹	-----	55.9 (71) ¹	.02	9.5 (12)	1 .016
Other Psychotic Disorder	4.39 (34)	61.8 (21)	-----	50 (17)	-----	11.8 (4)	-----
Psychosis related to methamphetamine abuse	5.16 (40)	65 (26)	-----	60 (24) ³	.078	5 (2) ¹	.031
	6.84 (53)	67.9 (36)	-----	56.6 (30)	-----	11.3 (6)	-----
	1.68 (13)	100 (13) ¹	.0003	100 (13) ¹	<.0001	0 (0) ¹	.027

¹ Significantly different than aggregate inpatient population without indicated diagnosis² Negatively correlated such that inpatient group with indicated diagnosis was less likely to smoke compared to larger group³ Sublevel was suggestive but not significant