## It is illegal to post this copyrighted PDF on any website. Prevalence and Correlates of Obsessive-Compulsive Symptoms in Individuals With Schizophrenia, Schizoaffective Disorder, or Bipolar Disorder

Deborah Ahn-Robbins, MSc<sup>a,e</sup>; Nina H. Grootendorst-van Mil, MD, PhD<sup>b</sup>; Chin-Kuo Chang, PhD<sup>a,c,d,e,\*</sup>; David Chandran, PhD<sup>e</sup>; Hitesh Shetty, PhD<sup>e</sup>; Jyoti Sanyal, PhD<sup>e</sup>; James H. MacCabe, FRCPsych, PhD<sup>a,e</sup>; Hannah Cohen, PhD<sup>a,e</sup>; Robert Stewart, MD<sup>a,e</sup>; Frederike Schirmbeck, PhD<sup>f,g</sup>; Lieuwe de Haan, MD, PhD<sup>f,g,‡</sup>; and Richard D. Hayes, PhD<sup>a,e,‡</sup>

## ABSTRACT

**Objective:** Although frequently reported in psychosis, obsessive-compulsive symptoms (OCS) are often not recognized and thus undertreated. We aimed to estimate the prevalence of OCS and obsessive-compulsive disorder (OCD) in patients with schizophrenia, schizoaffective disorder, or bipolar disorder in clinical records and identify clinical associations of OCS co-occurrence.

**Methods:** Data were retrieved from the South London and Maudsley NHS Foundation Trust Biomedical Research Centre case register. The study population was restricted to individuals diagnosed with schizophrenia (*ICD* F20.x), schizoaffective disorder (*ICD* F25.x), or bipolar disorder (*ICD* F31.x) between 2007 and 2015. OCS and OCD were ascertained from structural fields and via Natural Language Processing software applied to free-text records. Clinical characteristics were obtained from Health of the Nation Outcome Scales for the analyses on associations between clinical characteristics and OCS/OCD status using logistic regressions with confounders considered.

**Results:** 22,551 cases of schizophrenia, schizoaffective disorder, or bipolar disorder were identified in the observation window. Among these, 5,179 (24.0%) were identified as having OCS (including an OCD diagnosis) and 2,574 (11.9%) specifically with comorbid OCD. OCS/OCD was associated with an increased likelihood of recorded aggressive behavior (OR=1.18; 95% Cl, 1.10–1.26), cognitive problems (OR=1.21; 95% Cl, 1.13–1.30), hallucinations and delusions (OR=1.11; 95% Cl, 1.04–1.20), and physical problems (OR=1.17; 95% Cl, 1.09–1.26).

**Conclusions:** OCS and OCD are frequently recorded for patients with schizophrenia, schizoaffective disorder, and bipolar disorder and are associated with more severe psychiatric clinical characteristics. Automated information extraction tools hold potential to improve recognition and treatment of co-occurring OCS/OCD for psychosis.

J Clin Psychiatry 2022;83(6):21m14010

*To cite:* Ahn-Robbins D, Grootendorst-van Mil NH, Chang C-K, et al. Prevalence and correlates of obsessive-compulsive symptoms in individuals with schizophrenia, schizoaffective disorder, or bipolar disorder. *J Clin Psychiatry*. 2022;83(6):21m14010. *To share:* https://doi.org/10.4088/JCP.21m14010

© 2022 Physicians Postgraduate Press, Inc.

<sup>a</sup>King's College London (Institute of Psychiatry, Psychology, and Neuroscience), London, United Kingdom

<sup>b</sup>Erasmus MC, University Medical Center, Department of Psychiatry, Rotterdam, the Netherlands

<sup>c</sup>Global Health Program, College of Public Health, National Taiwan University, Taipei City, Taiwan

<sup>d</sup>Institute of Epidemiology and Preventive Medicine, College of Public Health, National Taiwan University, Taipei City, Taiwan

<sup>e</sup>South London and Maudsley NHS Foundation Trust, London, United Kingdom

<sup>f</sup>Academic Medical Center, Department of Psychiatry, University of Amsterdam, Amsterdam, the Netherlands

<sup>g</sup>Arkin Institute for Mental Health, Amsterdam, the Netherlands

‡Drs de Haan and Hayes share last authorship of this work.

\*Corresponding author: Chin-Kuo Chang, PhD, No 17, Xuzhou Rd, Zhongzheng District, Taipei City 100, Taiwan (chinkuochang@ntu.edu.tw). The presence of co-occurring obsessive and/or compulsive symptoms (OCS) has been suggested to predict adverse outcomes in individuals with schizophrenia, schizoaffective disorder, and bipolar disorder.<sup>1,2</sup> For example, several studies have reported that comorbid OCS are associated with earlier age at onset, higher psychotic symptom severity, and poorer social and vocational function.<sup>3,4</sup> Understanding the factors associated with OCS among individuals with severe mental disorders can help to identify vulnerable subgroups and potentially inform more personalized treatment.

OCS-related impairment has considerable implications, as comorbidity rates for OCS and obsessive-compulsive disorder (OCD) are significantly higher than expected among patients with schizophrenia, schizoaffective disorder, or bipolar disorder. While the lifetime prevalences of schizophrenia and OCD are around 0.6%<sup>5</sup> and 2%–3%,<sup>6</sup> respectively, the prevalences of comorbid OCD are about 12%–23% in patients with schizophrenia and schizoaffective disorder<sup>7,8</sup> and 13%–23% for patients with bipolar disorder.<sup>2</sup>

Published studies, however, are often not consistent with regard to the extent of the comorbidity. Estimates of OCD/OCS prevalence are influenced by the method of assessment and vary in different study populations. Some of the previous studies relied on selected samples, for example, specialized clinical facilities or convenience samples,<sup>2,8</sup> or had relatively small sample sizes,<sup>9</sup> prone to selection bias or limited statistical power.

Electronic health records hold the potential to capture real-world data on individuals on a large scale. Important clinical information is not only kept in structured data, such as diagnostic codes, but also recorded in unstructured free-text fields. The use of natural language processing (NLP) algorithms on unstructured

For reprints or permissions, contact permissions@psychiatrist.com. ♦ © 2022 Copyright Physicians Postgraduate Press, Inc. J Clin Psychiatry 83:6, November/December 2022 PSYCHIATRIST.COM ■ e1

Reprinted with correction to pages e1, e2, e4, e6–e8.

It is illegal to post this copyrighted PDF on any website. status had been assessed by a clinician using the Health

## **Clinical Points**

- Although obsessive-compulsive symptoms (OCS) or obsessive-compulsive disorder (OCD) frequently co-occur in patients with schizophrenia, schizoaffective disorder, or bipolar disorder, they are often not recognized and thus undertreated.
- Automated information extraction tools hold potential for adequate detection of OCS/OCD in patients with schizophrenia, schizoaffective disorder, or bipolar disorder.
- The existence of OCS/OCD was found to be related to the clinical characteristics of these mental disorders, implying that OCS/OCD might be potential treatment targets in clinical practice.

data has been well demonstrated and creates the possibility to derive clinical insights in representative samples of the source population. In this area of research, NLP could give an advantage by providing the ability to measure rates of diagnosed OCD, not just OCS, and the ability to look for associations with other clinical parameters.

In the current study, we used NLP techniques to support automated, text-based ascertainment of recorded OCS and OCD among patients with schizophrenia, schizoaffective disorder, or bipolar disorder in electronic clinical records from a large UK mental health case registry and explore factors related with co-occurrence of OCS and OCD, including demographic factors and clinical characteristics.

#### **METHODS**

#### **Setting and Study Population**

The study was conducted using clinical data from electronic health records of people receiving secondary mental health care from the South London and Maudsley NHS Foundation Trust (SLaM). SLaM has near-monopoly provision of mental health services to a defined geographic catchment of approximately 1.36 million residents of Lambeth, Southwark, Croydon, and Lewisham in south London, UK. SLaM services encompass all aspects of secondary mental health care across all age groups, including inpatient, community, general hospital liaison, and forensic services, as well as tertiary national specialist services. Electronic clinical records have been used comprehensively in all SLaM services since 2006, and the Clinical Record Interactive Search (CRIS) system, supported by SLaM's National Institute for Health Research (NIHR) Biomedical Research Centre, was developed in 2008 to enable researchers to search and retrieve deidentified data from the clinical records efficiently for research purposes. The protocol for this case register has been described in detail elsewhere,<sup>9</sup> and, currently, there are over 500,000 service users represented in CRIS. Individuals who had received a diagnosis of schizophrenia spectrum (ICD-10 code: F20.x), bipolar disorder (F31.x), or schizoaffective disorder (F25.x) during the observation period (from January 1, 2007, to December 31, 2016, inclusive) and whose clinical/functional of the Nations Outcome Scale<sup>10</sup> at least once during this observation period were included in this dynamic cohort. CRIS has received ethical approval as an anonymized data resource for secondary analyses (Oxford Research Ethics Committee C, reference 18/SC/0372).

#### Assessment of Obsessive/Compulsive Symptoms

NLP algorithms allowed information to be extracted from unstructured clinical text records (ie, free-text fields entered by clinicians, including recorded patient reviews, treatment notes, and clinical correspondence), which would not otherwise be available as structured entities. These have been widely developed and applied in CRIS to enhance the depth of data available for analysis on a large scale.<sup>9</sup> We developed NLP algorithms specifically to extract documentation of obsessive/compulsive symptoms from free-text fields in clinical assessments and correspondence in CRIS using Generalized Architecture for Text Engineering (GATE) software.<sup>11</sup> Full details concerning the development of this NLP application and the criteria for identifying obsessive/compulsive symptoms for NLP have been described previously.<sup>12</sup> In brief, coding rules to determine the presence of OCS, including OCD, in clinical assessments and correspondence were based on the items in the Yale-Brown Obsessive Compulsive Scale (YBOCS).<sup>13</sup> The OCS algorithm was able to identify OCS (including OCD) with a precision (ie, positive predictive value) of 0.67 and a recall (ie, sensitivity) of 0.77, and instances of a recorded clinical diagnosis of OCD were identified with a precision/recall of 1.00/0.85. In addition, the application was supplemented with output from a preexisting NLP algorithm ascertaining text associated with diagnosis statements, which performed at a precision/recall of 0.98/0.88 for OCD (ICD-10 code F42).<sup>9</sup> Data from the algorithms for OCS and psychiatric diagnosis and structured fields in CRIS were combined to produce the outcome measure of OCS, including OCD.

## Assessment of Sociodemographic and Clinical Characteristics

Study subjects were grouped into diagnostic categories based on the mental disorder diagnosis, received before or during the observation period. Information on diagnosis came from both the NLP algorithm (previously described) and recorded structured diagnostic fields, in which ICD-10 codes were applied. Where study subjects had received more than one diagnosis of interest during the observation period, the diagnosis was hierarchically assigned as schizophrenia, schizoaffective disorder, and then bipolar disorder. Other variables extracted for analysis included secondary comorbid diagnoses of alcohol use disorder (F11), opioid use disorder (F10), and major depressive disorder (F33) that were diagnosed before or during the observation period. These comorbidities were also extracted from structured fields and free-text fields using the GATE psychiatric diagnosis application described above. Data on age, sex, ethnicity, marital status, postcode (for index

For reprints or permissions, contact permissions@psychiatrist.com. • © 2022 Copyright Physicians Postgraduate Press, Inc. e2 PSYCHIATRIST.COM J Clin Psychiatry 83:6, November/December 2022 It is illegal to post this of multiple deprivation score), and use of mo were defined from routinely completed fields. Age at onset was calculated at the date on which the individual received their first schizophrenia, schizoaffective disorder, or bipolar disorder diagnosis date during the observation period. Ethnicity was classified into the following groups: "White British," "Other white," "South Asian," "East Asian," "Black Caribbean," "Other black," and "Others, mixed, and unknown" according to categories defined by the UK Office for National Statistics. Marital status was taken from the last available status and categorized as being in a relationship ("married," "civil partnership," or "cohabiting") or no relationship ("divorced," "civil partnership dissolved," "separated," "single," "widowed," or "unknown"). Socioeconomic status was measured using the Index of Multiple Deprivation score, which measures relative levels of deprivation in small-area neighborhoods in the UK, given in percentiles.<sup>14</sup> The Index of Multiple Deprivation is composed of 7 domains of deprivation taken from the 2011 UK census: income, employment, health and disability, education skills and training, barriers to housing and services, crime, and living environment at the level of Lower Layer Super Output Area (LSOA), with an average population of 1,722 in London. The address in England at LSOA level, recorded closest in time to the first schizophrenia, schizoaffective disorder, or bipolar disorder diagnosis received during the observation period, was used to obtain deprivation scores, with a separate category for homelessness. Information on clinical/functional status was obtained from the 12-item Health of the Nation Outcome Scale (HoNOS).<sup>10</sup> The HoNOS, which is routinely completed in SLAM patients, is commonly used as an outcome measure among mental health service providers in the UK. Current analysis included the following HoNOS items: item 1, assessing overactive aggressive behavior; item 2, assessing non-accidental self-injury; item 4, assessing cognitive problems; item 5, assessing physical illness or disability problems; item 6, assessing hallucinations and delusions; and item 7, assessing depressed mood. HoNOS items are scored according to the following Likert scale categories: 0 = not a problem; 1 = minor problem requiring no action; 2 = mild problem but definitely present; 3 = moderately severe problem; and 4 = severe to very severe problem. For our study, scores were categorized as present (1-4) vs absent (0) binary variables for further analyses.

### **Statistical Analysis**

Characteristics of demographics and clinical characteristics of the sample by presence of OCS/OCD are presented. Descriptive statistics were summarized as means and SDs for continuous variables and as frequencies with percentages for categorical variables. Logistic regression analyses were undertaken to estimate the crude and adjusted associations between sociodemographic and clinical characteristics and OCS/OCD in the sample, with potential interactions with psychiatric diagnosis (schizophrenia, schizoaffective disorder, bipolar disorder) assessed using





Abbreviations: OCD = obsessive-compulsive disorder, OCS = obsessivecompulsive symptoms, SLaM = South London and Maudsley NHS Foundation Trust.

log-likelihood ratio tests. All analyses were performed using Stata 12.0, and significance level ( $\alpha$  level) was set at 0.05.

### RESULTS

As shown in the flowchart of the data source in Figure 1, a total of 21,551 individuals were included in this study with schizophrenia (n = 13,754), schizoaffective disorder (n = 1, 113), and bipolar disorder (n = 6, 684) identified within the observation period. Their mean age was 42.2 years old (SD = 16.2), and 11,431 (53.0%) were male. In the cohort, 5,179 (24.0%; 95% CI, 23.5%-24.6%) people were identified as having recorded OCS (including OCD diagnosis). The prevalence of OCS (including OCD) slightly varied by psychiatric diagnosis, with 24.6% for schizophrenia (95%) CI, 23.9%-25.3%), 25.3% for schizoaffective disorder (95% CI, 22.8%–28.0%), and 22.6% for bipolar disorder (95% CI, 21.6%-23.6%). In addition, 2,574 individuals (11.9%; 95% CI, 11.5%–12.4%) were identified as having comorbid OCD. Individuals recorded as having OCS/OCD were more often of male gender, of non-white British origin, living in deprived neighborhoods, and single. Presence of comorbid alcohol use disorder, opioid use disorder, and major depressive disorder were all significantly positively associated with the co-occurrence of OCS/OCD symptoms. Details are shown in Table 1.

Table 2 displays associations between recorded OCS/ OCD and mental or physical health symptoms assessed by HoNOS. After full adjustment, OCS/OCD was significantly **It is illega** to post this converiable of DDE on any Table 1. Sample Characteristics According to Whether the Presence of Obsessive-Compulsive Symptoms/Disorder (OCS/OCD) Was Recorded Among Patients With Schizophrenia, Schizoaffective Disorder, or Bipolar Disorder in Southeast London During 2007–2016 (N = 21,551)<sup>a</sup>

	OCS/OCD recorded OCS/OCD not recorded			
	(n=5,179)	(n=16,372)	P value <sup>b</sup>	
Age, mean ± SD, y	39.3±15.1	43.2±16.4	<.01	
Gender				
Female	2,385 (46.1)	7,735 (47.3)	.13	
Male	2,794 (54.0)	8,637 (52.8)		
Ethnicity				
White	2,268 (43.8)	6,537 (39.9)	<.01	
Other White	474 (9.2)	1,774 (10.8)		
South Asian	121 (2.3)	491 (3.0)		
East Asian	142 (2.7)	504 (3.1)		
Caribbean	547 (10.6)	1,471 (9.0)		
Other Black	1,167 (22.5)	3,533 (21.6)		
Others/mixed/unknown	460 (8.9)	2,062 (12.6)		
Married or cohabiting				
No	4,672 (90.2)	13,950 (85.2)	<.01	
Yes	507 (9.8)	2,422 (14.8)		
Neighborhood deprivation (in tertiles)				
Low (1st tertile, highest SES level)	1,613 (31.2)	5,214 (31.9)	<.01	
Medium (2nd tertile)	1,626 (31,4)	5,138 (31.4)		
High (3rd tertile, lowest SES level)	1,729 (33,4)	5,170 (31.6)		
Homeless or missing	211 (4.1)	850 (5.2)		
Psychiatric diagnosis	,	,		
Schizophrenia (F20)	3,389 (65,4)	10,365 (63,3)	< .01	
Schizoaffective disorder (F25)	281 (5.4)	832 (5.1)		
Bipolar disorder (F32)	1.509 (29.1)	5.175 (31.6)		
Comorbid alcohol use disorder (F11)	.,	0,170 (0110)		
No	4 527 (87 4)	14 942 (91 3)	< 01	
Yes	652 (12.6)	1 430 (8 7)	1.01	
Comorbid onioid use disorder (E10)	002 (12.0)	1,150 (0)		
No	5 017 (96 9)	15 967 (97 5)	< 05	
Yes	162 (3.1)	405 (2 5)	1.05	
Comorbid major depressive disorder (F33)	102 (3.1)	403 (2.3)		
No	4 519 (87 3)	15,066 (92,0)	< 01	
Voc	660 (12 7)	1 306 (8 0)	<.01	
Overactive aggressive behavior <sup>c</sup>	000(12.7)	1,500 (0.0)		
Not a problem	2 204 (51 4)	7 138 (55 6)	< 01	
Minor to significant problem	2,334 (31.4)	5 942 (44 4)	<.01	
Non-accidental self-injury <sup>d</sup>	2,201 (40.0)	5,942 (44.4)		
Not a problem	3 845 (82 7)	11 334 (84 0)	< 01	
Minor to significant problem	2,043 (02.7) 207 (17 A)	2 021 (15 1)	<.01	
Cognitive problems <sup>e</sup>	007 (17.4)	2,021 (15.1)		
Not a problem	2667 (57 1)	9 102 (60 7)	< 01	
Not a problem Miner to significant problem	2,007 (37.4)	5,105 (00.7)	<.01	
Physical illness or disability <sup>f</sup>	1,974 (42.5)	5,259 (56.5)		
Not a much lam	2057(61.6)	0.166 (61.2)	64	
Not a problem	2,857 (01.0)	8,100 (01.2)	.04	
Minor to significant problem	1,/85 (38.5)	5,187 (38.9)		
Hallucinations and delusions <sup>®</sup>	1.045 (42.0)		. 01	
Not a problem	1,945 (42.0)	5,926 (44.5)	<.01	
ivinor to significant problem	2,689 (58.0)	/,395 (55.5)		
Depressea mooa	1 050 (40.1)	F (24 (42 2)	. 05	
Not a problem	1,859 (40.1)	5,624 (42.2)	<.05	
winor to significant problem	2,783 (60.0)	/,/10(5/.8)		

<sup>a</sup>Values expressed as n (%) unless otherwise noted.

<sup>b</sup>Independent *t* tests for continuous variables and  $\chi^2$  tests for categorical variables.

<sup>c</sup>Number of missing = 3,516. <sup>d</sup>Number of missing = 3,544. <sup>e</sup>Number of missing = 3,556. <sup>f</sup>Number of missing = 3,556. <sup>g</sup>Number of missing = 3,569.

Abbreviation: SES = socioeconomic status.

associated with recorded aggressive behavior (adjusted OR = 1.18; 95% CI, 1.10–1.26), cognitive problems (1.21; 1.13–1.30), hallucinations/delusions (1.11; 1.04–1.20), and physical illness/disability (1.17; 1.09–1.26), but not significantly with non-accidental self-injury or depressed mood. As including comorbid major depressive disorder in the model might have represented overadjustment for depressed mood (measured using HONOS), a further

analysis was run without this covariate; however, results were similar (Supplementary Table 1).

Considering the 3 psychiatric diagnosis groups, a significant interaction was found for the OCS/OCD association with hallucinations/delusions (log-likelihood ratio  $\chi^2 = 7.87$ , P = .02) in a fully adjusted model, but not for any other HoNOS scale investigated. Further stratification by diagnosis indicated that this association was significant

website.

sit

lt is i

Table 2. Associations Between Mental/Physical Health Symptoms and OCS/OCD Status Among Patients With Schizophrenia, Schizoaffective Disorder, or Bipolar Disorder in Southeast London: Univariable and Multivariable Logistic Regression

	Odds ratio (95% CI)					
	Crude	Adjusted	Crude	Adjusted	Crude	Adjusted
	Overactive aggressive behavior <sup>a</sup>		Non-accidental self-injury <sup>a</sup>		Cognitive problems <sup>a</sup>	
No OCS/OCD	Ref	Ref	Ref	Ref	Ref	Ref
OCS/OCD	1.18 (1.11–1.26)	1.18 (1.10–1.26)	1.18 (1.08–1.29)	1.02 (0.92–1.12)	1.14 (1.07–1.23)	1.21 (1.13–1.30)
	Physical illness or disability <sup>a</sup>		Hallucinations and delusions <sup>a</sup>		Depressed mood <sup>b</sup>	
No OCS/OCD	Ref	Ref	Ref	Ref	Ref	Ref
OCS/OCD	0.98 (0.92-1.05)	1.17 (1.09–1.26)	1.11 (1.04–1.19)	1.11 (1.04–1.20)	1.09 (1.02–1.17)	1.05 (0.98-1.12)

<sup>a</sup>N = 18,035; controlling for age, sex, ethnicity, relationship, deprivation score, psychiatric diagnosis (schizophrenia, schizoaffective disorder, or bipolar disorder), comorbidity of alcohol use disorder, comorbidity of opioid use disorder, and comorbidity of major depressive disorder in adjustment.

<sup>b</sup>N = 17,982; controlling for age, sex, ethnicity, relationship, deprivation score, psychiatric diagnosis (schizophrenia, schizoaffective disorder, or bipolar disorder), comorbidity of alcohol use disorder, and comorbidity of opioid use disorder in adjustment.

Abbreviations: OCD = obsessive-compulsive disorder, OCS = obsessive-compulsive symptoms, ref = reference.

Table 3. Adjusted Associations of OCS/OCD With Hallucinations/Delusions, Stratified by Psychiatric Diagnosis (N = $17,955$ ) <sup>a</sup>					
	Odds ratio (95% CI) for association with hallucinations/delusions				
Symptom	Schizophrenia (F20)	Schizoaffective disorder (F25)	Bipolar disorder (F32)		

 No OCS (including OCD)
 Ref
 Ref

 OCS (including OCD)
 1.02 (0.94–1.12)
 1.23 (0.91–1.66)
 1.24 (1.08–1.42)

 <sup>a</sup>Adjusting for age, sex, ethnicity, relationship, deprivation score, comorbidity of alcohol use disorder, and comorbidity of opioid use disorder.
 1.24 (1.08–1.42)

Abbreviations: OCD = obsessive-compulsive disorder, OCS = obsessive-compulsive symptoms, ref = reference.

only in patients with bipolar disorder (OR=1.24; 95% CI, 1.08–1.42; Table 3), with a similar strength of association in schizoaffective disorder (OR=1.23; 95% CI, 0.91–1.66) but an association close to the null value in patients with schizophrenia.

### DISCUSSION

In the study described here, we assessed OCS/ OCD in individuals with schizophrenia, schizoaffective disorder, or bipolar disorder using NLP to ascertain this recorded comorbidity across a large clinical population. The co-occurrence of OCS/OCD in individuals with schizophrenia, schizoaffective disorder, and bipolar disorder was associated with a number of indicators of higher clinical severity. In our large sample drawn from routine mental health care data, the prevalence of comorbid OCS/OCD (23.0%) in the combined diagnostic groups was lower than had been previously reported for schizophrenia (30%)<sup>8</sup> and comparable to that previously reported for bipolar disorder (13%-23%)<sup>2</sup> However, prevalence in previous studies has mainly been obtained from trained clinicians applying DSM-5 criteria and using a scale such as the YBOCS to assess the severity of OCS. Although the YBOCS was used to inform the OCS NLP application, the current estimates are still based on the unprompted documentation of OCS in clinical texts authored by a range of clinicians and health care professionals, as well as from descriptions of patients' self-reported symptoms. Our ostensibly lower OCS/OCD estimates may speak to the challenges that mental health

professionals face in clinical practice in distinguishing obsessions from delusions. For instance, a key criterion for differentiating psychotic symptoms and OCS has been the presence of insight into obsessions and compulsions.<sup>15,16</sup> However, when a patient presents with obsessions and poor insight, it remains difficult to disentangle that obsession from delusions. Furthermore, it is also possible that there exists a lack of awareness regarding the possible comorbidity of OCS in individuals with schizophrenia, schizoaffective disorder, or bipolar disorder, resulting in underrecording. In addition, although the NLP algorithm for ascertaining OCS/ OCD was supplemented by clinical diagnoses in structured fields and the results of other algorithms targeting diagnoses, the precision and recall were not perfect and may have resulted in some cases being missed.

Individuals with OCS/OCD comorbidity were more likely to have hallucinations/delusions, aggressive behavior, cognitive difficulties, and physical illness/disabilities and also were more likely to have a diagnosis of comorbid depressive, alcohol use disorder, or opioid use disorder. Previous reports on the association between OCS comorbidity and psychotic symptom severity in schizophrenia have been inconsistent. Several previous studies did not find significant associations<sup>4,17,18</sup> or fewer positive or negative symptoms in patients with OCS.<sup>19–21</sup> The meta-analysis of Cunill et al,<sup>1</sup> summarizing results of 18 studies of individuals with schizophrenia, concluded no differences in positive or negative symptom severity in OCD versus non-OCD subgroups; for patients with OCS, a higher symptom severity was described for positive and negative symptoms compared

#### Ahn-Robbins et al

to those without OCS, although methodological explanations could probably explain this difference. Some studies have found that aggressive behavior in schizophrenia is associated with clinical factors, such as positive symptoms,<sup>22</sup> as well as social factors, such as having physical disease<sup>23</sup> and being unmarried.<sup>24</sup> As individuals with OCS comorbidity have more unfavorable social characteristics, this could underlie the association between OCS comorbidity with aggressive behavior in our sample. In the current study, individuals with comorbid OCS/OCD were more likely to be reported to have cognitive problems. Earlier studies have noted negative associations of OCD with neurocognitive functioning in individuals with schizophrenia,<sup>1,25</sup> including in attention set shifting<sup>25,26</sup> and cognitive flexibility.<sup>26</sup> In particular, executive functioning and abstract capacity were reported to be impaired. Previous research after 68 patients with OCD, bipolar disorder, or both disorders did not indicate impaired recognition in individuals related to OCD comorbidity.<sup>27</sup> Our observed associations with alcohol and opioid use disorders are consistent with previous findings for bipolar disorder,<sup>28,29</sup> although previous research found no associations of OCD with substance use (other than nicotine) in schizophrenia.4,15,30 The effect estimates of OCS/OCD co-occurrence observed in the current study are small (eg, adjusted OR = 1.11 for hallucinations and delusions) to moderate (eg, adjusted OR = 1.21 for cognitive problems). However, effect sizes might not necessarily reflect their related clinical importance. Given the serious implications of these outcomes of interest, including overactive aggressive behavior and non-accidental selfinjury, the results could still provide useful insights for further investigations. The associations between OCS/OCD and depressed mood or non-accidental self-injury were no longer significant after adjustment for sociodemographics and clinical features as confounders. Previous studies have reported associations between OCS in schizophrenia and higher severity of depressive symptoms.<sup>3,21,31,32</sup> Also, in people with bipolar disorder, there is evidence that OCS may be more prevalent during depressive than euthymic or manic states, and people with bipolar disorder and OCD have more frequent depressive episodes than those with bipolar disorder alone.<sup>33,34</sup> Our study group described the 5-year course of OCS and OCD in first episode psychosis and concluded that comorbid OCD was only associated with more severe depressive symptoms, but not with suicidality.<sup>17</sup> Other studies also supported the earlier found association between comorbid OCD and depressive symptoms,<sup>35,36</sup> as well as suicidal ideation and suicide attempts in patients with schizophrenia.<sup>37</sup> Thus, more studies focusing on the complex roles played by OCS/OCD in relation to depressed mood or non-accidental self-injury behaviors among people with severe mental illness might be of help to further address these inconsistencies. The phenomenological overlap between OCS and psychotic disorders represents a challenge to clinicians and researchers. However, the limited utility of antipsychotics, the effectiveness of antidepressants in treating OCS in schizophrenia, and the persistence of **constant of an expression** of enduring psychosis. Previous researchers found the symptom profile of OCS/OCD in schizophrenia to be similar to that seen in patients with OCD only.<sup>39</sup> This corresponds to the belief that OCS are a continuous trait instead of a dichotomy.<sup>40</sup>

Previous studies of OCS in individuals with schizophrenia have been limited by smaller patient samples that were specifically recruited to a research project.<sup>15,41</sup> One of the key strengths of our study was our large sample of people with schizophrenia, schizoaffective disorder, or bipolar disorder that is representative of the clinical population in a defined geographical catchment area. Nevertheless, our study has several limitations. First, misclassification of OCS/OCD cannot be fully ruled out, but it would most likely have resulted in underestimation of the prevalence of OCD. Although Chandran et al showed that the algorithm was able to identify OCS with a positive predictive value of 0.67 and sensitivity of 0.77,12 this information was generated for the evaluation of validity at document level. However, most patients have multiple documents, especially the long-term service users of SLaM hospital. The probability of falsenegative findings would be reasonably low for them if OCS/ OCD was ever mentioned in electronic health records by clinicians. The only concern was that OCS/OCD had not been considered of clinical importance in daily psychiatric practice for treatment planning in people with schizophrenia, bipolar disorder, or schizoaffective disorder up to now. For the sake of retrospective study design, if the clinicians had never recorded any information about OCS/OCD, the app would not be able to detect it. This typical kind of potential missing data issue is not specific to our study. Furthermore, we have no reason to believe that these potential errors would have been systematic, so we would expect the bias to shift toward the null rather than cause spurious associations. Second, individuals with schizophrenia, schizoaffective disorder, or bipolar disorder known to health care services are more likely to suffer from prolonged and relapsing clinical courses.<sup>42</sup> Our results might be affected by prevalence bias such that individuals in the current study are more likely to have less favorable health outcomes. Therefore, caution is warranted in generalizing our results to incident cases of schizophrenia, schizoaffective disorder, or bipolar disorder. Third, in the present study, we used the OCS application to determine the presence or absence of OCS by examining the health records of patients diagnosed with schizophrenia, bipolar disorder, or schizoaffective disorder, but it was not possible at this point to delineate the temporality of the occurrence of OCS. This may be of importance since OCS can be a prodromal symptom of schizophrenia spectrum disorders.<sup>43</sup> In the current study, we did have the date of the annotated document, which might work as a proxy for current or prior OCS/OCD presence. However, this did not per se reflect the temporality of the issue. The observation period spanned 10 years, yet currently the OCS application is limited in its ability to ascertain whether an individual

For reprints or permissions, contact permissions@psychiatrist.com. • © 2022 Copyright Physicians Postgraduate Press, Inc. e6 • PSYCHIATRIST.COM J Clin Psychiatry 83:6, November/December 2022

Reprinted with correction to pages e1, e2, e4, e6-e8.

is currently experiencing OCS or has experienced the the past. Related attempts to use NLP to detect temporality for symptom onset in psychiatric health care text are still ongoing,44 but this remains a challenge in the near future. Fourth, there may be the issue of residual confounding in the observed association between OCS/OCD and specific clinical characteristics assessed by the HoNOS. Although we adjusted for all well-accepted independent risk factors available in our dataset as confounders in final models, there might be some other potential confounders (eg, head trauma or brain injury in correlation with cognitive disorders, or paranoia in relation to aggressive behaviors) to be further evaluated and properly controlled for. Finally, both HoNOS and OCS/OCD could be recorded multiple times during the observation period (from January 1, 2007, to December 31, 2016). The exact temporality of the OCS/OCD occurrences in relation to HoNOS could not be confirmed with the current NLP algorithm. To address this issue as much as possible, we extracted the closest HoNOS assessment after

the first date on which OCS/OCD was recorded in the data during the observation period.

Future studies will address this issue to increase the accuracy of the estimate of OCS, including OCD, in individuals with schizophrenia, schizoaffective disorder, or bipolar disorder. Finally, the application of NLP to mental health records may not identify OCS as accurately as a using a direct diagnostic assessment and assessing severity using the YBOCS scale.

To conclude, our data suggest that OCS/OCD can be identified at scale in clinical records using automated methods and that the symptoms/disorder are common in patients with schizophrenia, schizoaffective disorder, or bipolar disorder and are associated with poorer clinical status. Since treatment procedures are different, adequate detection of OCS in individuals with severe mental illness is warranted. The current findings highlight the potential of automated information extraction tools in mental health research and clinical practice.

Submitted: March 26, 2021; accepted May 13, 2022. Published online: September 28, 2022.

Relevant financial relationships: Drs Hayes, Chang, Shetty, and Stewart have received research funding from Roche, Pfizer, Janssen, Takeda, and Lundbeck. Dr MacCabe has received research funding from Lundbeck, unrelated to this work. Drs Grootendorst-van Mil, Chandran, Sanyal, Cohen, Schirmbeck, and de Haan and Ms Ahn-Robbins have no conflicts of interest to disclose.

Funding/support: The research was supported by the Clinical Records Interactive Search (CRIS) system funded and developed by the National Institute for Health Research (NIHR) Mental Health Biomedical Research Centre at South London and Maudsley NHS Foundation Trust and King's College London and a joint infrastructure grant from Guy's and St Thomas' Charity and the Maudsley Charity (grant number BRC-2011-10035). For part of the time spent on this project, Dr Hayes was funded by a Medical Research Council (MRC) Population Health Scientist Fellowship (grant number MR/ J01219X/1). Drs Chang, Chandran, Shetty, Sanyal, Cohen, Stewart, MacCabe, and Hayes and Ms Ahn-Robbins have all received salary support from the NIHR Mental Health Biomedical Research Centre at South London and Maudsley NHS Foundation Trust and King's College London. Dr Stewart is additionally funded in part by (1) a Medical Research Council (MRC) Mental Health Data Pathfinder Award to King's College London; (2) an NIHR Senior Investigator Award; and (3) the NIHR Applied Research Collaboration South London (NIHR ARC South London) at King's College Hospital NHS Foundation Trust.

**Role of the sponsor:** The funding agencies had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript, and decision to submit the manuscript for publication.

**Disclaimer:** The views expressed are those of the authors and not necessarily those of the NHS, the NIHR, or the Department of Health.

Additional information: The data linkage accessed by CRIS remains within an NHS firewall, and a patient-led oversight committee presides over research governance for all CRIS projects and dissemination. Data access is encouraged upon adherence to these conditions. Interested parties may contact Dr Stewart (robert.stewart@kcl.ac.uk), CRIS academic lead.

**Supplementary material:** Available at Psychiatrist.com.

#### REFERENCES

- Cunill R, Castells X, Simeon D. Relationships between obsessive-compulsive symptomatology and severity of psychosis in schizophrenia: a systematic review and metaanalysis. J Clin Psychiatry. 2009;70(1):70–82.
- Cederlöf M, Lichtenstein P, Larsson H, et al. Obsessive-compulsive disorder, psychosis, and bipolarity: a longitudinal cohort and multigenerational family study. *Schizophr Bull.* 2015;41(5):1076–1083.
- Lysaker PH, Whitney KA. Obsessive-compulsive symptoms in schizophrenia: prevalence, correlates and treatment. *Expert Rev Neurother*. 2009;9(1):99–107.
- Poyurovsky M, Faragian S, Pashinian A, et al. Clinical characteristics of schizotypal-related obsessive-compulsive disorder. *Psychiatry Res.* 2008;159(1-2):254–258.
- McGrath J, Saha S, Chant D, et al. Schizophrenia: a concise overview of incidence, prevalence, and mortality. *Epidemiol Rev.* 2008;30(1):67–76.
- Ruscio AM, Stein DJ, Chiu WT, et al. The epidemiology of obsessive-compulsive disorder in the National Comorbidity Survey Replication. *Mol Psychiatry*. 2010;15(1):53–63.
- Achim AM, Maziade M, Raymond E, et al. How prevalent are anxiety disorders in schizophrenia? a meta-analysis and critical review on a significant association. *Schizophr Bull*. 2011;37(4):811–821.
- Swets M, Dekker J, van Emmerik-van Oortmerssen K, et al. The obsessive compulsive spectrum in schizophrenia: a meta-analysis and meta-regression exploring prevalence rates. Schizophr Res. 2014;152(2-3):458–468.
- Perera G, Broadbent M, Callard F, et al. Cohort profile of the South London and Maudsley NHS Foundation Trust Biomedical Research Centre (SLaM BRC) Case Register: current status and recent enhancement of an Electronic Mental Health Record-derived data resource. *BMJ*

Open. 2016;6(3):e008721.

- Wing J, Curtis RH, Beevor A. Health of the Nation Outcome Scales (HoNOS). Glossary for HoNOS score sheet. *Br J Psychiatry*. 1999;174(5):432–434.
- Cunningham H, Tablan V, Roberts A, et al. Getting more out of biomedical documents with GATE's full lifecycle open source text analytics. *PLOS Comput Biol.* 2013;9(2):e1002854.
- Chandran D, Robbins DA, Chang CK, et al. Use of natural language processing to identify obsessive compulsive symptoms in patients with schizophrenia, schizoaffective disorder or bipolar disorder. *Sci Rep.* 2019;9(1):14146.
- Goodman WK, Price LH, Rasmussen SA, et al. The Yale-Brown Obsessive Compulsive Scale, I: development, use, and reliability. Arch Gen Psychiatry. 1989;46(11):1006–1011.
- Department for Communities and Local Government. English indices of deprivation 2015. GOV.UK website. https://www.gov.uk/ government/statistics/english-indices-ofdeprivation-2015. Accessed September 2019.
- de Haan L, Sterk B, van der Valk R. Presence of obsessive compulsive symptoms in firstepisode schizophrenia or related disorders is associated with subjective well-being and quality of life. *Early Interv Psychiatry*. 2013;7(3):285–290.
- Buckley PHM. Comorbid psychiatric disorders in schizophrenia: more than just a chance cooccurrence. In: De Haan LSF, Zink M, eds. Obsessive-Compulsive Symptoms in Schizophrenia. Springer; 2015. 3–10.
- de Haan L, Sterk B, Wouters L, et al. The 5-year course of obsessive-compulsive symptoms and obsessive-compulsive disorder in first-episode schizophrenia and related disorders. Schizophr Bull. 2013;39(1):151–160.
- Faragian S, Pashinian A, Fuchs C, et al. Obsessive-compulsive symptom dimensions in schizophrenia patients with comorbid obsessive-compulsive disorder. *Prog Neuropsychopharmacol Biol Psychiatry*. 2009;33(6):1009–1012.
- Tibbo P, Kroetsch M, Chue P, et al. Obsessivecompulsive disorder in schizophrenia. *J Psychiatr Res.* 2000;34(2):139–146.
- 20. Poyurovsky M, Fuchs C, Weizman A. Obsessivecompulsive disorder in patients with

J Clin Psychiatry 83:6, November/December 2022 Reprinted with correction to pages e1, e2, e4, e6–e8.

# Ahn-Robbins et al

#### first-episode schizophrenia. 1999;156(12):1998–2000.

- de Haan L, Hoogenboom B, Beuk N, et al. Obsessive-compulsive symptoms and positive, negative, and depressive symptoms in patients with recent-onset schizophrenic disorders. *Can J Psychiatry*. 2005;50(9):519–524.
- Appelbaum PS, Robbins PC, Monahan J. Violence and delusions: data from the MacArthur Violence Risk Assessment Study. Am J Psychiatry. 2000;157(4):566–572.
- Palijan TZ, Radeljak S, Kovac M, et al. Relationship between comorbidity and violence risk assessment in forensic psychiatry - the implication of neuroimaging studies. *Psychiatr Danub*. 2010;22(2):253–256.
- 24. Volavka J. Violence in schizophrenia and bipolar disorder. *Psychiatr Danub*. 2013;25(1):24–33.
- Patel DD, Laws KR, Padhi A, et al. The neuropsychology of the schizo-obsessive subtype of schizophrenia: a new analysis. *Psychol Med*. 2010;40(6):921–933.
- Schirmbeck F, Rausch F, Englisch S, et al. Stable cognitive deficits in schizophrenia patients with comorbid obsessive-compulsive symptoms: a 12-month longitudinal study. Schizophr Bull. 2013;39(6):1261–1271.
- de Filippis R, Aloi M, Bruni A, et al. Bipolar disorder and obsessive compulsive disorder: the comorbidity does not further impair the neurocognitive profile. J Affect Disord. 2018;235:1–6.
- Perugi G, Toni C, Frare F, et al. Obsessivecompulsive-bipolar comorbidity: a systematic exploration of clinical features and treatment outcome. J Clin Psychiatry. 2002;63(12):1129–1134.
- Timpano KR, Rubenstein LM, Murphy DL. Phenomenological features and clinical impact of affective disorders in OCD: a focus on the bipolar disorder and OCD connection. *Depress Anxiety*. 2012;29(3):226–233.
- 30. Dekker N, Swets M, Investigators G. GROUP

Investigators. Substance use in a large sampl of patients with schizophrenia or related disorders and co-morbid obsessivecompulsive symptoms. *Aust NZ J Psychiatry*. 2013;47(9):868–874.

- Hunter H, Lysaker PH. Associations of comorbid obsessive-compulsive symptoms with psychotic and affective symp- toms and general functioning. In: de Haan L, Schirmbeck F, Zink M, eds. Obsessive-Compulsive Symptoms in Schizophrenia. Springer; 2015:77–88.
- Kim SW, Jeong BO, Kim JM, et al. Associations of obsessive-compulsive symptoms with clinical and neurocognitive features in schizophrenia according to stage of illness. *Psychiatry Res.* 2015;226(1):368–375.
- 33. Goes FS, McCusker MG, Bienvenu OJ, et al; National Institute of Mental Health Genetics Initiative Bipolar Disorder Consortium. Comorbid anxiety disorders in bipolar disorder and major depression: familial aggregation and clinical characteristics of co-morbid panic disorder, social phobia, specific phobia and obsessive-compulsive disorder. *Psychol Med*. 2012;42(7):1449–1459.
- Issler CK, Monkul ES, Amaral JA, et al. Bipolar disorder and comorbid obsessive-compulsive disorder is associated with higher rates of anxiety and impulse control disorders. Acta Neuropsychiatr. 2010;22(2):81–86.
- Lysaker PH, Marks KA, Picone JB, et al. Obsessive and compulsive symptoms in schizophrenia: clinical and neurocognitive correlates. J Nerv Ment Dis. 2000;188(2):78–83.
- Lysaker PH, Whitney KA, Davis LW. Obsessivecompulsive and negative symptoms in schizophrenia: associations with coping preference and hope. *Psychiatry Res.* 2006;141(3):253–259.
- Sevincok L, Akoglu A, Kokcu F. Suicidality in schizophrenic patients with and without obsessive-compulsive disorder. *Schizophr Res.* 2007;90(1-3):198–202.
- 38. Bottas A, Cooke RG, Richter MA. Comorbidity

and pathophysiology of obsessive-compulsive disorder in schizophrenia: is there evidence for a schizo-obsessive subtype of schizophrenia? *J Psychiatry Neurosci.* 2005:30(3):187–193.

- Grover S, Sahoo S, Surendran I. Obsessivecompulsive symptoms in schizophrenia: a review. Acta Neuropsychiatr. 2019;31(2):63–73.
- Brakoulias V, Starcevic V, Sammut P, et al. Obsessive-compulsive spectrum disorders: a comorbidity and family history perspective. *Australas Psychiatry*. 2011;19(2):151–155.
- Schirmbeck F, Swets M, Meijer CJ, et al; GROUP Investigators. Longitudinal association between cognitive performance and obsessive-compulsive symptoms in patients with psychosis and unaffected siblings. Acta Psychiatr Scand. 2016;133(5):399–409.
- Jayatilleke N, Hayes RD, Chang CK, et al. Acute general hospital admissions in people with serious mental illness. *Psychol Med.* 2018;48(16):2676–2683.
- Niendam TA, Berzak J, Cannon TD, et al. Obsessive compulsive symptoms in the psychosis prodrome: correlates of clinical and functional outcome. *Schizophr Res.* 2009;108(1-3):170–175.
- 44. Viani N, Yin L, Kam J, et al. Time expressions in mental health records for symptom onset extraction. In proceedings of the 9th International workshop on health text mining and information analysis (LOUHI 2018). 2018:183–92. https://kclpure.kcl.ac.uk/portal/ files/102467507/Time\_Expressions\_in\_ Mental\_VIANI\_Published310ctober2018\_ GREEN\_AAM.pdf. Accessed January 23, 2022.

*Editor's Note:* We encourage authors to submit papers for consideration as a part of our Early Career Psychiatrists section. Please contact Joseph F. Goldberg, MD, at jgoldberg@psychiatrist.com.

See supplementary material for this article at PSYCHIATRIST.COM.



THE OFFICIAL JOURNAL OF THE AMERICAN SOCIETY OF CLINICAL PSYCHOPHARMACOLOGY

Supplementary Material

- Article Title: Prevalence and Correlates of Obsessive-Compulsive Symptoms in Individuals With Schizophrenia, Schizoaffective Disorder, or Bipolar Disorder
- Authors:Deborah Ahn-Robbins, MSc; Nina H. Grootendorst-van Mil, MD, PhD; Chin-Kuo Chang, PhD;<br/>David Chandran, PhD; Hitesh Shetty, PhD; Jyoti Sanyal, PhD;<br/>James H. MacCabe, FRCPsych, PhD; Hannah Cohen, PhD; Robert Stewart, MD;<br/>Frederike Schirmbeck, PhD; Lieuwe de Haan, MD, PhD; and Richard D. Hayes, PhD
- **DOI Number:** 10.4088/JCP.21m14010

## List of Supplementary Material for the article

1. <u>Table 1</u> Associations Between Mental/Physical Health Symptoms and OCS (Including OCD) Status Among SLaM Service Users With Schizophrenia, Schizoaffective Disorder or Bipolar Disorder in Southeast London by Univariable and Multivariable Logistic Regression

## **Disclaimer**

This Supplementary Material has been provided by the author(s) as an enhancement to the published article. It has been approved by peer review; however, it has undergone neither editing nor formatting by in-house editorial staff. The material is presented in the manner supplied by the author.

© Copyright 2022 Physicians Postgraduate Press, Inc.

Supplementary Table 1. Associations between mental / physical health symptoms and OCS (including OCD) status among SLaM service users with schizophrenia, schizoaffective disorder or bipolar disorder in southeast London by univariable and multivariable logistic regression

	Odds Ratio (95% CI)					
Status of obsessive	essive Overactive aggressive beha		Ir <sup>a</sup> Non-accidental self-injury <sup>b</sup>		Cognitive problems <sup>c</sup>	
compulsive symptom	Crude	Adjusted <sup>^</sup>	Crude	Adjusted <sup>^</sup>	Crude	Adjusted <sup>^</sup>
OCS (including OCD)						
No	Ref	Ref	Ref	Ref	Ref	Ref
Yes	1.18 (1.11, 1.26)	1.17 (1.9, 1.25)	1.18 (1.08, 1.29)	1.04 (0.95, 1.14)	1.14 (1.07, 1.23)	1.20 (1.12, 1.29)
(continue)						
	Odds Ratio (95% CI)					
Status of obsessive	Physical illness or disability <sup>d</sup>		Hallucinations and delusions <sup>e</sup>		Depressed mood <sup>f</sup>	
compulsive symptom	Crude	Adjusted <sup>^</sup>	Crude	Adjusted <sup>^</sup>	Crude	Adjusted <sup>^</sup>
OCS (including OCD)						
No	Ref	Ref	Ref	Ref	Ref	Ref
Yes	0.98 (0.92, 1.05)	1.17 (1.09, 1.27)	1.11 (1.04, 1.19)	1.09 (1.02, 1.18)	1.09 (1.02, 1.17)	1.05 (0.98, 1.12)

^ Adjusting age, sex, ethnicity, relationship, deprivation score, psychiatric diagnosis (schizophrenia, schizoaffective disorder, or bipolar disorder), comorbidity of alcohol use disorder, and comorbidity of opioid use disorder

<sup>a</sup> N=18,035; <sup>b</sup> N=18,007; <sup>c</sup> N=17,983; <sup>d</sup> N=17,995; <sup>e</sup> N=17,955; <sup>f</sup> N=17,982