

# Substance Use Patterns and Schizophrenia Spectrum Disorders: A Retrospective Study of Inpatients at a Community Teaching Hospital

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## Abstract

**Background:** Schizophrenia is one of the chronic mental illnesses, characterized by delusions, hallucinations, disorganized speech, grossly disorganized or catatonic behavior, and cognitive decline. It frequently leads to a lifetime of impairment and disability that span the entire lifespan of the patients. Several epidemiologic studies have shown that schizophrenia spectrum disorders (SSDs) contribute significantly to years lived with disability. Additionally, substance use disorders have been reported to co-occur commonly among patients with SSD (a comorbidity also known as dual diagnosis), attracting notable attention over the past few decades. This dual diagnosis often requires treatment modifications to ensure for best patient outcomes.

**Methods:** This study was a retrospective review of the electronic medical charts. The patients included in the study were discharged from the psychiatric unit of our hospital between July 1, 2017 and October 31, 2017. Patients were included in the study using three inclusion criteria: 1) age  $\geq 18$  years; 2) had a diagnosis of SSD at discharge; and 3) had urine drug screen performed. Sociodemographic and clinical variables were abstracted. Univariate analysis and summary statistics were performed. Bivariate and multivariate analyses were done via logistic regression models to determine the odds ratios (ORs) and corresponding P values (P).

**Results:** A total of 365 (52.2%) patients had a diagnosis of SSD at discharge. Of these, 349 met the inclusion criteria. The age ranged from 19 to 79 years, with a mean age of 42.2 years, and 76.8% of the patients used substances. Out of the 269 patients who used substances, 199 (74%) used two or more substances. Tobacco use was most prevalent (62.3%), followed by cannabis use (41.5%), alcohol use (40.2%), and cocaine use (27.4%). Patients who reported using tobacco, were

more likely to have comorbid alcohol use (OR = 7.24; P = 0.000), cannabis use (OR = 2.80; P = 0.000), cocaine use (OR = 5.00; P = 0.000), and synthetic cannabis (K2) use (OR = 4.62; P = 0.048). Results of the multivariate analyses supported the other findings.

**Conclusions:** Our study found a high association between schizophrenia spectrum disorders and substance use, with three out of four patients with SSD using a substance. This prevalence is higher than previously reported by other studies. Among those who use substances, about three in four use multiple substances. These point to some interaction between the substances and appear to be heavily influenced by significant social determinants of mental health that continue to plague the community. It is important to establish if a patient with schizophrenia has a comorbid substance use disorder, because addressing both generally leads to better patient outcomes.

**Keywords:** Substance use; Schizophrenia; Schizophrenia spectrum disorders; Mental health; Public health

## Introduction

Schizophrenia is one of the chronic mental illnesses. Patients commonly present with delusions, hallucinations, disorganized speech, grossly disorganized or catatonic behavior, and negative symptoms. It frequently leads to a lifetime of impairment, cognitive decline, and disability that span the entire lifespan of the patients. Several epidemiologic studies have shown that schizophrenia spectrum disorders (SSDs) contribute significantly to years lived with disability [1]. Additionally, substance use disorders (SUDs) have been reported to co-occur commonly among patients with SSD (a comorbidity also known as dual diagnosis), attracting notable attention over the past few decades [2-5]. For example, in one epidemiological study, 47% of patients with schizophrenia were reported to have a SUD [2]. Patients diagnosed with schizophrenia and other psychotic disorders usually have comorbid SUDs. This dual diagnosis often requires treatment modifications to ensure for best outcomes. This estimate is in-keeping with other studies reporting approximately half of schizophrenia patients have a comorbid SUD [4, 5].

Most patients with comorbid SSD and substance use are

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young males and have been shown to have a higher risk for medication noncompliance, multiple hospitalizations, unstable housing and homelessness, human immunodeficiency virus (HIV) infection, suicide, and violent behavior [3]. Regarding specific substances, those who use alcohol are reported to have higher hospital admissions, higher severity of positive symptoms, higher rates of extrapyramidal side effects including tardive dyskinesia, and “relative neuroleptic refractoriness” [2]. There have been studies about the exacerbation of psychotic symptoms, increased hospital admissions, and increased tardive dyskinesia with cannabis use [2, 5]; while cocaine use reportedly is associated with a higher risk of depression, milder negative symptoms, and a high rate of readmission [2]. Additionally, patients with dual diagnosis have been shown to have a link between current suicide risk, positive symptoms, insight, and first-degree relatives with SUD [6].

Although several studies show an association between SSD and substance use, with the attendant negative health effects, the direction of influence remains unclear. Furthermore, it is uncertain if it is more likely that patients with SSD would use one or a combination of substances (e.g., use of tobacco alone versus tobacco and cannabis). Hence, investigating the pattern of substance use among patients with SSD in different clinical/geographic settings is a crucial step. In this research study, we choose to evaluate the prevalence of substance use and the common combination of substances used by patients diagnosed with SSDs at a community teaching hospital.

## Materials and Methods

### Study setting and population

The study was conducted at Interfaith Medical Center, a community teaching hospital in Central Brooklyn, NY. The hospital serves patients, representing every racial, ethnic, and national origin group in Central Brooklyn, with the majority being Caribbean-Americans and African Americans.

### Study design and sample

This study was a retrospective review of the electronic medical charts. The patients included in the study were discharged from the psychiatric unit of our hospital between July 1, 2017 and October 31, 2017. Patients were included in the study using three inclusion criteria: 1) age  $\geq$  18 years old; 2) had a diagnosis of SSD at discharge; and 3) had urine drug screen performed.

### Data collection and management

Data on discharges from the inpatient psychiatric unit were obtained from the director of quality assurance. Data on study variables were manually abstracted from the electronic medical record system and populated into an excel spreadsheet. The data were recoded and exported to STATA software for analy-

sis. To maintain HIPAA compliance, no personal identifiable information was recorded.

### Choice of variables and categorization

The variables chosen were hypothesized to influence substance use directly or indirectly in patients with SSD. Socio-demographic characteristics included age, gender, race, employment status, and living arrangement of the patients. The clinical variables included length of stay in the hospital, readmission to the hospital within 30 days, urine drug screen result, and self-reported tobacco use.

Some quantitative variables were recoded into categorical variables. As such, age was recoded into two categories (0 = patients aged 18 to 42 years; 1 = patients aged 43 years or older); readmission to the hospital within 30 days was recoded as “0” for no readmission within 30 days following discharge and “1” for patients that were readmitted within 30 days of discharge; given that the median length of stay was 12 days, length of hospital stay (LOS) was recoded as “0” for patients with a hospital stay of 12 days or less, and “1” for those with a hospital stay greater than 12 days.

### Statistical methods

Statistical analysis was done using STATA software version 16. The Chi-square test and *t*-test for independent samples were used to compare groups at baseline. A total of 10 variables were included in the baseline analysis and data description. Frequencies were reported for the substances used by the study population.

In patients who reported using tobacco (62.3%), bivariate logistic regression analyses were run to determine the odds ratios (ORs) and corresponding P values of co-occurring substance use. We defined statistical significance using a two-tailed P value of less than or equal to 0.05, for all analyses. A multivariate logistic regression was then performed including all covariates in the unadjusted bivariate models, regardless of statistical significance.

We used the Hosmer-Lemeshow test to verify the goodness-of-fit of our model. The goodness-of-fit model shows that the model cannot be dismissed and therefore leads to the inference that the model fits well.

### Ethical issues

For this study, institutional review board (IRB) approval was obtained. This research was carried out in accordance with the ethical principles of the organization responsible for human subjects, as well as with the Declaration of Helsinki.

## Results

We extracted 365 (52.2%) of records with a discharge diagno-

**Table 1.** Characteristics of the Study Population

Variables	Substance use		P value
	Yes (n = 268)	No (n = 81)	
Age (years ± SD)	41.7 ± 12.1	43.3 ± 15.1	0.326*
Age category, n (%)			0.652
18 - 42	140 (52.24)	40 (49.38)	
> 42	128 (47.76)	41 (50.62)	
Sex, n (%)			0.001
Female	66 (24.63)	37 (45.68)	
Male	199 (74.25)	43 (53.09)	
Trans female	3 (1.12)	1 (1.23)	
Race, n (%)			0.008
Black or AA	217 (80.97)	53 (65.43)	
White	13 (4.85)	10 (12.35)	
Hispanic	33 (12.31)	13 (16.05)	
Other	5 (1.87)	5 (6.17)	
Length of stay (days ± SD)	13.8 ± 13.3	15.7 ± 11.2	0.253
Length of stay category, n (%)			0.326
0 - 12 days	162 (60.45)	44 (54.32)	
> 12 days	106 (39.55)	37 (45.68)	
Marital status, n (%)			0.578
Single	254 (94.78)	78 (96.30)	
Married	14 (5.22)	3 (3.70)	
Employment status, n (%)			0.688
Unemployed	259 (96.64)	79 (97.53)	
Employed	9 (3.36)	2 (2.47)	
Living arrangement, n (%)			0.984
Homeless	136 (50.75)	41 (50.62)	
Domiciled	132 (49.25)	40 (49.38)	
Readmitted within 30 days, n (%)			0.616
No	229 (85.45)	71 (87.65)	
Yes	39 (14.55)	10 (12.35)	

\*Based on two sample *t*-test for independent samples. All other analyses in Table 1 are based on  $\chi^2$  test. Note that all patients included in this study were diagnosed with schizophrenia spectrum disorders (SSDs). AA: African American.

sis of SSD out of a total of 698 discharges. Of these, 16 patients were excluded as they did not have a urine drug screen and did not report on their tobacco use. There were 349 patients that were included in the study (Table 1), of which 77.4% were African American, 6.6% White, 13.2% Hispanic, and 2.8% identified as other race. Of the 349 patients, 76.8% used substances as evidenced by urine drug screen results and/or self-reported tobacco use. The mean age was 42.2 years, with the youngest being 19 years and the oldest being 79 years. The mean age was 41.7 years for those using substances as compared to 43.3 years in those who did not report any substance use. There was no statistical difference between the young (18 - 42 years) versus the older age group (> 42 years), irrespec-

tive of whether they used substances or not. The male gender was the most represented, with 69.3% of the study population, and it was also significantly associated substance use (P value = 0.001). African Americans used substances more than any other race, though the association was not statistically significant (P value = 0.008). Other factors such as being single, being unemployed, and being homeless, were also found to be nonsignificant in our study populations, with P values of 0.578, 0.688, and 0.984, respectively.

Among those with substance use, 74% (199/269) used two or more substances. In the frequency analyses (Table 2), tobacco use was most prevalent (62.3%), followed by cannabis use (41.5%), alcohol use (40.2%), and cocaine use (27.4%). In the

**Table 2.** Frequency Distribution of the Substances Used in the Study Population

Variable	N	%
Alcohol		
No	205	59.8
Yes	138	40.2
Amphetamine		
No	316	98.1
Yes	6	1.9
Benzodiazepine		
No	314	96.6
Yes	6	3.4
Cannabis		
No	189	58.5
Yes	134	41.5
Cocaine		
No	236	72.6
Yes	89	27.4
K2 (synthetic cannabinoids)		
No	217	93.1
Yes	16	6.9
Opioids		
No	312	95.7
Yes	14	4.3
Tobacco		
No	129	37.7
Yes	213	62.3

bivariate analyses (Table 3), among patients who reported using tobacco, alcohol use (OR = 7.24; P value = 0.000), cannabis use (OR = 2.80; P value = 0.000), cocaine use (OR = 5.00; P value = 0.000), and synthetic cannabis (K2) use (OR = 4.62; P value = 0.048), were all found to be statistically significant. However, after adjusting for all covariates in the multivariate analysis, the only variables significantly associated with tobacco use in our study population were alcohol use, cannabis use, and cocaine use (Table 4).

The Hosmer-Lemeshow test was used to verify the goodness-of-fit of our model (number of groups = 7;  $\chi^2 = 6.64$ ; P value = 0.248). The result shows that the model cannot be dismissed and therefore leads to the inference that the model fits well.

## Discussion

This study found that more than three quarters of the patients reported substance use. Of these, more than six out of 10 reported smoking tobacco. Patients with schizophrenia are three times more likely than the general population to start smok-

**Table 3.** Unadjusted Odds Ratios (ORs), 95% Confidence Intervals (CIs) and P Values From Bivariate Logistic Regression Models in Patients Using Tobacco

Variables	Unadjusted OR	95% CI	P value
Alcohol use			
Yes vs. No	7.24	4.14 - 12.67	0.000
Amphetamine use			
Yes vs. No	3.09	0.36 - 26.74	0.307
Benzodiazepine use			
Yes vs. No	2.78	0.59 - 13.10	0.196
Cannabis use			
Yes vs. No	2.8	1.70 - 4.59	0.000
Cocaine			
Yes vs. No	5	2.60 - 9.52	0.000
K2 use			
Yes vs. No	4.62	1.02 - 20.99	0.048
Opioids			
Yes vs. No	2.26	0.62 - 8.27	0.218

ing and are five times less likely to stop smoking, with current prevalence rates of up to 80% [7].

In our study, we found that most patients used multiple substances as well as a significant link between tobacco use and other substances such as alcohol, cannabis, and cocaine. According to Canadian Schizophrenia Guidelines, in people who have schizophrenia and other psychotic disorders, substance use is common [8]. A possible explanation is that the

**Table 4.** Adjusted Odds Ratios (ORs), 95% Confidence Intervals (CIs) and P values From Multivariate Logistic Regression Model in Patients Using Tobacco<sup>a</sup>

Variables	Adjusted OR	95% CI	P value
Alcohol use			
Yes vs. No	2.3	1.12 - 4.72	0.023
Amphetamine use			
Yes vs. No	2.35	0.20 - 27.03	0.493
Benzodiazepine use			
Yes vs. No	2.62	0.23 - 29.65	0.436
Cannabis use			
Yes vs. No	2.94	1.58 - 5.48	0.001
Cocaine use			
Yes vs. No	3.4	1.45 - 7.97	0.005
K2 use			
Yes vs. No	2.22	0.40 - 12.37	0.362
Opioids			
Yes vs. No	1.82	0.40 - 8.32	0.442

<sup>a</sup>All the covariates in the bivariate analyses in Table 3, were included in the multivariate model regardless of statistical significance.

ultimate shared influence of substances on the brain reward circuitry affects individuals who use several [9]. The findings in this research like those of other studies, indicate that persons with SSD use substances at a higher rate. In a prevalence study of patients with a psychiatric disorder conducted in Denmark in 2016, of the 53,035 patients with schizophrenia, 37% (19,623) reported using a substance [10]. Mueser et al reported in their study that alcohol was mostly likely to be abused by patients (47%), followed by cannabis (42%), stimulants (25%), and hallucinogens (18%). Sedatives (7%) or narcotics (4%) were abused by very few patients [11]. In severely mentally ill psychiatric patients, the most common type of SUD, followed by cannabis and cocaine use, was alcohol [12]. The misuse of both alcohol and cannabis has a negative effect on the clinical outcomes of schizophrenia. In the case of cannabis, it was also debated whether schizophrenia would actually be induced, on the basis of a three-to-six-fold dose-dependent rise in the risk of psychosis among cannabis users [7].

Large epidemiologic studies indicate that among people with schizophrenia, the rate of SUDs (excluding nicotine and caffeine use disorders) is 47% and 44.8%, respectively; with alcohol and cannabis being the most used substances. Moreover, in 60-90% of people with schizophrenia and other psychotic disorders, cigarette smoking has been documented [8]. Hunt et al conducted a meta-analysis and found that SUDs are extremely prevalent in schizophrenia, and rates over time have remained unchanged. They reported that the prevalence of any SUD was 41.7%. This was followed by illicit drugs with 27.5%, cannabis with 26.2%, alcohol with 24.3%, and stimulant use with 7.3% of the study population [4]. However, Margolese et al found that patients with ongoing depressive disorder compared to those with SSD (49.6%) were more likely to smoke cigarettes (88.9%) and they had significantly longer cigarette smoking histories (19.1 years for depressive disorders vs. 11.5 years for SSD) [13, 14]. Nesvag et al looked at the prevalence of SUD in patients diagnosed with schizophrenia, bipolar disorder, and depression. They reported that SUD was prevalent among 25.1% patients with schizophrenia, 20.1% patients with bipolar disorder, and 10.9% patients with depressive illness [10]. Looking at the number of patients using cocaine in our study, the results are in line with other studies which reported that beginning in 1988 and continuing to the present, cocaine use has risen significantly among urban schizophrenic patients. In addition, since the crack epidemic, cocaine appears to be the preferred substance of abuse for schizophrenic patients, surpassing amphetamines [9].

With respect to gender, our study found that males used more substances than females. This finding is similar to that of DeQuardo and colleagues who reported that the rate of substance abuse was much lower in female (20%) compared to male subjects (48%). The most widely abused drug, however, was cannabis (28%), followed closely by alcohol (21%), with slightly less patients abusing cocaine, hallucinogens, and stimulants [15]. For both substance abuse and schizophrenia, gender is an especially significant factor. For alcohol and cannabis in particular, males abused each class of drugs more than females [12]. Verma et al reported in their study of the Asian population looking at patients with a first episode of SSD, that alcohol was the substance most abused. They also stated that substance users

were more likely to be males and were also more likely to have a criminal record than those who did not use substances [16].

### Limitations

There are some drawbacks to this study, including those relating to the retrospective study design of medical charts. We were constrained, for instance, by the quality of information given in the charts. To assess whether the patients met criteria for SUD, we did not characterize the substance based on severity, such as mild, moderate, and severe. This was further compounded by using self-reports to determine tobacco use disorder, which is inherently subject to recall bias and underreporting. Another limitation of the study is that we did not look at medical comorbidities in these patients, factors that can also predispose to substance use.

The relatively large sample size is a strength of this analysis, which makes it possible that minor variations were observed between the study variables.

### Conclusions

Patients diagnosed with schizophrenia and other psychotic disorders usually have comorbid SUDs. This dual diagnosis often requires treatment modifications to ensure for best outcomes. Our study found a high association between SSDs and substance use, with three out of four patients with SSD using a substance. This prevalence is higher than previously reported by other studies. Among those who use substances, about three in four use multiple substances. These points to some interaction between the substances and appears to be heavily influenced by significant social determinants of mental health that continue to plague the community. As previously reported by almost all studies if not all, there is a need to modify treatment to accommodate or address substance use comorbidity to achieve a favorable outcome in patients with SSD. This makes it important to establish if a patient with schizophrenia has a comorbid SUD. Psychiatric patients with comorbid SUD are frequently diagnosed later than those with no substance use, therefore delaying effective treatment. Identifying those at high risk so that care is initiated sooner would be of great interest.

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## Conflict of Interest

The authors have no conflict of interest.

## Informed Consent

This was a retrospective review of patients' charts. The patients were discharged from Interfaith Medical Center's inpatient psychiatric unit. No personal identifiable information was obtained from study participants.

## Author Contributions

As the primary author of the manuscript, TT has contributed to the study design, data collection, data analysis, helped to write the final draft of the manuscript, and has complete access to all the data in the study. O. Oladeji assisted with the gathering of data and the preparation of the final draft of the manuscript. MG assisted with the gathering of data and the writing of the final draft of the manuscript. BK assisted with gathering of data and writing of the final draft of the manuscript. O. Olayinka contributed to the study's design, assisted with collection of data, and the writing of the final manuscript. CO helped with data collection and the final manuscript writing. TO contributed to the design of the report and supervised the writing of the manuscript's final draft.

## Data Availability

Any questions should be addressed to the corresponding author about the supporting data availability.

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