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Original article

Cigarette smoking in obsessive-compulsive disorder and unaffected parents of OCD patients

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ABSTRACT

Background: Cigarette smoking is more prevalent among individuals with psychiatric disorders than the general population. Obsessive-compulsive disorder (OCD) may be an intriguing exception, although no recent study has investigated this hypothesis in OCD patients. Moreover, it is unknown whether reduced smoking rates are present in unaffected first-degree relatives of OCD patients.
Methods: We assessed smoking prevalence in adults with OCD and unaffected parents of youth with OCD (PYOCD). To this end, 113 adults with OCD completed online questionnaires assessing symptom severity and smoking status. Smoking status was obtained from an independent sample of 210 PYOCD assessed for psychiatric diagnoses.
Results: Smoking prevalence rates in adults with OCD (13.3%; $n = 15$) and PYOCD (9.5%; $n = 20$) samples were significantly lower than those found in representative samples of the general population (19–24%, all $P < .001$) and Axis I disorders (36–64%; all $P < .001$). There were no smokers in the adult OCD subset without clinically significant depressive symptoms ($n = 54$).
Conclusion: Low prevalence of smoking in OCD may be familial and unique among psychiatric disorders, and might represent a possible state-independent OCD marker. Hypotheses concerning the uncharacteristically low prevalence rates are discussed with relation to OCD phenomenology and pathophysiology.

1. Introduction

Cigarette smoking produces significant detrimental effects on general health and longevity. Smoking is associated with various types of cancer, diabetes, cardiovascular and respiratory diseases, and a general increase in mortality [64]. Annually, smoking causes between 5–6 million deaths worldwide [41]. Psychiatric disorders are considered major risk factors for cigarette smoking [3,21,48,81]. Indeed, 7% of the US population that meets criteria for both a psychiatric disorder and nicotine dependence consumes 34% of the cigarettes smoked in the US [35].

Epidemiological studies estimate that 19% of the adult general population (US [14]) smoke cigarettes. However, smoking rates are substantially higher among individuals with psychiatric disorders such as schizophrenia (62%–90% [3,18,20]), bipolar disorder (44%–69% [20,48]), depression (30%–60% [81]), and attention deficit/hyperactivity disorder (ADHD, 42% [47,67]). Taken together, 50%–80% of psychiatric patients in the US are daily smokers [78].

An intriguing exception to this rule may be obsessive-compulsive disorder (OCD), a prevalent (2.3% [70]) and debilitating disorder, which appears to be associated with low smoking rates [7,39]. Specifically, a small number of studies examining daily smoking in OCD subjects found significantly lower prevalence rates of smoking compared to rates reported in both general and psychiatric populations. In the first study to examine smoking in OCD, Bejerot and Humble [7] recorded the smoking status of 193 participants with OCD compared to 52 non-OCD psychiatric outpatients and a national normative sample in Sweden. The authors found that 14% of the OCD patients were current smokers, compared to 42% in the psychiatric outpatient group and 25% in the general population.

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Results from three additional studies are in support of this finding and reported smoking prevalence rates in OCD ranging from 5.5%–20% [6–8,54]. However, these studies did not address the potential mediating effect of depression and impulsivity, and provided little information regarding important aspects of smoking behaviors (e.g., level of nicotine dependence, and number of cigarettes per day). Moreover, the last two decades have been characterized by a consistent decline in smoking in the US population. The most recent report regarding smoking prevalence in a sample with OCD ($n = 39$) was published 9 years ago [6]. Furthermore, extrapolation from European prevalence data to the US is difficult due to trans-continental differences in cultures, attitudes towards smoking, and anti-smoking campaigns.

Thus, the first goal of the current study was to evaluate smoking rates in a current US cohort while addressing the limitations of previous research in this area. In light of prior hypotheses that nicotine might exacerbate an already hyperactivated frontal cortex and worsen OCD symptoms [7], we expected lower prevalence rates of cigarette smoking in OCD patients compared to psychiatric cohorts and large normative samples of the general population, as well as lower levels of nicotine dependence, fewer cigarette smoked per day, and fewer heavy smokers in our OCD sample. Moreover, in light of ample evidence regarding the association between depressive disorders and smoking [48], as well as evidence of the mediating role of depressive symptomatology in smoking onset and escalation [42], we expected to find a positive association between depression and depressive severity and smoking in OCD. That is, we hypothesized higher prevalence of smoking among depressed OCD patients compared to non-depressed OCD patients as well as among OCD patients with clinical levels of depressive symptoms compared to patients with subclinical levels of depressive severity (regardless of the presence of depressive disorder). Finally, in considering evidence that cigarette smoking is strongly associated with impulsivity [26], we hypothesized that OCD smokers will be more impulsive than OCD non-smokers.

A second goal of the current study was to investigate whether reduced smoking rates might extend to unaffected first-degree relatives of individuals with OCD and thus represent a familial characteristic of OCD. Prior evidence suggests that risk for cigarette smoking may be familial [9], and the familial transmission is likely influenced by a combination of genetic and environmental factors [5,19,43]. Results from familial risk studies suggest that OCD is a familial disorder [30,61]. Furthermore, results from imaging studies suggest that unaffected first-degree relatives of OCD patients share some frontostriatal functional abnormalities [16,17], abnormal error-related brain activity [69], and white matter abnormalities [55]. Based on suggestions that smoking may exacerbate OCD pathology via nicotine effects on an putatively hyperactive frontal cortex [7], and evidence for shared neurobiological abnormalities in unaffected first-degree relatives of OCD patients, we hypothesized that unaffected parents of OCD probands would also show lower prevalence rates of smoking compared to the general population.

2. Subjects and methods

2.1. Recruitment

Recruitment for the OCD sample consisted of four cohorts; the first cohort included 25 participants with a verified diagnosis of OCD who had previously participated in research studies [e.g., 56] or received treatment at the Massachusetts General Hospital OCD and Related Disorders Program. The second cohort consisted of 22 individuals who had sought treatment and consented to be contacted directly for research. The third cohort consisted of 42 participants who responded to an online advertisement on an OCD forum, and the final cohort included 24 participants who responded to advertisements posted on the hospital, program, and the International Obsessive-Compulsive Foundation (IOCDF) web page.

Parents of youth with OCD were recruited as part of an OCD family study via referral to the Pediatric OCD Program at McLean Hospital in Belmont, Massachusetts. Detailed recruitment and study methodology is reported elsewhere [31]. In brief, as part of a large pediatric OCD family study, 130 probands and 374 first-degree relatives were recruited mostly via referrals to a pediatric OCD program (22 families were ascertained directly through advertising). No ethnic or racial group was excluded from this study. Families were excluded if probands had a diagnosis of autism or pervasive developmental disorder, or a major sensorimotor handicap (e.g., deafness, blindness) or if they were not adequately fluent in the English language.

2.2. Web-based screening and assessment tool

All data for the OCD sample were collected using REDCap, a secure, web-based survey platform. Upon receiving a link to the study with relevant information and signing an online consent form, participants learned of the compensation for completing the survey (a $10 gift card). Participants then attested that they were at least 18 years of age, that they were previously diagnosed with OCD by a licensed mental health professional (i.e., psychiatrist or psychologist), and affirmed their English proficiency. To determine eligibility, participants completed a DSM-IV-based diagnostic questionnaire for OCD preceded by the statement: "The next short section will assess your eligibility to participate in this study and complete this survey." After entering their initials, eligible participants were redirected to complete the survey, which took 20–40 minutes, depending on the optional measures that appeared for participants who endorsed current, past, or no smoking behaviors.

2.3. Participants

The respective Institutional Review Boards (i.e., Massachusetts General Hospital and McLean Hospital) approved all measures and procedures. The adult OCD survey registered 156 complete entries, and we identified 16 suspicious entries (determined by either incongruent content responses across measures, similar email addresses, and/or reports regarding the referral source that did not match the recruiting cohort), which were subsequently excluded. Participants were included if they were aged 18 or older, proficient in English, and diagnosed with primary OCD. Exclusion criteria included: OCD not being the primary disorder, comorbid diagnosis of ADHD, bipolar disorder, autism, tic disorders, PTSD, anorexia, schizophrenia and bulimia nervosa. These disorders were selected as exclusion criteria in order to decrease the probability of inflated prevalence rates due to known disorder-specific high risk for smoking (e.g., bipolar disorder) and/or anhedonia (e.g., schizophrenia). To probe for comorbid disorders, participants read a brief description of major DSM-IV disorders and answered four multiple-response questions (i.e., "Based on these descriptions, please check any of the disorders you... are likely to have"; "have you ever in your lifetime been diagnosed with one of the following disorders by a psychologist or psychiatrist?") Next, participants selected the disorder that caused the most distress and significant interference with daily functioning. These items included the option to select "other" and specify in an open-ended text box. Using the information provided from items concerning psychiatric diagnoses and comorbidities (i.e., "have you ever in your lifetime been diagnosed with one of the following by a psychologist or psychiatrist?"), we excluded participants ($n = 27$) with a

self-reported diagnosis of ADHD, bipolar disorder, autism, tic disorders, PTSD, anorexia, schizophrenia and bulimia nervosa. Notably, of the 27 participants excluded, 8 (29.6%) were smokers, and 10 (37%) had a primary diagnosis of disorders other than OCD (e.g., PTSD, Tourette's syndrome). OCD was considered primary in cases where participants reported OCD as their most severe disorder *and* the primary cause for functional impairment *and* distress. In the resulting final sample (n = 113), 85% met our criteria for primary OCD, and the remaining 15% reported that OCD was the primary cause for *either* impairment *or* distress.

Diagnostic assessments of PYOCD were based on direct interviews with each parent using the Structured Clinical Interview for DSM-IV (SCID) [25] with supplemental KSADS-E [63] modules to cover childhood diagnoses. Children of PYOCD were assessed using the Kiddie SADS-E (Epidemiologic Version) [63] and diagnoses were based on independent interviews with the mothers and direct interviews of affected children and siblings. Current diagnosis of OCD was the only exclusion criteria determined for the PYOCD sample. The prevalence of current psychiatric disorders among the PYOCD sample were: major depressive disorder 7.1% (n = 15), simple phobia 5.7% (n = 12), social anxiety disorder 4.3% (n = 9), generalized anxiety disorder 2.9% (n = 6), panic disorder 2.9% (n = 6), post-traumatic stress disorder 1.4% (n = 3), and bipolar disorder 0.5% (n = 1).

2.4. Measures

2.4.1. Yale-Brown Obsessive-Compulsive Scale–Self-Report (Y-BOCS-SR [4])

The scale was used to assess OCD symptom severity. The Y-BOCS-SR is analogous to the clinician administered Y-BOCS [32,33], a gold standard measure for OCD symptom severity. The Y-BOCS-SR demonstrates good psychometric properties in clinical and non-clinical samples and is strongly correlated with the clinician administered Y-BOCS. In the present study, internal consistency was very good (Cronbach's α = .91).

2.4.2. Depression Anxiety Stress Scales (DASS-21 [52])

The 21-item DASS is a short self-report measure designed to assess severity of depression, anxiety, and stress. Participants rate seven items of each subscale on a four-point Likert scale ranging from 0 (*never*) to 3 (*most of the time*). In the present sample, Cronbach's α coefficients for the depression, anxiety, and stress subscales were .93, .81, and .88, respectively.

2.4.3. Fagerström Test for Nicotine Dependence (FTND)

Current smokers completed the FTND, the most widely used instrument to establish and quantify nicotine dependence, with six items that provide a total score ranging between 0 and 10 [38]. The FTND has very good psychometric properties in non-psychiatric smokers as well as in clinical populations. Internal consistency for the sample was .75. In this study, we focused on individuals who identified as current smokers.

2.4.4. The Eysenck Impulsiveness Venturesomeness Empathy Scale (IVE)

The IVE [22] is a 63-item self-report questionnaire designed to assess impulsivity and risk-taking (venturesomeness). The IVE has good psychometric properties, with reliability coefficients of .79 and .85 for venturesomeness and impulsivity, respectively [22]. In the present study, α for impulsivity and venturesomeness were .87 and .85, respectively.

2.4.5. The Structured Clinical Interview for DSM-IV (SCID)

The SCID is a gold standard semi-structured DSM-IV-based clinical interview [25] used to diagnose Axis I disorders.

2.5. Statistical analysis

Data analyses were conducted using the Statistical Package for the Social Sciences (SPSS) version 20.0 [40]. Comparison of all prevalence rates between our samples and samples published in other studies, as well as analysis of nominal variables (e.g., gender, income level) were conducted using Pearsons' χ^2 test. Univariate analysis of variance (ANOVA) was used to compare continuous variables such as age, as well as the Y-BOCS, FTND, IVE and DASS-21 scores. We used logistic regression to analyze the relative predictive value of predictors of smoking status between the subsample of OCD smokers and OCD non-smokers. To assess internal consistency we computed Cronbach's alpha. As detailed below, comparison of correlation coefficients was conducted using Fisher's Z transformation. Cohen's d coefficients were used to estimate effect sizes. The significance threshold was set at .05.

2.5.1. Statistical control measures

Web-based research may face unique obstacles. However, studies comparing web-based and face-to-face studies suggest that web-based research is reliable when proper control measures are implemented [34,68]. We used several recommended measures (i.e., multiple recruitment cohorts, control questions that appeared twice, open-ended/detailed-response questions) to increase data integrity and diagnostic validity before and during recruitment, and in the preliminary analysis phase [4,60].

Within-group correlations and acceptable and comparable reliability coefficients between samples may serve as a proxy for OCD diagnosis validity [60]. We therefore compared Cronbach's alphas and within-group correlations between recruitment cohorts [23]. We separately compared the Y-BOCS Cronbach's alpha for the first recruitment cohort (i.e., verified OCD) with the alphas obtained from each of the three subsamples using the formula suggested by Feldt et al. [23]. No significant differences were found between the subsamples (alphas ranging from .81 to .94). We used Fisher's Z transformation to compare within-group correlations between the Y-BOCS and the DASS depression subscale. Again, no significant differences were found between recruitment cohorts (Z scores ranging from .73–.17, P ranging from .46–.86).

3. Results

3.1. OCD sample

Demographic and clinical characteristics of the OCD sample (n = 113) are presented in Table 1. The current sample was primarily characterized by Caucasian participants, and the majority of participants were female.

Analyses revealed that 13.3% (n = 15) of the OCD sample smoked daily. As presented in Table 2, Pearson's χ^2 comparisons between prevalence rates among our samples and prevalence rates reported in large and recent US clinical samples indicated that the prevalence rate found in our OCD sample was significantly lower than the prevalence rates among patients with ADHD, schizophrenia, and bipolar disorder. In addition, the prevalence rate in our OCD sample was significantly lower than the prevalence rates found in a very large representative sample of mentally ill individuals in the US [15]. Comparison with the smoking prevalence in the US general population [14] yielded no significant difference between our OCD sample (13.3%) and a national representative sample (19%; P = .12). However, a significantly reduced prevalence rate was found when compared to a representative sample of adults without mental illness (24%; P = .006) [15].

Table 1
Demographic characteristics of the OCD and PYOCD samples.

Characteristics	OCD (n = 113)	PYOCD (n = 210)
Gender, % (n)		
% Female	62.8 (71)	54.7 (115)
Age		
M (SD)	35.7 (12.5)	44.5 (5.7)
Range	18–61	29–60
Race, % (n)		
Caucasian	90.3 (102)	94.3 (198)
Ethnicity, % (n)		
Hispanic	4.4 (5)	0.5 (1)
Marital status, % (n)		
Single/Never married/Divorced	56.6 (59)	41.1 (86)
Married	43.4 (49)	58.6 (123)
Education, % (n)		
Less than high school diploma	0.9 (1)	6.2 (13)
High school diploma or equivalent	8.8 (10)	15.2 (32)
Some college, 2-year degree	19.5 (22)	24.2 (53)
Bachelor's or professional degree	70.8 (80)	52.8 (111)
Employment status, % (n)[a]		
Employed		98.1 (206)
Full-time	50.9 (56)	
Part-time	13.6 (15)	
Not employed		
Student	11.8 (13)	
Unemployed	14.5 (16)	0.9 (2)
Retired	2.7 (3)	0.9 (2)
Disability	6.4 (7)	
Annual household income, % (n)[b]		
Less than $35,000/year	20.7 (23)	N/A
$35,000–$50,000/year	13.5 (15)	N/A
$50,000–$75,000/year	27.0 (30)	N/A
$75,000–$100,000/year	13.5 (15)	N/A
Over $100,000/year	25.2 (28)	N/A

OCD: obsessive-compulsive disorder; PYOCD: unaffected parents of youth with OCD.
[a] PYOCD were not screened for part- or full-time employment status.
[b] Annual household income was not recorded for the PYOCD sample.

Comparisons between OCD smokers and non-smokers yielded no differences in terms of demographic characteristics (Table 3). Specifically, to address the potential impact of education and household income, which have both been found to affect smoking rates [14], we compared OCD smokers with the subgroup of OCD non-smokers and found no significant differences between the two groups on these measures (both Ps > 0.05). However, in terms of clinical characteristics (Table 4), we found that smokers with OCD scored significantly higher on the IVE impulsivity subscale (P = .008, Cohen's d = .75). No other significant differences emerged.

In order to explore the relative predictive power of factors affecting smoking within the OCD group, we conducted a logistic regression in which Y-BOCS total score, DASS-21 depression score, gender, income, education, and impulsivity were entered as predictors of smoking status. Results reveal that the present model was non-significant ($\chi^2(6) = 10.968$, P = .089). Notably, only impulsivity significantly predicted smoking status, above and beyond all other variables in the equation (OR = 1.175, P = .02). This odds ratio represents a 1.17 times increased risk of smoking for every one-unit increase on the IVE impulsivity scale within the OCD group.

To further assess the impact of comorbid depression severity and presence of any comorbid depressive disorder on smoking, we examined smoking prevalence in two ways. First, we compared smoking rates in subsets of OCD participants with and without a self-reported comorbid depressive disorder. Second, we compared subgroups of OCD that were either above or below the DASS-21 cutoff score for clinical levels versus normal levels of depressive symptom severity (according to the DASS-21 guidelines). There was no significant difference in the prevalence rates of smoking between the OCD subset with (total n = 68, 14.7% smokers) and without (total n = 45, 11.1% smokers) comorbid depression, $\chi^2(1) = .30$, P = .58. However, smoking prevalence among OCD participants with DASS-21 scores in the normal range (depression score ≤ 9; n = 54) differed significantly from OCD participants with clinically significant depression assessed by this scale (n = 59), $\chi^2(1) = 17.53$, $P < .001$, in that there were no smokers in the OCD group without clinically significant depressive symptoms.

Smoking behavior indices are presented in Table 4. The average number of cigarettes smoked per day (NCPD) was 12.2, whereas the average NCPD in the US general adult population is 15.1 [14]. Notably, NCPD among mentally ill individuals (26.2) is higher than the general population [48]. In fact, only one person in our sample met the definition of a 'heavy smoker' (more than 25 cigarettes per day) as opposed to 50% or more among mentally ill populations [48]. OCD participants' FTND scores represented a low level of nicotine dependence (M = 3.20, SD = 2.27) and were significantly lower than scores from a sample of psychiatric patients diagnosed with either schizophrenia or mood disorders [17] (n = 117, M = 6.2, SD = 2.2) F(1, 130) = 24.55, $P < .001$. The mean FTND score among

Table 2
Comparison of smoking prevalence in the present OCD sample (13%, total n = 113) with recent representative surveys and large clinical samples across psychiatric disorders and the general population.

Condition	Paper	Sample	Smokers (%)	$\chi^2(1)$[a]	Sig.[a]
General adult population	CDC MMWR, 2011	NHIS national representative sample 2011 (n = 33,014)	6273 (19%)	2.402	.12
Adults without mental illness	CDC MMWR, 2013	HSDUH national representative sample 2009–2011 (n = 84,700)	20,667 (24%)	7.576	.006
Adults with any mental illness	CDC MMWR, 2013	HSDUH national representative sample 2009–2011 (n = 29,400)	10,613 (36%)	25.567	< .001
Bipolar disorder	McClave et al., 2007	NHIS (n = 387)	180 (46%)	40.416	< .001
Bipolar disorder[b]	Dickerson et al., 2012	The Stanly Research Program (n = 126)	55 (44%)	26.542	< .001
Depression	Pratt et al., 2010	NHNES, 2005–2008 (n = 350)	150 (43%)	31.310	< .001
Depression	Lyons et al., 2006	Vietnam Era Twin Registry (n = 398)	268 (63%)	84.550	< .001
Schizophrenia	McClave et al., 2007	NHIS (n = 150)	89 (60%)	57.191	< .001
Schizophrenia[b]	Dickerson et al., 2012	The Stanly Research Program (n = 421)	268 (64%)	90.786	< .001
ADHD	McClave et al., 2007	NHIS (n = 557)	207 (37%)	24.198	< .001
ADHD[b]	Lambert and Hartsough, 2006	Longitudinal ADHD study (n = 128)	45 (33%)	14.220	< .001

CDC: Centers for Disease Control and Prevention; MMWR: Morbidity and Mortality Weekly Report; NHIS: National Health Interview Surveys; HSDUH: National Survey on Drug Use and Health; NHNES: National Health and Nutrition Examination Survey; ADHD: Attention Deficit/Hyperactivity Disorder.
[a] Analyses in comparison to current smokers (n = 15, 13%) in OCD sample (n = 113).
[b] Large non-representative sample.

Table 3
Demographic characteristics of OCD participants by smoking status.

Characteristics	OCD smokers (n = 15)	OCD non-smokers (n = 98)	F(1, 111)/ χ^2 (1)	P
Gender, % (n)				
% Female	73.3 (11)	61.2 (60)	.817	.37
Age				
M (SD)	35.9 (12.5)	35.7 (12.6)	.001	.97
Race, % (n)				
Caucasian	93.3 (14)	89.8 (88)	.185	.67
Asian	6.7 (1)	10.2 (10)	.700	.40
Ethnicity, % (n)				
Latino/a	6.7 (1)	4.2 (4)	.188	.66
Education, % (n)[a]				
Less than high school diploma	0.0 (0)	1.0 (1)	.185	.67
High school diploma or equivalent	6.7 (1)	9.2 (9)		
Some college or a 2-year degree	20.0 (3)	19.4 (19)		
Bachelor's or professional degree	73.3 (11)	70.4 (69)		
Employment status, % (n)[b]				
Employed				
Full-time	60.0 (9)	49.5 (47)	.059	.81
Part-time	0.0 (0)	15.8 (15)		
Not employed				
Student	6.7 (1)	12.6 (12)		
Unemployed	20.0 (3)	13.7 (13)		
Retired	6.7 (1)	2.1 (2)		
Disability	6.7 (1)	6.3 (6)		
Annual household income, % (n)[c]				
Less than $35,000/year	26.7 (4)	19.8 (19)	3.009	.083
$35,000–$50,000/year	26.7 (4)	11.5 (11)		
$50,000–$75,000/year	6.7 (1)	30.2 (29)		
$75,000–$100,000/year	13.3 (2)	13.5 (13)		
Over $100,000/year	26.7 (4)	25.0 (24)		

OCD: obsessive-compulsive disorder.
[a] Comparison between college vs. no college status.
[b] χ^2 comparison between employed vs. unemployed status.
[c] Two participants from the non-smoking OCD group did not report.

OCD smokers was also significantly lower than the average reported for a large US representative sample (n = 2,120, M = 4.6, SD = .07) [74], F(1, 2133) = 29.19, $P < .001$. The representative sample's mean FTND score represents moderate nicotine dependence, with 3 participants (20%) exhibiting high dependency level (FTND score > 5).

Most of the sample reported at least one serious attempt at smoking cessation. Analysis of participants' free-text responses to their primary and secondary reasons for smoking cessation attempts yielded mostly health-related reasons. None of the participants' reasons were associated with OCD symptomatology (i.e., disgust, cleanliness and contamination concerns) (Table 5).

Table 4
Clinical characteristics of OCD participants by smoking status.

Variable	OCD smokers (n = 15)	OCD non-smokers (n = 98)	F(1,111)	P	Cohen's d
Age first diagnosed, M (SD)	27.3 (9.9)	24.3 (9.9)	1.143	.29	.30
Y-BOCS total score, M (SD)	18.8 (6.6)	19.1 (7.7)	.018	.89	−.04
Y-BOCS obsessions, M (SD)[a]	10.8 (3.6)	9.9 (3.9)	.642	.43	.22
Y-BOCS compulsions, M (SD)[a]	8.0 (4.8)	9.1 (4.2)	.894	.35	−.26
DASS-21 depression, M (SD)[b]	18.0 (12.3)	12.8 (11.1)	2.782	.098	.47
DASS-21 anxiety, M (SD)[b]	12.1 (9.1)	9.3 (8.2)	1.478	.23	.34
DASS-21 stress, M (SD)[b]	21.9 (8.5)	17.7 (9.7)	2.499	.12	.44
IVE impulsivity, M (SD)	10.2 (4.1)	7.1 (4.2)	7.264	.008	.75
IVE venturesomeness, M (SD)	6.8 (3.8)	6.4 (4.0)	.177	.68	.12
Number of comorbidities, M (SD)	1.2 (1.2)	0.8 (0.8)	1.529	.14	.35
			χ^2(1)		
Comorbid any depressive disorder, % (n)	66.7 (10)	59.2 (58)	.304	.58	.10
Comorbid social anxiety disorder, % (n)	20.0 (3)	9.2 (9)	1.603	.21	.24
Comorbid body dysmorphic disorder, % (n)	13.3 (2)	3.1 (3)	3.246	.072	.34
Comorbid panic disorder, % (n)	20 (3)	14.3 (14)	.332	.56	.11
Currently taking medication, % (n)	86.7 (13)	76.5 (75)	.776	.38	.17

OCD: obsessive-compulsive disorder; Y-BOCS: Yale-Brown Obsessive-Compulsive Scale; DASS-21: Depression Anxiety and Stress Scale; IVE: Eysenck Impulsiveness-Veturesomeness-Empathy Scale.
[a] Y-BOCS scores represent mild to moderately severe OCD.
[b] In line with the scoring instructions, DASS-21 sum of subscales are multiplied by two.

Table 5
Smoking behaviors in smokers with OCD ($n = 15$).

Variable	Mean (SD)	Median	Range
Number of years smoking	12.2 (9.1)	11.5	1–30
Average daily number of cigarettes	12.5 (8.4)	10.0	2–30
Heavy smokers, % (n)	6.7 (1)		
FTND total score	3.3 (2.3)	4.0	0–7
Made at least one serious quitting attempt, % (n)	73.3 (11)		
Number of serious quitting attempts	5.2 (3.12)	4.0	1–10
At least one smoker in family of origin, % (n)	80.0 (12)		
Primary reason for attempts at quitting ($n = 11$)			
Health, % (n)	81.8 (8)		
Pregnancy, % (n)	18.2 (2)		
Secondary reason for attempts at quitting ($n = 10$)			
Expensive, % (n)	20.0 (2)		
Smells bad, % (n)	30.0 (3)		
Sense of control/discontinue a bad habit, % (n)	20.0 (2)		
Family/social pressure, % (n)	20.0 (2)		
Cancer in family, % (n)	10.0 (1)		

OCD: obsessive-compulsive disorder; FTND: Fagerström Test of Nicotine Dependence.

3.2. Parents of youth with OCD (PYOCD) sample

Demographic and clinical characteristics of the PYOCD sample ($n = 210$) are presented in Table 1. Similar to the OCD sample, the PYOCD sample was primarily characterized by Caucasian participants, and the majority of participants were female. Smoking prevalence among parents of youth with OCD was 9.5%. This prevalence rate was lower than the prevalence rates found in two recent national US representative samples conducted by the Centers for Disease Control and Prevention in 2011 and 2013 [14,15]. Statistical comparison revealed that smoking prevalence in the PYOCD sample was significantly lower than the one found in a large sample of adults without mental illness (24%, $n = 84{,}700$; $\chi^2(1) = 25.16$, $P < .001$) [15] and the prevalence found in a large representative sample of adults in the general population (19%, $n = 33{,}014$; $\chi^2(1) = 12.21$, $P < .001$) [14].

4. Discussion

The primary purpose of the present research was to assess the prevalence of cigarette smoking in patients with OCD as well as in a sample of unaffected parents of youth with OCD. We found that 13.3% of our OCD sample currently smoked, which was significantly lower than the prevalence rates in major Axis I psychiatric disorders (Table 2). This did not differ from the rates reported in a representative adult US sample (19% [14]) but was significantly lower than the smoking prevalence in a large representative sample of non-mentally ill individuals (24% [15]).

Apart from a non-significant trend toward lower total household income in the smokers group (Table 3), no differences were found on demographic measures between smokers and non-smokers with OCD. However, in terms of clinical correlates, smokers with OCD were found to be more behaviorally impulsive, in accordance with reports regarding impulsivity as a risk factor for smoking in psychiatric disorders and the general population [26,36,58]. Additionally, no smokers were found among OCD participants with subclinical levels of depressive symptoms. In addition to these lower rates, analyses of smoking behaviors among smokers with OCD revealed a low level of nicotine dependence, a relatively low number of cigarettes smoked per day, and an unusually low prevalence of heavy smokers (6.7%) compared to other major Axis I psychiatric disorders. These rates are lower than psychiatric and general normative samples that reported higher rates of heavy smokers [21] and significantly higher nicotine dependency levels [17,74].

Thus, the notion of OCD as a protective factor against smoking may be more than a prevalence issue in OCD. That is, in addition to reduced smoking prevalence found in our OCD and PYOCD samples, our findings suggest that compared to the average smoker (with or without a psychiatric diagnosis), OCD patients who smoke are less nicotine-dependent and smoke fewer cigarettes per day. In fact, heightened impulsivity is the only characteristic we found to be in accordance with what may be a risk factor for smoking in patients and controls. Finally, there were no smokers in the non-depressed subsample. This finding is in line with the known association between depression and smoking and seems to support the notion that the presence of OCD itself may be the primary protective factor against smoking.

Evidence for the familial nature of OCD [61,66], as well as for shared neurobiological abnormalities in first-degree relatives of OCD patients [16,69] led us to hypothesize that reduced smoking rates may be found in unaffected relatives with OCD. Indeed, our results reveal that the prevalence of smoking in our sample of unaffected parents of OCD probands (9.5%) was lower in comparison to the rate reported in the general population, which contrasts to the increased prevalence of smoking among relatives of patients with ADHD and schizophrenia [23,57,59]. Whereas our results are in support of the idea that smoking is in part familial [9,51], to our knowledge, no study to date reported reduced familial risk for smoking in any particular group, let alone among psychiatric disorders. In fact, current theoretical explanations for familiality of smoking among psychiatric disorders, such as the self-medicating hypothesis for schizophrenia [49] and the nicotine receptor hypothesis for ADHD [57], attempt to account for *elevated* smoking prevalence among family members of psychiatric patients. To our knowledge, no theoretical account for *reduced* smoking prevalence of smoking among families of individuals with psychiatric condition is currently available.

Our findings of a possible familial reduced risk for smoking in OCD may support the hypothetical explanation offered by Bejerot and Humble [7], who highlighted nicotine's potential to exacerbate OCD symptoms. Given that frontostriatal activation is positively associated with OCD symptom severity, it is possible that nicotine may increase activation of an already hyperactivated system and thus exacerbate symptoms. This effect has been demonstrated in rat studies in which the dopamine agonist quinpirole induced compulsive checking behaviors in rats [76,77].

In contrast, some case reports and one small ($n = 11$) study suggest that nicotine might improve OCD symptoms [53,65,71]. However, theoretically, there is a reason to believe that nicotine may not have a therapeutic but rather an adverse effect on OCD symptoms. Nicotine may be viewed as a stimulant that promotes the release of dopamine [50]. Dopamine antagonists (neuroleptics) have been demonstrated as efficacious therapeutic agents when used to augment SRIs in OCD [10]. In addition, stimulant medications have been reported to exacerbate OCD symptoms and may even induce OCD [45,46,73,79].

Our results may be considered in light of a second hypothetical explanation offered by Bejerot and Humble [7] concerning the low prevalence of smoking in OCD, namely the reduced levels of impulsivity and risk-taking in OCD. With regards to this hypothesis, we found that smokers with OCD are indeed more impulsive than non-smokers with OCD. However, the impulsivity score for OCD smokers did not differ significantly from those found on the same measure in non-psychiatric controls [1,12,13]. This finding is not surprising given that though impulsivity is strongly associated with cigarette smoking [26], research regarding

impulsivity in OCD has found normal or lower levels of behavioral impulsivity [2,29,75,80]. Thus, the higher levels of self-reported impulsivity within the OCD group, while associated with increased smoking, may not correspond to clinical levels of impulsivity.

Finally, Bejerot and Humble [7] offered a third speculative hypothesis in which they argued that patients with OCD may not experience positive reinforcement from nicotine. Our results in OCD differ uniquely from observed higher rates of cigarette smoking in other prevalent Axis I disorders associated with the hypofrontality hypothesis (e.g., depression, ADHD, schizophrenia, bipolar disorder) [3,18,20]. Notably, these disorders are associated with reduced reward-related reactivity [28,62,72], which predicts an increase in maladaptive behaviors targeted to activate the reward system and/or relieve symptoms [11,37,44]. With regards to the third speculative hypothesis suggested by Bejerot and Humble concerning lack of positive reinforcement from nicotine in OCD [7], our results suggest that a different mechanism may be operating in OCD, which may be linked to repeated engagement in negative reinforcement, analogous to the one seen in drug addiction [27]. In OCD, this mechanism may have different behavioral correlates (e.g., reduced, instead of elevated smoking), due to the disorders' unique pathophysiology.

The present study has several limitations and therefore our results must be interpreted with caution. First, our OCD smokers subsample included only 15 participants. Thus, conclusions from analyses pertaining to this sample should be drawn with caution. However, this is the first study to provide extensive information regarding OCD smokers versus OCD non-smokers, and given the low prevalence of smoking in OCD, information drawn from this small sample makes a significant contribution to the field. Second, although results were compared to large normative samples from the same country, a direct comparison between OCD patients and an active control group is warranted. In addition, in comparison to national representative samples, our samples were comprised predominantly of Caucasians and had a majority of female participants, as well as higher income and education levels that may affect smoking prevalence. However, our comparative analysis between OCD smokers and OCD non-smokers yielded that these variables did not account for smoking status in our sample. Nevertheless, future research should incorporate a more diverse sample in a prospective study design, preferably a representative sample with similar demographics. An additional potential limitation pertains to the fact that information from the OCD sample was largely based on self-report measures. While we employed a large number of methodological control measures, this still represents a limitation of this study. In addition, no biological measures of smoking were used. Another potential limitation pertains to our exclusion criteria. We excluded patients with certain comorbidities that are highly associated with increased smoking. However, in nearly 40% of these cases, patients were excluded because these disorders were determined as primary disorders. Finally, our PYOCD data was collected between the years 2000–2006, but compared to representative samples for which information was collected between 2009–2011. However, given a consistent decrease in smoking prevalence in the United States, comparison to a contemporary sample entails a more conservative approach that further strengthens our findings.

5. Conclusion

OCD is a psychiatric disorder characterized by significantly reduced rates of cigarette smoking in both patients and unaffected family members. One possible explanation for this phenomenon is the stimulating effect of nicotine that may exacerbate OCD symptoms. Taken together with recent findings of reduced reward reactivity in OCD [e.g., 24], further insight into the association between OCD's unique pathophysiology and reduced smoking prevalence may advance our understanding of this disorder and potentially contribute to our understanding of the interaction between frontostriatal and reward networks, smoking addiction, and smoking cessation in general.

Disclosure of interest

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References

[1] Abramovitch A, Dar R, Hermesh H, Schweiger A. Comparative neuropsychology of adult obsessive-compulsive disorder and attention deficit/hyperactivity disorder: implications for a novel executive overload model of OCD. J Neuropsychol 2012;6:161–91.
[2] Alonso P, Menchon JM, Jimenez S, Segalas J, Mataix-Cols D, Jaurrieta N, et al. Personality dimensions in obsessive-compulsive disorder: relation to clinical variables. Psychiatry Res 2008;157:159–68.
[3] Aubin H-J, Rollema H, Svensson TH, Winterer G. Smoking, quitting, and psychiatric disease: a review. Neurosci Biobehav Rev 2011;36:271–84.
[4] Baer L. Getting control: overcoming your obsessions and compulsions. New York, NY, US: Plume/Penguin Books; 1992.
[5] Bailey SL, Ennett ST, Ringwalt CL. Potential mediators, moderators, or independent effects in the relationship between parents' former and current cigarette use and their children's cigarette use. Addict Behav 1993;18:601–21.
[6] Baker-Morissette SL, Gulliver SB, Wiegel M, Barlow DH. Prevalence of smoking in anxiety disorders uncomplicated by comorbid alcohol or substance abuse. J Psychopathol Behav Assess 2004;26:107–12.
[7] Bejerot S, Humble M. Low prevalence of smoking among patients with obsessive-compulsive disorder. Compr Psychiatry 1999;40:268–72.
[8] Bejerot S, von Knorring L, Ekselius L. Personality traits and smoking in patients with obsessive-compulsive disorder. Eur Psychiatry 2000;15:395–401.
[9] Bierut LJ, Dinwiddie SH, Begleiter H, Crowe RR, Hesselbrock V, Nurnberger Jr JI, et al. Familial transmission of substance dependence: alcohol, marijuana, cocaine, and habitual smoking: a report from the Collaborative Study on the Genetics of Alcoholism. Arch Gen Psychiatry 1998;55:982–8.
[10] Bloch MH, Landeros-Weisenberger A, Kelmendi B, Coric V, Bracken MB, Leckman JF. A systematic review: antipsychotic augmentation with treatment refractory obsessive-compulsive disorder. Mol Psychiatry 2006;11:622–32.
[11] Bolton JM, Robinson J, Sareen J. Self-medication of mood disorders with alcohol and drugs in the National Epidemiologic Survey on Alcohol and Related Conditions. J Affect Disord 2009;115:367–75.
[12] Butler GKL, Montgomery AMJ. Impulsivity, risk taking and recreational ecstasy (MDMA) use. Drug Alcohol Depend 2004;76:55–62.
[13] Caci H, Mattei V, Bayle FJ, Nadalet L, Dossios C, Robert P, et al. Impulsivity but not venturesomeness is related to morningness. Psychiatry Res 2005;134:259–65.
[14] CDC. Vital signs: current cigarette smoking among adults - United States, 2011. MMWR Morb Mortal Wkly Rep 2012;61:889–94.
[15] CDC. Vital signs: current cigarette smoking among adults aged $\geq$ 18 years with mental illness - United States, 2009–2011. MMWR Morb Mortal Wkly Rep 2013;62:81–7.
[16] Chamberlain SR, Menzies L, Hampshire A, Suckling J, Fineberg NA, del Campo N, et al. Orbitofrontal dysfunction in patients with obsessive-compulsive disorder and their unaffected relatives. Science 2008;321:421–2.
[17] de Leon J, Diaz FJ, Rogers T, Browne D, Dinsmore L. Initiation of daily smoking and nicotine dependence in schizophrenia and mood disorders. Schizophr Res 2002;56:47–54.
[18] de Leon J, Diaz FJ. A meta-analysis of worldwide studies demonstrates an association between schizophrenia and tobacco smoking behaviors. Schizophr Res 2005;76:135–57.
[19] den Exter Blokland EA, Engels RC, Hale 3rd WW, Meeus W, Willemsen MC. Lifetime parental smoking history and cessation and early adolescent smoking behavior. Prev Med 2004;38:359–68.
[20] Dickerson F, Stallings C, Origoni A, Vaughan C, Khushalani S, Schroeder J, et al. Cigarette smoking among persons with schizophrenia or bipolar disorder in routine clinical settings, 1999–2011. Psychiatr Serv 2013;64:44–450.
[21] Dome P, Lazary J, Kalapos MP, Rihmer Z. Smoking, nicotine and neuropsychiatric disorders. Neurosci Biobehav Rev 2010;34:295–342.

[22] Eysenck SB, Eysenck HJ. Impulsiveness and venturesomeness: their position in a dimensional system of personality description. Psychol Rep 1978;43:1247–55.
[23] Feldt LS, Woodruff DJ, Salih FA. Statistical inference for coefficient alpha. Appl Psychol Meas 1987;11:93–103.
[24] Figee M, Vink M, de Geus F, Vulink N, Veltman DJ, Westenberg H, et al. Dysfunctional reward circuitry in obsessive-compulsive disorder. Biol Psychiatry 2011;69:867–74.
[25] First MB, Spitzer RL, Gibbon M, Williams J. Structured clinical interview for DSM-IV-TR Axis I disorders, research version. Non-patient edition. (SCID-I/NP). New York Biometrics Research, New York State Psychiatric Institute; 2002
[26] Flory JD, Manuck SB. Impulsiveness and cigarette smoking. Psychosom Med 2009;71:431–7.
[27] Fontenelle L, Oostermeijer S, Harrison B, Pantelis C, Yücel M. Obsessive-compulsive disorder, impulse control disorders and drug addiction: common features and potential treatments. Drugs 2011;71:827–40.
[28] Forbes EE. fMRI studies of reward processing in adolescent depression. Neuropsychopharmacology 2011;36:372–3.
[29] Fullana MA, Mataix-Cols D, Trujillo JL, Aseras X, Errano F, Lonso P, et al. Personality characteristics in obsessive-compulsive disorder and individuals with subclinical obsessive-compulsive problems. Br J Clin Psychol 2004;43:387–98.
[30] Geller DA. Obsessive-compulsive and spectrum disorders in children and adolescents. Psychiatr Clin North Am 2006;29:353–70.
[31] Geller DA, Wieland N, Carey K, Vivas F, Petty CR, Johnson J, et al. Perinatal factors affecting expression of obsessive-compulsive disorder in children and adolescents. J Child Adolesc Psychopharmacol 2008;18:373–9.
[32] Goodman WK, Price LH, Rasmussen SA, Mazure C, Delgado P, Heninger GR, et al. The Yale-Brown Obsessive Compulsive Scale. II. Validity. Arch Gen Psychiatry 1989;46:1012–6.
[33] Goodman WK, Price LH, Rasmussen SA, Mazure C, Fleischmann RL, Hill CL, et al. The Yale-Brown Obsessive Compulsive Scale: I. Development, use, and reliability. Arch Gen Psychiatry 1989;46:1006–11.
[34] Gosling SD, Vazire S, Srivastava S, John OP. Should we trust web-based studies. A comparative analysis of six preconceptions about Internet questionnaires. Am Psychol 2004;59:93–104.
[35] Grant B, Hasin DS, Chou S, Stinson FS, Dawson DA. Nicotine dependence and psychiatric disorders in the United States: results from the national epidemiologic survey on alcohol and relatedconditions. Arch Gen Psychiatry 2004;61:1107–15.
[36] Gurpegui M, Jurado D, Luna JD, Fernandez-Molina C, Moreno-Abril O, Galvez R. Personality traits associated with caffeine intake and smoking. Prog Neuropsychopharmacol Biol Psychiatry 2007;31:997–1005.
[37] Harris KM, Edlund MJ. Self-medication of mental health problems: new evidence from a national survey. Health Serv Res 2005;40:117–34.
[38] Heatherton TF, Kozlowski LT, Frecker RC, Fagerstrom K-O. The Fagerstrom Test for nicotine dependence: a revision of the Fagerstrom Tolerance Questionnaire. Br J Addict 1991;86:1119–27.
[39] Hennighausen K, Rischmüller B, Heseker H, Remschmidt H, Hebebrand J. Low body mass indices in adolescents with obsessive-compulsive disorder. Acta Psychiatr Scand 1999;99:267–73.
[40] IBM. IBM SPSS Statistics for Windows. 20.0 ed. Armonk, NY: IBM Corp; 2011.
[41] Jha P. Avoidable global cancer deaths and total deaths from smoking. Nat Rev Cancer 2009;9:655–64.
[42] Kassel JD, Stroud LR, Paronis CA. Smoking, stress, and negative affect: correlation, causation, and context across stages of smoking. Psychol Bull 2003;129:270–304.
[43] Keyes M, Legrand LN, Iacono WG, McGue M. Parental smoking and adolescent problem behavior: an adoption study of general and specific effects. Am J Psychiatry 2008;165:1338–44.
[44] Khantzian EJ. The self-medication hypothesis of substance use disorders: a reconsideration and recent applications. Harv Rev Psychiatry 1997;4:231–44.
[45] Koizumi HM. Obsessive-compulsive symptoms following stimulants. Biol Psychiatry 1985;20:1332–3.
[46] Kouris S. Methylphenidate-induced obsessive-compulsiveness. J Am Acad Child Adolesc Psychiatry 1998;37:135.
[47] Lambert NM, Hartsough CS. Prospective study of tobacco smoking and substance dependencies among samples of ADHD and non-ADHD participants. J Learn Disabil 1998;31:533–44.
[48] Lasser K, Boyd J, Woolhandler S, Himmelstein DU, McCormick D, Bor DH. Smoking and mental illness: a population-based prevalence study. JAMA 2000;284:2606–10.
[49] Leonard S, Mexal S, Freedman R. Smoking, genetics and schizophrenia evidence for self medication. J Dual Diagn 2007;3:43–59.
[50] Levin ED, Eisner B. Nicotine interactions with dopamine agonists: effects on working memory function. Drug Dev Res 1994;31:32–7.
[51] Li MD. The genetics of nicotine dependence. Curr Psychiatry Rep 2006;8:158–64.
[52] Lovibond PF, Lovibond SH. The structure of negative emotional states: comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. Behav Res Ther 1995;33:335–43.
[53] Lundberg S, Carlsson A, Norfeldt P, Carlsson ML. Nicotine treatment of obsessive-compulsive disorder. Prog Neuropsychopharmacol Biol Psychiatry 2004;28:1195–9.
[54] McCabe RE, Chudzik SM, Antony MM, Young L, Swinson RP, Zolvensky MJ. Smoking behaviors across anxiety disorders. J Anxiety Disord 2004;18:7–18.
[55] Menzies L, Williams GB, Chamberlain SR, Ooi C, Fineberg N, Suckling J, et al. White matter abnormalities in patients with obsessive-compulsive disorder and their first-degree relatives. Am J Psychiatry 2008;165:1308–15.
[56] Milad MR, Furtak SC, Greenberg JL, Keshaviah A, Im JJ, Falkenstein MJ, et al. Deficits in conditioned fear extinction in obsessive-compulsive disorder and neurobiological changes in the fear circuit. JAMA Psychiatry 2013;70:608–18 [quiz 554].
[57] Milberger S, Biederman J, Faraone SV, Chen L, Jones J. Further evidence of an association between attention-deficit/hyperactivity disorder and cigarette smoking. Findings from a high-risk sample of siblings. Am J Addict 1997;6:205–17.
[58] Mitchell SH. Measuring impulsivity and modeling its association with cigarette smoking. Behav Cogn Neurosci Rev 2004;3:261–75.
[59] Monuteaux MC, Faraone SV, Hammerness P, Wilens TE, Fraire M, Biederman J. The familial association between cigarette smoking and ADHD: a study of clinically referred girls with and without ADHD, and their families. Nicotine Tob Res 2008;10:1549–58.
[60] Moritz S, Van Quaquebeke N, Hauschildt M, Jelinek L, Gönner S. Good news for allegedly bad studies: assessment of psychometric properties may help to elucidate deception in online studies on OCD. J Obsessive Compulsive Relat Disord 2012;1.
[61] Nestadt G, Samuels J, Riddle M, Bienvenu 3rd OJ, Liang KY, LaBuda M, et al. A family study of obsessive-compulsive disorder. Arch Gen Psychiatry 2000;57:358–63.
[62] Nielsen MO, Rostrup E, Wulff S, Bak N, Lublin H, Kapur S, et al. Alterations of the Brain Reward System in antipsychotic naïve schizophrenia patients. Biol Psychiatry 2012;71:898–905.
[63] Orvaschel H, Puig-Antich J. Schedule for affective disorders and schizophrenia for school-age children: epidemiologic 4th version. Ft. Lauderdale, FL: Nova University, Center for Psychological Studies; 1987.
[64] Ostbye T, Taylor DH, Jung S-H. A longitudinal study of the effects of tobacco smoking and other modifiable risk factors on ill health in middle-aged and old Americans: results from the Health and Retirement Study and Asset and Health Dynamics among the Oldest Old Survey. Prev Med 2002;34:334–45.
[65] Pasquini M, Garavini A, Biondi M. Nicotine augmentation for refractory obsessive-compulsive disorder. A case report. Prog Neuropsychopharmacol Biol Psychiatry 2005;29:157–9.
[66] Pauls DL, Alsobrook 2nd JP, Goodman WK, Rasmussen S, Leckman JF. A family study of obsessive-compulsive disorder. Am J Psychiatry 1995;152:76–84.
[67] Pomerleau OF, Downey KK, Stelson FW, Pomerleau CS. Cigarette smoking in adult patients diagnosed with attention deficit hyperactivity disorder. J Subst Abuse 1995;7:373–8.
[68] Reips U-D. Standards for Internet-based experimenting. Exp Psychol 2002;49:243–56.
[69] Riesel A, Endrass T, Kaufmann C, Kathmann N. Overactive error-related brain activity as a candidate endophenotype for obsessive-compulsive disorder: evidence from unaffected first-degree relatives. Am J Psychiatry 2011;168:317–24.
[70] Ruscio AM, Stein DJ, Chiu WT, Kessler RC. The epidemiology of obsessive-compulsive disorder in the National Comorbidity Survey Replication. Mol Psychiatry 2010;15:53–63.
[71] Salín-Pascual RJ, Basañez-Villa E. Changes in compulsion and anxiety symptoms with nicotine transdermal patches in non-smoking obsessive-compulsive disorder patients. Rev Invest Clin 2003;55:650–4.
[72] Scheres A, Milham MP, Knutson B, Castellanos FX. Ventral striatal hyporesponsiveness during reward anticipation in attention-deficit/hyperactivity disorder. Biol Psychiatry 2007;61:720–4.
[73] Serby M. Methylphenidate-induced obsessive-compulsive symptoms in an elderly man. CNS Spectr 2003;8:612–3.
[74] Shiffman S, Pillitteri JL, Burton SL, Rohay JM, Gitchell JG. Smokers' beliefs about Light and Ultra Light cigarettes. Tob Control 2001;10(Suppl. 1):i17–23.
[75] Shoval G, Zalsman G, Sher L, Apter A, Weizman A. Clinical characteristics of inpatient adolescents with severe obsessive-compulsive disorder. Depress Anxiety 2006;23:62–70.
[76] Szechtman H, Sulis W, Eilam D. Quinpirole induces compulsive checking behavior in rats: a potential animal model of obsessive-compulsive disorder (OCD). Behav Neurosci 1998;112:1475–85.
[77] Szechtman H, Eckert MJ, Tse WS, Boersma JT, Bonura CA, McClelland JZ, et al. Compulsive checking behavior of quinpirole-sensitized rats as an animal model of Obsessive-Compulsive Disorder (OCD): form and control. BMC Neurosci 2001;2:4.
[78] Vanable PA, Carey MP, Carey KB, Maisto SA. Smoking among psychiatric outpatients: relationship to substance use, diagnosis, and illness severity. Psychol Addict Behav 2003;17:259–65.
[79] Woolley JB, Heyman I. Dexamphetamine for obsessive-compulsive disorder. Am J Psychiatry 2003;160:183.
[80] Wu KD, Clark LA, Watson D. Relations between Obsessive-Compulsive Disorder and personality: beyond Axis I-Axis II comorbidity. J Anxiety Disord 2006;20:695–717.
[81] Ziedonis D, Hitsman B, Beckham JC, Zvolensky M, Adler LE, Audrain-McGovern J, et al. Tobacco use and cessation in psychiatric disorders: National Institute of Mental Health report. Nicotine Tob Res 2008;10:1691–715.