



## Distribution and correlates of long-acting injectable antipsychotic use among community mental health center patients

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### ARTICLE INFO

#### Keywords:

Long-acting injectable antipsychotics  
Community mental health centers  
Population distribution  
Psychotic disorders

### ABSTRACT

Although long-acting injectable antipsychotics (LAIs) are an important pharmaceutical option in the management of schizophrenia and related disorders, little is known about patient characteristics related to LAI use in real-world outpatient settings. We analyzed electronic medical records from 41,401 patients who received psychiatric services from one of 16 regional mental health centers operated by the South Carolina Department of Mental Health in 2022. We compared the use of first- and second-generation LAIs and oral antipsychotics by sociodemographic (age, gender, race/ethnicity, zip code, payment source) and clinical characteristics (psychiatric diagnoses, service use). We used logistic regression models to estimate associations between patient characteristics and the likelihood of using LAIs. In total, 7,029 (17.0 %) patients used LAIs in 2022, including 5,901 with schizophrenia or another psychotic disorder. Compared to White patients, Black (Odds Ratio (OR): 2.19, 95 % Confidence Interval (CI): 1.96 – 2.44) and Asian (OR: 3.39, 95 % CI: 1.54 – 7.43) patients were significantly more likely to use LAIs, controlling for other patient demographic and clinical characteristics. LAI users were also more likely to be male (OR: 1.83, 95 % CI: 1.64, 2.03), to live in suburban areas (OR: 1.25, 95 % CI: 1.10, 1.42), and to use Medicaid (OR: 1.55, 95 % CI: 1.34, 1.79). Similar differences were not found for oral antipsychotics. Results suggest that LAI use differs substantially by patient characteristics independent of psychiatric diagnoses. Identifying and understanding reasons for differences in LAI use is important to promote equitable access to and use of LAIs across racial, geographic, and other sociodemographic groups.

### 1. Introduction

Antipsychotic medications have long formed the foundation for the treatment of schizophrenia and other mental health disorders characterized by psychotic symptoms such as hallucinations and delusions. Both first-generation (typical) and second-/third-generation (atypical) antipsychotics are widely prescribed and shown to be effective at reducing psychotic symptoms (Huhn et al., 2019; Lian et al., 2022a; Schneider-Thoma et al., 2022), improving social and occupational functioning (Huhn et al., 2019; Lian et al., 2022a), and reducing relapse (Leucht et al., 2012; Lian et al., 2022a; Miyamoto and Wolfgang Fleischhacker, 2017); however, both classes of antipsychotic medication may also lead to distinct and often troubling neurological and metabolic side effects (Dibonaventura et al., 2012; Lally and MacCabe, 2015;

Poloni et al., 2019). For this and other reasons, non-adherence to oral antipsychotic regimens and treatment discontinuation is common. Up to 67 % of patients prescribed an oral antipsychotic are not fully adherent, and 26–44 % of persons with schizophrenia discontinue use of oral antipsychotics (Kaplan et al., 2013).

Long-acting injectable antipsychotic medications (LAIs) are alternative formulations of first-, second-, and third-generation antipsychotics that are administered via injection by a health professional. LAIs offer several advantages compared to oral antipsychotics, including improved adherence (Biagi et al., 2017; Lin et al., 2021; Titus-Lay et al., 2018); lower relapse rates (Lian et al., 2022b); reduction in hospitalization risk, frequency, and duration (Kane et al., 2020; Kishimoto et al., 2021, 2014, 2013); and better clinical outcomes (Brissos et al., 2014; Lin et al., 2021). Since the advent of second-generation LAIs, LAI

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<https://doi.org/10.1016/j.psychres.2025.116378>

Received 20 December 2024; Received in revised form 23 January 2025; Accepted 25 January 2025

Available online 26 January 2025

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antipsychotics are increasingly used to manage both chronic and first-episode psychosis and are recommended for those with previous problems with adherence. However, despite the advantages offered by LAIs, evidence suggests that they are utilized far less frequently than oral medications and are often perceived negatively or inaccurately by both patients and providers (Geerts et al., 2013; Kirschner et al., 2013; Waddell and Taylor, 2009). Limited provider knowledge and experience with LAIs and pragmatic healthcare system barriers (cost, storage, staffing) contribute to underuse of LAIs (Iyer et al., 2013a, 2013b). Additionally, LAIs have been viewed by some as reducing or infringing upon patient autonomy, particularly among Black and economically disadvantaged people (Iyer et al., 2013a; Potkin et al., 2013, 2017). Physician concerns about patient perceptions of medical coercion may account for some hesitancy to prescribe or even offer LAIs (Jaeger and Rossler, 2010). However, population-based research of patients with schizophrenia shows that patient acceptance of LAI antipsychotics is higher than prescription rates – illuminating an opportunity for increasing their use (Heres, 2014; Heres et al., 2014).

A potential contributor to attitudes and knowledge about LAIs is a lack of robust research on the frequency, distribution, and determinants of LAI use in representative populations. Descriptive research on LAI use has generally been limited to clinical samples or to samples drawn from large payer-specific databases, like Medicaid or the Veterans Affairs Administration (Brown et al., 2014; Caballero et al., 2023; Cai et al., 2024; Li et al., 2023a, 2023b; McCreath et al., 2017; Soleman et al., 2017). While these databases can provide invaluable information regarding LAI use, they may not capture the full spectrum of patients served in a geographic region. Specific patient populations are frequently omitted or underrepresented, such as the uninsured, un-housed, and privately insured, and an increasing number of young adults who are covered under their parents' insurance plans (VanGarde et al., 2018). In addition, there is scant research on utilization of LAIs among minority populations.

Given current research gaps, examining the sociodemographic and clinical characteristics of LAI users in a large diverse population could have broad public benefit by contributing to knowledge about real-world implementation of LAIs. In this population-based study we examined the frequency and distribution of LAI use across South Carolina (SC) through electronic health records of patients from the South Carolina Department of Mental Health (SCDMH). Previous work has shown that South Carolina has the highest rate of LAI adoption among Medicaid beneficiaries in the United States – 26 % of patients with a schizophrenia diagnosis had at least one claim for an LAI, compared to the national average rate of 13 % (Patel et al., 2022). South Carolina is also a demographically diverse state by race/ethnicity (White: 69.0 %; Black: 26.0 %; Asian: 2.0 %; Hispanic: 7.5 %), age (19.3 % are 65 and older), geographic distribution (33.7 % of residents live in rural areas), and other socioeconomic indicators (U.S. Census Bureau, 2024), making it an ideal setting for research on factors related to LAI use. Specifically, this study was guided by the following research questions: 1) What are the sociodemographic and clinical characteristics of LAI users served by SCDMH? 2) Which patient characteristics are independently associated with greater likelihood of LAI use?

## 2. Methods

### 2.1. Data source

This cross-sectional study analyzed electronic medical records (EMR) from patients who received ambulatory psychiatric services at one of 16 community mental health centers operated by the South Carolina Department of Mental Health (SCDMH) from January 1, 2022, to December 31, 2022. The mental health center catchment areas span all regions of South Carolina. An SCDMH staff member who was not involved in the present analysis compiled patient EMR records according to unique client identification numbers, which are shared across all

SCDMH centers. Patient records were then provided to study researchers as deidentified data. The protocol for this study was approved by the institutional review boards of SCDMH and the University of South Carolina (Pro00130788). Informed consent was waived because the study used deidentified EMR data and no patients were contacted for further data collection. The study design and results are reported according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

### 2.2. Setting and participants

SCDMH provides direct oversight of the state's 16 community mental health centers (CMHCs) all of which are accredited by the Commission on Accreditation of Rehabilitation Facilities and share policies, procedures, and administrative resources including an EMR. Each CMHC has a geographic catchment area ranging from 1 to 7 counties, which allows mental health coverage across the entire state. While some CMHCs have developed unique programs, all CMHCs provide a core set of mental health services including crisis intervention; individual, group and family psychotherapy; psychiatric diagnostic evaluations and medical management; psychosocial rehabilitation; family support; behavior modification and targeted case management. CMHC clinical staff include physicians, nurses, advanced practice providers (nurses and PAs), mental health professionals, care coordinators and peer support specialists. SCDMH accepts all types of insurance and, in many SC counties, is the only service provider who accepts Medicaid.

The sample included adults aged 18 and older who received any ambulatory psychiatric services from an SCDMH regional MHC from January 1, 2022, to December 31, 2022. EMR data contained patients' demographic information (e.g., age, race, ethnicity, gender, treatment location, insurance payment source) and health-related information (e.g. primary and secondary psychiatric diagnoses, services received, medications prescribed).

### 2.3. Measures

#### 2.3.1. Antipsychotic medications

Long-acting injectable antipsychotic medication (LAI) administration was recorded in patients' EMRs by MHC staff at the time of LAI administration. Patients were considered to be using an LAI medication if their EMR contained a record of at least one dose of any of seven commonly prescribed LAIs during the study period by either brand or generic name: Aripiprazole (Abilify Maintena, Aristada) Haloperidol, (Haldol Decanoate), Paliperidone (Invega Sustenna/Trinza), Risperidone (Perseris, Risperdal Consta), and Fluphenazine (Prolixin Decanoate). In secondary analyses among only LAI users, we classified LAIs as first- vs. second-/third-generation. Oral antipsychotic medication prescriptions, like LAIs, were recorded in patient EMRs by brand or generic name. Oral antipsychotics were categorized in analyses as (yes/no) or, among oral antipsychotic users, as first- vs. second-/third-generation.

#### 2.3.2. Psychiatric diagnoses

Patients' primary and up to 15 secondary diagnoses were recorded in EMR per International Classification of Diseases (ICD-10) codes. We created indicator variables for all diagnoses appearing in greater than 1 % of the sample population. Because antipsychotic medications are regularly used to treat individuals with diagnoses other than schizophrenia and related disorders (e.g., bipolar disorder), we did not restrict the sample to those with a psychotic disorder. However, psychiatric diagnoses were statistically controlled in regression analyses.

#### 2.3.3. Sociodemographic variables

Information on race (Black, White, Asian, Native American/Alaskan Native, >1 race), ethnicity (Hispanic, not Hispanic), and age were obtained from the EMR. We examined distribution of age in both 10-year

increments and in clinically meaningful groupings (18–26, 27–64, and 65+ years).

Location-of-care was measured by the zip code of the MHC at which services were provided. To measure geographic population density, zip codes were linked with 2010 Rural-Urban Commuting Area (RUCA) codes (USDA) and categorized as urban (metropolitan; primary commuting flow within urbanized area with population >50,000), suburban (micropolitan; primary commuting flow within urban cluster with population of 10,000 – 49,999), rural/small town (commuting flow within small urban cluster with population <10,000) (United States Department of Agriculture, Economic Research Service, 2024).

Payment source for LAI and payment source for other services were categorized separately and included Medicaid, Medicare, private insurance, self-pay and other (e.g., no charge, SC Prime, SC Hopes, CHAMPUS).

## 2.4. Statistical analysis

### 2.4.1. Research question 1

We generated summary statistics for sociodemographic and other characteristics overall and within groups defined by LAI use and oral antipsychotic use. We compared distributions of these variables between users and non-users of (1) LAIs and (2) oral antipsychotic medications, specifically using t-tests for continuous variables and chi-square tests for categorical variables.

### 2.4.2. Research question 2

To explore associations between individual-level factors and the likelihood of LAI use, we fit bivariate logistic regression models with LAI use (1=yes; 0=no) as the dependent variable and each demographic/contextual factors as independent variables. Next, we fit multivariable logistic regression models to estimate associations between individual-level factors and the likelihood of LAI use while controlling other factors. Covariates were included in models if found to be significantly associated with LAI use in bivariate models using a pre-determined alpha level of 0.05 to indicate statistical significance. We repeated this approach with oral antipsychotic use as the dependent outcome in models. In secondary analyses, we repeated this approach among LAI users only, to determine factors related to administration of first-generation (vs. second- or third-generation) LAIs.

All analyses were performed using Stata statistical software version 17 (StataCorp, 2021).

## 3. Results

### 3.1. Distribution of LAI use

In 2022, 41,401 adult patients received mental health services from an SCDMH CMHC. Across all CMHCs, 7029 (17.0 %) patients received at least one dose of an LAI antipsychotic and 20,620 (49.8 %) were prescribed at least one oral antipsychotic. Patients with schizophrenia (41.5 %), schizoaffective disorder (36.0 %), and bipolar disorder (13.1 %) accounted for the majority of LAI users. As shown in Table 1, the

**Table 1**  
Sample characteristics of patients according to long-acting injectable and oral antipsychotic use in South Carolina in 2022 (n = 41,401).

Total	Total Ambulatory Population		LAI User		No LAI Use		p	Oral AP Use		No Oral AP Use		p
	n	%	n	%	n	%		n	%	n	%	
	n = 41,401		n = 7029		n = 34,372			n = 20,620		n = 20,781		
<b>Race</b>							<0.01					<0.01
Black	16,790	40.6 %	4734	67.3 %	12,056	35.1 %		9296	45.1 %	7494	36.1 %	
Asian	189	0.5 %	44	0.6 %	145	0.4 %		94	0.5 %	95	0.5 %	
White	21,842	52.8 %	1989	28.3 %	19,853	57.8 %		10,172	49.3 %	11,670	56.2 %	
American Indian/Alaskan Native	172	0.4 %	30	0.4 %	142	0.4 %		89	0.4 %	83	0.4 %	
>1 Race	200	0.5 %	25	0.4 %	175	0.5 %		87	0.4 %	113	0.5 %	
Not reported	2208	5.3 %	207	2.9 %	2001	5.8 %		882	4.3 %	1326	6.4 %	
<b>Ethnicity</b>							<0.01					<0.01
Hispanic	1305	3.2 %	169	2.4 %	1136	3.3 %		585	2.8 %	720	3.5 %	
Not Hispanic	31,371	75.8 %	5397	76.8 %	25,974	75.6 %		15,708	76.2 %	15,663	75.4 %	
Not reported	8725	21.1 %	1463	20.8 %	7262	21.1 %		4327	21.0 %	4398	21.2 %	
<b>Gender</b>							<0.01					<0.01
Female	24,275	58.6 %	2672	38.0 %	21,603	62.9 %		11,248	54.6 %	13,027	62.7 %	
Male	17,126	41.4 %	4357	62.0 %	12,769	37.1 %		9372	45.5 %	7754	37.3 %	
<b>Age</b>							<0.01					<0.01
18–26 yrs	6760	16.3 %	740	10.5 %	6020	17.5 %		2536	12.3 %	4224	20.3 %	
27–64 yrs	29,948	72.3 %	5397	78.8 %	24,409	71.0 %		15,528	75.3 %	14,420	69.4 %	
65+ years	4693	11.3 %	750	10.7 %	3943	11.5 %		2556	12.4 %	2137	10.3 %	
<b>Diagnoses<sup>a</sup></b>							<0.01					<0.01
Schizophrenia	5565	13.4 %	2914	41.5 %	2651	7.7 %	<0.01	3925	19.0 %	1640	7.9 %	<0.01
Schizoaffective disorder	6060	14.6 %	2532	36.0 %	3497	10.2 %	<0.01	4706	22.8 %	1354	6.5 %	<0.01
Unspecified psychotic disorder	1961	4.7 %	455	6.5 %	1464	4.3 %	<0.01	1455	7.1 %	506	2.4 %	<0.01
Bipolar disorder	9247	22.3 %	921	13.1 %	8247	24.0 %	<0.01	5803	28.1 %	3444	16.6 %	<0.01
Major depression	9069	21.9 %	69	1.0 %	8506	24.7 %	<0.01	2982	14.5 %	6087	29.3 %	<0.01
Other diagnoses	10,285	24.8 %	138	2.0 %	10,147	29.5 %	<0.01	2339	11.3 %	7946	38.2 %	<0.01
<b>Insurance<sup>b</sup></b>							<0.01					<0.01
Medicaid MCO	21,504	51.9 %	4791	68.2 %	16,824	48.9 %		11,507	55.8 %	9997	48.1 %	
Medicare	6737	16.3 %	1718	24.4 %	5093	14.8 %		4048	19.6 %	2689	12.9 %	
Private	16,179	39.1 %	2511	35.7 %	13,704	39.9 %		8282	40.2 %	7897	38.0 %	
Self-pay	19,565	47.3 %	2485	35.4 %	17,370	50.5 %		9037	43.8 %	10,528	50.7 %	
Other	7296	17.6 %	4545	64.7 %	2885	8.4 %		3854	18.7 %	3442	16.6 %	
<b>Population Density</b>							<0.01					<0.01
Urban	25,341	67.3	3908	64.3 %	21,433	67.9 %		12,472	67.0 %	12,869	67.6 %	
Suburban	8028	21.3	1406	23.1 %	6622	21.0 %		3835	20.6 %	4193	22.0 %	
Rural/small town	4290	11.4	763	12.6 %	3527	11.2 %		2321	12.5 %	1969	10.4 %	

Notes: p: p-value from chi-square tests.

<sup>a</sup> Diagnoses are not mutually exclusive. Individuals may have multiple listed diagnoses.

<sup>b</sup> Payment sources are not mutually exclusive within individuals. Individuals may have multiple payment sources for different services at different times.

distribution of LAI users differed significantly according to sociodemographic factors in bivariate comparisons. Compared to the overall ambulatory population, LAI users were more likely to be Black, male, age 18–26, to have government sponsored health insurance (i.e., Medicaid, Medicare), and to receive services in suburban (micropolitan) areas. In contrast, oral antipsychotic users were more likely to be White, female, age 27 and older, and to have private insurance or to self-pay for services. Oral antipsychotic users also had a wider array of psychiatric diagnoses, including 53.9 % with bipolar disorder, major depression, or other non-psychotic disorders.

Fig. 1 shows proportions of LAI types used by age group. First-generation antipsychotics such as haloperidol and fluphenazine were more common in older age groups, whereas second- and third-generation antipsychotics like aripiprazole made up a greater proportion of LAIs among younger age groups. As shown in Fig. 2, there were also significant differences in LAI type by race. A greater proportion of Black LAI users were prescribed first-generation antipsychotics compared to White patients and Asian patients. Fig. 3 shows the distribution of LAI use and population density across regional CMHC catchment areas. In general, LAI use was proportional to the patient population density in each CHMC catchment area, with larger urban areas accounting for the largest absolute number of LAI users. Among patients with a psychotic disorder, however, the largest proportion of LAI use was in catchment areas with mixed urban, suburban, and rural counties, such as the Orangeburg (52.8 %) and Waccamaw (54.7 %) areas.

### 3.2. Factors associated with LAI use

The associations between sociodemographic factors and antipsychotic use were evaluated using logistic regression models (Table 2). As shown in Table 2, Black, Asian, and American Indian/Alaskan Native patients were, respectively, 2.19, 3.39, and 2.05 times as likely to use an LAI compared to White patients, after controlling for patient sociodemographic and clinical differences, such as the majority of patients with schizophrenia (73 %) being Black. Hispanic ethnicity was not associated with a significant difference in odds of LAI use. Male patients had 83 % greater odds of LAI use compared to female (Odds Ratio (OR) = 1.83, 95 % confidence interval (CI): 1.64, 2.03). Compared to patients aged 18–26, those aged 27–64 did not have significantly different odds of LAI use, whereas patients aged 65 and older had significantly lower odds of LAI use (OR=0.65, 95 % CI: 0.52, 0.83). Compared to those who received care in an urban area, patients receiving care in suburban areas had greater odds of LAI use (OR=1.25, 95 % CI: 1.10, 1.42), while

patients in rural areas had lower odds of LAI use (OR=0.77, 95 % CI: 0.66, 0.89). Patients with Medicaid were 55 % more likely (OR=1.55, 95 % CI: 1.34, 1.79) to use LAIs compared to those without Medicaid. There were no meaningful differences in the likelihood of LAI use by other payment sources.

In contrast to LAI use, there were no significant racial differences in use of oral antipsychotics (Table 2). Male patients were more likely than female patients to use oral antipsychotics (OR=1.12, 95 % CI: 1.06, 1.19), but this sex difference was smaller than for LAI use. In contrast to LAI use, patients aged 27 and older were significantly more likely to use oral antipsychotics compared to those aged 18–26. Patients using Medicaid were more likely than those without Medicaid to use oral antipsychotics (OR=1.14, 95 % CI: 1.07, 1.22).

Lastly, among LAI users, logistic regression models showed that patients who were Black, male, older age, and receiving care in a rural location were more likely to be using a first-generation (vs. second- or third-generation) LAI, after adjusting for clinical and sociodemographic characteristics (Supplemental Table 1). Specifically, older adults (age 65+) were more than four times as likely to use first-generation LAIs compared to patients aged 18–26. Black patients had 58 % greater odds of first-generation LAI use compared to White patients (OR=1.58, 95 % CI: 1.35, 1.85), but there were no other significant racial or ethnic differences in first-generation LAI use.

## 4. Discussion

In this sample of individuals receiving care at South Carolina CMHCs, we found significant differences in the use of long-acting injectable antipsychotic (LAI) medications by race, age, gender, and population density that were not explained by prevalence of psychotic disorders, different payment sources, or other demographic differences. A lack of similar differences in the use of oral antipsychotics by race, age, and population density suggests that these findings are unique to injectable antipsychotics. Such information is important for understanding mental health needs in the community and for promoting equitable and effective care across sociodemographic groups.

This study provides among the first characterizations of LAI use in a regionally, clinically, and racially diverse population, expanding on previous research that relied on smaller outpatient samples (McCreath et al., 2017), inpatient data (Soleman et al., 2017), or single payment-source databases (Brown et al., 2014; Caballero et al., 2023; Cai et al., 2024; Lawson et al., 2015). Notably, several previous studies reported racial differences in antipsychotic use, although with mixed implications. For example, an analysis of data from the National

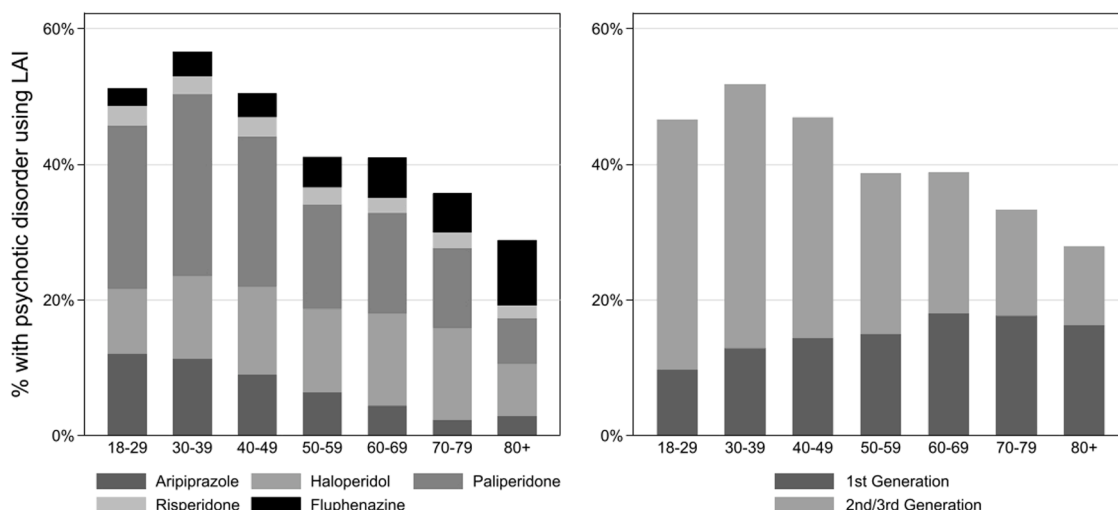


Fig. 1. Long-acting injectable antipsychotic (LAI) use by age.

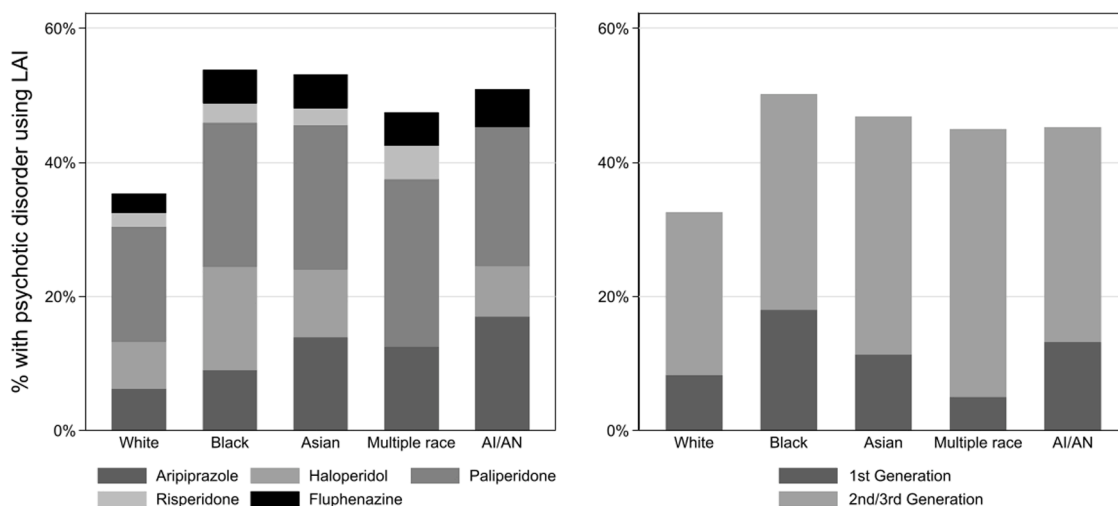


Fig. 2. Long-acting injectable antipsychotic (LAI) use by race.

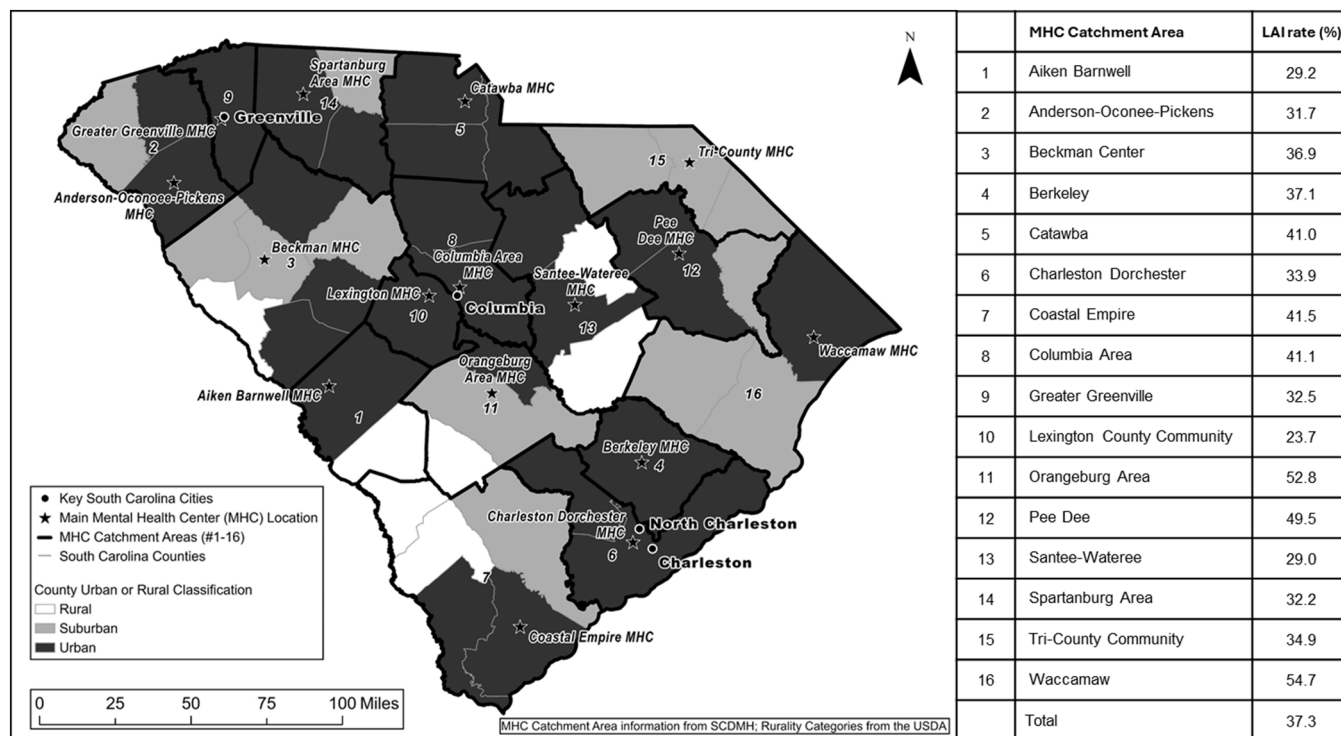


Fig. 3. Population density and long-acting injectable (LAI) distribution among patients with psychotic disorder in mental health center (MHC) catchment areas.

Ambulatory Medical Care Survey found that while Black patients were approximately twice as likely to be diagnosed with schizophrenia compared to White patients (OR=1.94; 95 % CI: 1.28–2.95), Black patients with schizophrenia were less likely to be prescribed an antipsychotic medication (Bazargan-Hejazi et al., 2023). Another study of over 200,000 Medicare beneficiaries with schizophrenia found that Black and Hispanic patients were, respectively, 38 % and 22 % more likely to use an LAI but 37 % and 21 % less likely to be prescribed a second- and third-generation LAI compared to White patients (Li et al., 2023b). In the present sample, Black, Asian, and American Indian/Alaskan Native patients were more likely to use LAIs than White patients. Black patients were also more likely to use first-generation LAIs than White patients. One potential explanation for these findings is racial differences in patient attitudes toward LAIs, although there is mixed evidence regarding whether patients from racial minority groups view LAIs as coercive or

more stigmatizing than oral antipsychotics (Iyer et al., 2013a; Patel et al., 2010; Potkin et al., 2013, 2017). Another explanatory factor may be distinct cultural variations in individual decision-making and autonomy. For example, Hispanic patients have been found to be more deferential to physician recommendations than patients from other racial/ethnic groups (Katz et al., 2011), while Asian patients have reported that physicians involve them less in treatment decisions than desired (Ngo-Metzger et al., 2004). Others have argued that greater LAI use among patients from racial minority groups may reflect prescribers perceiving them as at higher risk of nonadherence (Aggarwal et al., 2012). Because previous adherence issues, rather than personal preference, is the primary predictor of LAI prescription (Patel et al., 2009), this could explain why minority race patients are more likely to use LAIs despite more negative attitudes towards them. Providers may reduce barriers to LAI acceptance among patients by encouraging patient input

**Table 2**  
Odds of long-acting injectable and oral antipsychotic use by patient characteristics.

	LAI Antipsychotic Use		Oral Antipsychotic Use	
	OR	95 % CI	OR	95 % CI
<b>Race</b>				
White	REF	REF	REF	REF
Black	2.19	(1.96, 2.44)	1.04	(0.98, 1.10)
Asian	3.39	(1.54, 7.43)	0.90	(0.60, 1.36)
AI/AN	2.05	(1.00, 4.21)	1.28	(0.79, 1.93)
Multiple races	1.34	(0.61, 2.95)	1.13	(0.84, 1.60)
<b>Ethnicity</b>				
Non-Hispanic	REF	REF	REF	REF
Hispanic	1.15	(0.79, 1.68)	1.03	(0.85, 1.24)
<b>Sex</b>				
Female	REF	REF	REF	REF
Male	1.83	(1.64, 2.03)	1.10	(1.04, 1.16)
<b>Age</b>				
18 – 26	REF	REF	REF	REF
27 – 64	0.99	(0.85, 1.16)	1.40	(1.30, 1.51)
65+	0.65	(0.52, 0.83)	1.61	(1.45, 1.80)
<b>Population density</b>				
Urban	REF	REF	REF	REF
Suburban	1.25	(1.10, 1.42)	0.97	(0.91, 1.03)
Rural	0.77	(0.66, 0.89)	1.09	(1.00, 1.18)
<b>Payment sources</b>				
Medicaid	1.55	(1.34, 1.79)	1.14	(1.07, 1.22)
Medicare	1.01	(1.01, 1.02)	1.00	(0.99, 1.00)
Private insurance	1.01	(1.00, 1.01)	1.00	(1.00, 1.00)
Self-pay	1.01	(1.00, 1.01)	1.00	(1.00, 1.01)
Other	1.09	(1.08, 1.10)	0.98	(0.97, 0.98)

95 % CI = 95 % Confidence Interval.

AI/AN = American Indian or Alaska Native.

Note: Models additionally adjusted for psychiatric diagnosis (schizophrenia, schizoaffective disorder, other psychotic disorders, bipolar disorder) and total number of mental health services received.

in treatment decisions and increasing time spent addressing patient concerns (Potkin et al., 2017).

Previous research has also highlighted regional differences in LAI use. For example, Brown and colleagues found that the percentage of Medicaid beneficiaries with schizophrenia who were prescribed LAIs was highest in southern, predominantly rural US states like Alabama and Louisiana and particularly high among African Americans in those states (Brown et al., 2014). The researchers speculated that rural geography and high poverty may have played a role in the use of LAIs in southern states. In contrast, the present results suggest that, although urban areas accounted for the greatest number of LAI users, LAI use was more likely among patients attending clinics in suburban areas after accounting for demographic and clinical factors. Patients attending rural clinics had the lowest likelihood of receiving LAIs. This finding conflicts with the perceived benefits of LAIs for those in rural, low resource areas, where systemic factors, limited transportation, and poor access to healthcare can create additional barriers to antipsychotic adherence (Chang et al., 2024; Houghton et al., 2023). Indeed, smaller trials in the U.S. and Canada have shown that adherence and use of LAIs in rural areas can be increased through community-based pharmacist intervention (Chang et al., 2024) and standardized LAI treatment recommendations (McKee et al., 2023).

Finally, few studies have compared patient characteristics among LAI and oral antipsychotic users. Soleman and colleagues, for instance, found no racial/ethnic differences between oral and LAI users but greater LAI use among younger adults (Soleman et al., 2017). The results of the present study, however, draw clear contrasts between factors associated with LAI and oral antipsychotic use. Whereas Black, Asian, and American Indian/Alaskan Native patients had greater likelihood of LAI use, race was not associated with oral antipsychotic use; although younger patients and those living in suburban areas had higher likelihood of LAI use, the opposite was true for oral medications. Higher

prevalence of oral antipsychotic use among older adults could reflect already established patient treatment preferences. As most older adults with a psychotic disorder were diagnosed earlier in life when LAIs may not have been as widely prescribed, they are more likely to have initiated (and thus continued) treatment with oral antipsychotics. This may similarly explain why older adults were more likely to use first-generation antipsychotics. Another explanation for differences between oral and LAI antipsychotic use is that certain patient characteristics are associated with non-adherence rather than preferences, access, or other factors directly related to LAI use. This may help explain greater LAI use among younger patients and men, who have generally poorer adherence to oral medications (Kardas et al., 2013) and thus would be more likely to be prescribed LAIs; however, rural residency is also associated with poorer adherence (Kardas et al., 2013), so adherence history cannot fully explain differences in antipsychotic use. Another possible explanation for differences between oral and LAI antipsychotic users is that they may present to treatment under different circumstances. An Australian study showed, for instance, that patients under involuntary community treatment orders due to recent psychiatric hospitalization or legal issues were significantly more likely to receive an LAI versus oral antipsychotic (Lambert et al., 2009). Likewise, research suggests that patients with schizophrenia and schizoaffective disorder are significantly less likely to have encounters with law enforcement after LAI initiation (Bhatta et al., 2021). So, although patients in the US generally cannot be compelled to take medications except in rare situations such as to restore competency before criminal trial (Wang et al., 2022), providers may consider these legal and social circumstances when making treatment recommendations, especially for patients who are unhoused or have a history of contact with the criminal justice system.

This study has notable strengths that enhance the relevance of its findings. First, the analysis was based on a large and representative sample of those receiving psychiatric services in the community, comprising patients from a variety of regions and with different payment sources. Furthermore, information on key patient clinical and socio-demographic characteristics allowed analysis while accounting for a variety of other factors that might influence LAI use. Finally, the recency of the data helps to capture current patterns of a relatively new and evolving treatment modality. This study also has some limitations. First, although antipsychotic use was measured across an entire calendar year, the data is cross-sectional, which precludes inferences about individuals' initiation or discontinuation of antipsychotics. Data on duration of previous oral antipsychotic use and adherence was likewise unavailable. Therefore, it is unclear whether sociodemographic factors are related to LAI prescription/acceptance or to poor adherence to oral medications that would lead to consideration of LAIs. Lastly, EMR data lacks context about personal circumstances, attitudes, preferences and behaviors of both patients and providers that might help to understand reasons for sociodemographic differences in the use of LAIs. Future qualitative studies should explore these in more detail.

## Funding

This work was supported by a grant from the South Carolina Department of Mental Health, Ensor Trust Fund.

## CRediT authorship contribution statement

**Matthew C. Lohman:** Writing – review & editing, Writing – original draft, Visualization, Validation, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Victoria Scott:** Writing – review & editing, Writing – original draft, Investigation, Funding acquisition, Conceptualization. **Mansi Verma:** Writing – review & editing, Investigation, Conceptualization. **Paige Jones:** Writing – review & editing, Investigation, Conceptualization. **Eve Fields:** Writing – review & editing,

Writing – original draft, Visualization, Resources, Project administration, Methodology, Investigation, Funding acquisition.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Acknowledgements

The authors would like to thank Daniel Walker for assistance with data collection and management, and Dr. Aída R. Guhlincozzi for assistance with mapping medication use in South Carolina.

## Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.psychres.2025.116378](https://doi.org/10.1016/j.psychres.2025.116378).

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