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Reward Value of Cigarette Smoking for Comparably Heavy Smoking Schizophrenic, Depressed, and Nonpatient Smokers

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Objective: The study goal was to determine whether schizophrenic and depressed smokers perceive the reinforcement value of cigarette smoking differently from nonpsychiatric smokers who smoke as heavily.

Method: The authors assessed the preferences for smoking cigarettes versus engaging in other pleasant activities, the perceived advantages and disadvantages of smoking, and the amount of reinforcement that would be needed to attain smoking abstinence among 26 schizophrenic, 26 depressed, and 26 nonpsychiatric heavy smokers.

Results: Both schizophrenic and depressed participants chose smoking as their preferred activity more often than nonpsychiatric smokers, and they did not differ from each other. The patients also exceeded the comparison group in the benefits they ascribed to smoking and felt they would require more incentives to quit, but they attributed comparable drawbacks to smoking.

Conclusions: Schizophrenic and depressed smokers recognize many drawbacks associated with smoking, but compared to nonpatients who smoke as heavily, they also perceive more benefits and find cigarettes more appealing than alternative rewards. The heightened reward value of smoking warrants attention in tailoring tobacco control interventions for schizophrenic and depressed smokers.

Cigarette smoking remains the greatest preventable cause of death and disease in the United States (1, 2). After declining steadily for several decades, the prevalence of smoking stabilized in 1990 and since has decreased only minimally (3). The plateau in the smoking rate derives partly from several subpopulations of recalcitrant smokers who have been unable to quit (4, 5).

Schizophrenic and depressed smokers are two subgroups that have been especially difficult to reach. A decade-long antismoking campaign that made most hospitals smoke-free (6–8) has done little to decrease rates of smoking by psychiatric patients. Nor have either generic or selectively targeted treatments achieved notable success in promoting smoking cessation among either schizophrenic (9–12) or depressed (13, 14) individuals. Only about 1% of the population is affected by schizophrenia, but the prevalence of nicotine dependence among schizophrenic people is very high (58%–92%) (15–18). Major depression affects about 15% of the population and has a smoking prevalence rate of 31%–61% (15, 19, 20), higher than that for the general population (20%–30%) (3) but lower than that for schizophrenia. Thus, comorbidity of nicotine dependence with these two forms of psychopathology affects a substantial segment of the population, adding to health care expenditures (21–23). Higher rates of smoking in schizophrenia and depression cannot be explained by differences in socioeconomic status, occupation, education, marital status, caffeine intake, or institutionalization, because they persist even after the effects of these confounding variables are taken into account (15).

The influences that make schizophrenic patients especially likely to smoke could be the same ones that lead depressed individuals to smoke, or they could differ. Consequently, we tested two alternative hypotheses: 1) diagnostic specificity: that schizophrenic patients find smoking more rewarding than depressed patients, and 2) psychopathologic commonality: that schizophrenic and depressed smokers find smoking similarly more rewarding than do comparison smokers without psychiatric disorders other than nicotine dependence.

The substantially higher prevalence of smoking in schizophrenia than depression suggests diagnostic specificity, which might reflect schizophrenia’s unique pathophysiology or treatment. For example, schizophrenic patients may smoke to reduce the side effects of antipsychotic medications (24), although support for that proposition has been mixed (25–27). Also, schizophrenic patients may smoke to alleviate negative symptoms (11). Nicotine may be particularly reinforcing in schizophrenia because it stimulates the subcortical reward system and the prefrontal cortex, which both appear to be hypofunctional in schizophrenia (28–30). Through its action at nicotinic
cholinergic receptors, nicotine increases firing of dopamine neurons in mesocorticlimbic pathways, enhancing dopamine release in both the nucleus accumbens and prefrontal cortex (28). Dopamine deficiency and low metabolic activity in these regions have been linked to the negative symptoms (29) and sensory gating deficits (31) that characterize schizophrenia.

Alternatively, smoking might function to ameliorate behavioral and biological vulnerabilities that are shared by schizophrenic and depressed individuals. For example, self-administering nicotine through smoking might transiently help to ameliorate anhedonia: a diminished capacity for pleasure that is evident in both schizophrenia and depression (32, 33). Nicotine’s ability to directly trigger dopamine release in mesolimbic reward centers may render smoking one of few remaining reinforcers that schizophrenic and depressed patients experience as pleasurable (34). There are functional interactions between the cholinergic system and other neurotransmitter systems (e.g., glutamate, γ-aminobutyric acid [GABA], serotonin) that are abnormal in the two disorders. Self-administering nicotine may, therefore, serve to mediate affective, cognitive, and behavioral problems that arise from dysfunction in several neurotransmitter systems (28, 35, 36).

In this study we compared several aspects of the reinforcing value of smoking for schizophrenic, depressed, and nonpsychiatric comparison subjects. One facet was the perceived advantages (“pros”) and disadvantages (“cons”) associated with smoking. We predicted that a decisional “balance sheet” of either the patients generally or the schizophrenic patients particularly would show that their perception tipped more strongly than that of comparison subjects toward believing that the pros of smoking outweigh the cons. We further expected that the biased decisional balance would result from the perception that smoking has both more pros and fewer cons than perceived by the comparison subjects. The rationale for predicting greater pros was that smoking should serve as a potent negative reinforcer particularly for schizophrenic patients, and perhaps more generally for psychiatric patients, because it dispels troublesome psychiatric symptoms (e.g., negative symptoms and medication side effects for schizophrenic patients, attentional problems and dysphoric mood for both schizophrenic and depressed patients). The rationale for predicting fewer perceived cons of smoking was that the cognitive deficits and social isolation that occur especially in schizophrenia but also in depression (37–39) might insulate patients from learning to fully appreciate the negative consequences of smoking.

In addition to the perceived pros and cons of smoking, we also evaluated two other aspects of smoking’s reward value. One was participants’ reported preferences for engaging in smoking rather than alternative pleasant activities. We expected that either the schizophrenic patients specifically or both psychiatric groups would show greater than normal preferences for smoking over other activities. The rationale was that smoking may remain one of few dependable sources of pleasure by virtue of its ability to directly trigger dopamine release. Finally, we also appraised reward value by quantifying how much of each of a variety of rewards smokers felt they would require in order to quit smoking permanently. We predicted that schizophrenic patients particularly or patients generally would feel they needed greater than normal rewards to quit.

To validly test the study hypotheses, the research design needed to control for smoking rate. Otherwise, apparent differences between patients and normal subjects could arise spuriously from the fact that patients, especially schizophrenic ones, tend to smoke heavily (15). So that differences between psychiatric and nonpsychiatric smokers would not be attributable to different smoking rates, we compared psychiatric outpatients to a normal comparison group of firefighters, a group characterized by heavy smoking (40).

Method

The study had 78 participants: 26 with schizophrenia (disorganized subtype, N=9; paranoid, N=9; catatonic, N=4; undifferentiated, N=4), 26 with major depression (recurrent in all cases), and 26 nonpsychiatric comparison smokers. The schizophrenic and depressed subjects were outpatients receiving treatment at an urban psychiatric rehabilitation center. All of the schizophrenic patients were taking typical neuroleptics; the depressed patients were taking either selective serotonin reuptake inhibitors or tricyclic antidepressants. The nonpsychiatric comparison smokers were employees at a local fire station. The eligibility criteria required that participants be older than 18 years of age, smoke more than 15 cigarettes per day, and lack evidence of gross cognitive impairment (evidenced by a Mini Mental State Examination [41] score higher than 24).

A pilot study was conducted to determine whether the schizophrenic and depressed patients could be diagnosed reliably on the basis of chart review and whether the nonpatients’ screening interview reports of psychiatric symptoms corresponded to the results of semistructured interviews. An advanced clinical psychology graduate student administered the patient version of the Structured Clinical Interview for DSM-III-R (SCID) (42) to seven schizophrenic patients and five depressed patients from the rehabilitation center and the nonpatient version to five firefighters. Findings of 100% concordance between the SCID and chart review diagnoses for the patients and between the SCID and screening interview diagnoses for the nonpatients supported the use of screening interview diagnoses, supplemented for patients by chart review.

Nonpsychiatric comparison smokers were excluded if they presented evidence of any current or past axis I disorder other than nicotine dependence. Psychiatric participants were excluded if they exhibited comorbid axis I disorders other than schizophrenia, depression, and nicotine dependence. Those with schizoaffective disorder were excluded. The interviewer also assessed demographic and smoking characteristics and administered the Fagerstrom Tolerance Questionnaire (43) to measure physical dependence on nicotine. After complete description of the study to the subjects, written informed consent was obtained. Assessments were usually performed on a single day, during which participants could take smoking breaks.

Perceived pros and cons of smoking were assessed by a modified 28-item version of the Decisional Balance Scale (44). Partici-
Results

All three groups of participants were nicotine-dependent, heavy smokers who had smoked since their teenage years (Table 1). Univariate analysis of variance (ANOVA) detected no differences among the groups in the number of cigarettes smoked daily. The percentages of women in the three groups were as follows: schizophrenic, 26.9% (N=24); depressed, 50.0% (N=13); comparison, 19.2% (N=5); and Fagerstrom score were treated as covariates in the analysis of these outcomes. ANCOVA was not used to analyze pros and cons because the slopes of the regressions predicting these outcomes from age and Fagerstrom score were not parallel across the groups. Therefore, for the analysis of pros and cons, age and Fagerstrom score were transformed to discrete variables and treated as ANOVA blocking factors, making it possible to examine any interactions with group (45). Age was dichotomized as ≤36 years versus older, and Fagerstrom score was trichotomized as ≤7 versus 8 versus ≥9. Pros and cons were analyzed by two univariate ANOVAs rather than by multivariate analysis of variance, because they were uncorrelated (r=0.07, df=78). For all analyses, two a priori orthogonal contrasts examined the alternative hypotheses that the schizophrenic patients differed from the depressed patients (diagnostic specificity) and that the two patient groups differed from the nonpatients (psychopathologic commonality).

Analysis of the decisional balance indexes, controlling for age and Fagerstrom score, indicated that the groups differed significantly (F=15.2, df=2, 73, p<0.001). Consistent with psychopathologic commonality, the patients, compared to the normal subjects, attributed relatively greater advantages than disadvantages to smoking (F=27.9, df=1, 73, p<0.001), and there were no significant differences between the schizophrenic and depressed patients. The positive decisional balances shown by the schizophrenic (mean=10.31, SD=4.74) and depressed (mean=11.81, SD=3.29) smokers indicated that both groups appraised the advantages of smoking as greatly outweighing the disadvantages. In contrast, the index approached zero for the nonpsychiatric comparison subjects (mean=0.42, SD=3.52), indicating that they judged the pros and cons of smoking nearly equivalent.

As expected, the groups differed significantly on how strongly they endorsed the pros of smoking (Figure 1), and there were no interactions with age or Fagerstrom score. Consistent with psychopathologic commonality, the patients exceeded the comparison subjects in the pros they ascribed to smoking (F=187.0, df=1, 75, p<0.001). The scores of the schizophrenic patients (mean=32.85, SD=3.71) and depressed patients (mean=33.88, SD=3.48) did not differ significantly and were both higher than that of the comparison subjects (mean=22.77, SD=2.32). Unexpectedly, the groups failed to differ in their perceptions of the negative consequences of smoking (comparison: mean=22.35, SD=2.87; schizophrenic: mean=22.54, SD=3.71; depressed: mean=23.31, SD=3.61; comparison: mean=22.77, SD=2.32).

## Table 1. Demographic and Smoking Characteristics of Schizophrenic, Depressed, and Nonpsychiatric Heavy Smokers

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Patients With Schizophrenia (N=26)</th>
<th>Patients With Major Depression (N=26)</th>
<th>Nonpsychiatric Comparison Subjects (N=26)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td>Age (years)²</td>
<td>40.00 (10.85)</td>
<td>35.31 (11.13)</td>
<td>26.20 (11.69)</td>
</tr>
<tr>
<td>Education (years)</td>
<td>11.81 (2.15)</td>
<td>13.21 (2.24)</td>
<td>12.96 (1.01)</td>
</tr>
<tr>
<td>Packs smoked per day</td>
<td>1.85 (0.85)</td>
<td>1.83 (0.84)</td>
<td>1.81 (0.72)</td>
</tr>
<tr>
<td>Age when smoking began (years)</td>
<td>15.88 (5.46)</td>
<td>14.50 (4.56)</td>
<td>14.73 (3.64)</td>
</tr>
<tr>
<td>Score on Fagerstrom Tolerance Questionnaire²</td>
<td>9.04 (1.68)</td>
<td>9.00 (1.57)</td>
<td>7.54 (1.82)</td>
</tr>
</tbody>
</table>

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² Significant difference among groups (F=10.2, df=2, 76, p<0.001).  
² Significant difference among groups (F=6.6, df=2, 76, p<0.01).
There was no interaction with age or Fagerstrom score. The results, shown in Figure 1, indicate that the schizophrenic and depressed patients recognized the disadvantages of smoking as fully as did the nonpsychiatric comparison smokers but considered them less impressive than the advantages.

Also supporting psychopathologic commonality, both patient groups exceeded the comparison subjects in their reported preferences for smoking rather than other pleasant activities, after age and Fagerstrom score were controlled for (Figure 2). Again, there was no difference between the schizophrenic and depressed patients. As shown in Figure 2, the average nonpsychiatric comparison subject chose smoking over other rewards in about 33% of the 15 choices (mean score=5.27, SD=1.04), whereas the average schizophrenic and depressed patients preferred smoking in about 67% of the choices (schizophrenic: mean=10.42, SD=1.88; depressed: mean=10.04, SD=1.87).

Finally, controlling for age and Fagerstrom, we found that the groups differed in the magnitude of the rewards they would find necessary in order to quit smoking (Figure 3). Again, the schizophrenic (mean score=102.65, SD=2.15) and depressed (mean=102.62, SD=2.52) smokers failed to differ from each other. Both patient groups felt that quitting would require substantially more rewards than did the comparison smokers (mean=69.35, SD=7.93).

Discussion

The results of this study indicate that both schizophrenic and depressed smokers associate greater advantages and reward value with cigarette smoking than do individuals without psychiatric disorders who smoke as heavily. There were virtually no differences between the patient groups. The findings also show that the patients appreciated the drawbacks of smoking as fully as the nonpsychiatric comparison subjects but considered them less impressive than the advantages.

The rarity of smoking cessation by schizophrenic and depressed smokers has remained largely unexplained. Candidate explanations have been that patients 1) have minimal contact with antismoking messages and little access to smoking cessation treatment, 2) are characterized by a preponderance of heavy smokers, or 3) experience nicotine effects on psychopathologic vulnerabilities that render the smoking habit exceptionally rewarding and difficult to break. The current prevalence of nonsmoking environments and media antismoking messages, coupled with the availability of over-the-counter cessation aids, make it increasingly implausible that psychiatric patients smoke because they are unaware of the risks or lack access to cessation resources. Indeed, the current findings contradict that premise, by showing that psychiatric patients
that disorder but held many sociodemographic features in
lected depressed patients who were unrepresentative of
schizophrenic patients. Two explanations suggest them-
higher prevalence of smoking usually observed among
pressed smokers was surprising, especially given the
analyses controlled for them.
for smokers with other psychiatric disorders because our
pendence can explain the greater reward value of cigarettes
we think it unlikely that group differences in nicotine de-
comparable nicotine exposure, is intriguing. Nevertheless,
psychiatric comparison subjects, even given seemingly
apparently exhibit greater nicotine dependence than non-
patients, smoked heavily (nearly two packs per day), and there was no differ-
ence among them in the amount smoked. It is interesting
that, despite smoking equally heavily, the patients reported
features (such as smoking soon after awakening) that sug-
greater physical dependence on nicotine. That patients
apparently exhibit greater nicotine dependence than non-
psychiatric comparison subjects, even given seemingly
comparable nicotine exposure, is intriguing. Nevertheless,
we think it unlikely that group differences in nicotine de-
pendence can explain the greater reward value of cigarettes
for smokers with other psychiatric disorders because our
analyses controlled for them.

The lack of difference between schizophrenic and de-
pressed smokers was surprising, especially given the
higher prevalence of smoking usually observed among
schizophrenic patients. Two explanations suggest them-
selves. One is that, by studying only heavy smokers, we se-
lected depressed patients who were unrepresentative of
that disorder but held many sociodemographic features in
common with schizophrenic patients. An alternative ex-
planation that seems more likely is that there may be
genuine commonalities in what hooks schizophrenic and
depressed smokers to their cigarettes. Plausibly, schizo-
phrenic and depressed individuals share certain neurobi-
ological features, either premorbidly or as a consequence
of illness, medications, comorbid addictions, or even
chronic nicotine exposure, that render nicotine a particu-
larly appealing drug to self-administer. Earlier we posited
that nicotine’s ability to trigger dopamine release in me-
solimbic reward centers might render smoking one of
the few reinforcers able to overcome the anhedonia that char-
acterizes schizophrenia and depression (28). Beneficial ef-
fects on other core affective and cognitive psychopatho-
logic vulnerabilities may also occur (46), mediated by
nicotine’s effects on serotonin, glutamate, GABA, and
acetylcholine (36).

Certain limitations of the current study need to be con-
considered. First, the findings can be interpreted only as indi-
cating that cigarette smoking (not necessarily nicotine)
has disproportionate reward value for schizophrenic and
depressed smokers. Laboratory experimental studies are
needed to differentiate between the pharmacological ef-
effects of nicotine and the sensory effects of smoking on
perceived reward. Second, the data were based on self-re-
ports provided by psychiatric patients. Can such self-re-
ports, particularly those of patients with schizophrenia,
be considered valid? Some reassurance derives from the
consistent pattern of group differences across all mea-
sures of smoking’s reward value, from how closely the re-
ports of the schizophrenic patients resembled those of
the depressed outpatients, and from the fact that all of the
groups seemed well informed of the negative conse-
quences of smoking. Nevertheless, it would be advanta-
geous for the results to be replicated by behavioral proto-
cols not requiring participants to have any insight into
their own motivations (see reference 47). Third, the gen-
eralizability of the findings remains unclear. The patients
with psychiatric disorders had relatively high levels of
functioning; the groups included only patients who were
able to live outside the hospital, manage their own ap-
pointment schedules, and pass the mental state entry cri-
teria imposed for this study. It cannot be assumed that the
results, perhaps particularly those showing full awareness
of the disadvantages of smoking, would generalize to
more severely impaired patient populations.

The results may have implications for smoking cessa-
tion treatment. Research guided by the transtheoretical
model has shown that people progress through a series of
stages in their readiness to initiate change in health-re-
lated behavior (48). The patients’ motivational balance
sheet, in which the pros of smoking outweighed the cons,
is typical of people in the precontemplative stage of readi-
ness to quit smoking. Smokers in the precontemplative
stage recognize intellectually that they need to quit, but
they are not actually intending to make an attempt to quit

**FIGURE 3. Amounts of 15 Rewards Considered Necessary
to Quit Smoking by Schizophrenic, Depressed, and Non-
psychiatric Heavy Smokers**

<table>
<thead>
<tr>
<th>Reward Value</th>
<th>Nonpsychiatric Comparison Subjects (N=26)</th>
<th>Patients With Major Depression (N=26)</th>
<th>Patients With Schizophrenia (N=26)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>a= minimal other rewards needed to quit smoking (needs only 1 unit of each of 15 rewards)</td>
<td>b= maximal other rewards needed to quit smoking (needs 10 units of each of 15 rewards)</td>
<td>Significant difference among groups (F=12.5, df=2, 73, p=0.0001).</td>
</tr>
</tbody>
</table>
in the foreseeable future. To progress to the stage of contemplation, which involves seriously thinking about making an attempt to quit, the smoker needs to experience a decline in the perceived advantages of smoking. The heavy-smoking nonpatient participants in this study differed from the patients in showing a typical motivational balance for contemplators: one in which the perceived advantages of smoking have lessened and are roughly equivalent to its perceived drawbacks. The contemplator’s likelihood of moving into the stage of preparing to make a quit attempt will be enhanced by experiences that enhance feelings of self-efficacy about being able to quit.

Enrollment in smoking cessation treatment has been shown to be unproductive until a smoker reaches the stage of at least contemplating, if not actively preparing to quit, referral to smoking cessation treatment would be premature and ineffectual. More appropriate and needed to quit, a quit attempt (49). If the patients in the current study are representative of other schizophrenic and depressed smokers in being at a very early stage of readiness to quit, referral to smoking cessation treatment would be premature and ineffectual. More appropriate and needed forms of tobacco control intervention for smokers with psychiatric disorders may involve motivational interviewing and other brief interventions that overcome barriers to quitting nicotine addiction: acute positive reinforcement and withdrawal. Nicotine Tob Res 2000; 2:19–37.

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REWARD VALUE OF CIGARETTE SMOKING

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