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## Effectiveness of antipsychotic medication in patients with schizophrenia in a real world retrospective observational study in Ethiopia

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Antipsychotic medications have become the cornerstone of treatment for schizophrenia. The antipsychotic drugs are high-affinity antagonists of dopamine D2 receptors that are most effective against psychotic symptoms, but antipsychotic drugs can have side effects that overshadow their advantages, like sedation, extrapyramidal symptoms, and weight gain, which are often experienced as adverse effects. In our country, the relative effectiveness of antipsychotic medication as well as their tolerance in schizophrenia patients is not fully addressed. This study aims to determine the effectiveness of antipsychotic medication and associated factors in schizophrenia patients at the psychiatry clinic. An institutional-based retrospective cohort study was conducted using administrative data of patients with schizophrenia disorder based on the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, Text Revision (DSM-5-TR) that initiated or changed to a new antipsychotic treatment by clinicians assessments from April 1, 2023, to March 1, 2024 at university of Gondar specialized hospital. The effectiveness of prescribed antipsychotic medication was evaluated using the Clinical Global Impressions-Schizophrenia scale (CGI-SCH), inclusive of subscales for positive, negative, depressive, and cognitive symptoms. A total of 608 patients were receiving antipsychotic medications as follows: 118 patients (19.4%) were prescribed haloperidol, 88 patients (14.5%) were taking chlorpromazine, 48 patients (7.9%) received fluphenazine (decanoate), 126 patients (20.7%) were on risperidone, and 228 patients (37.5%) were treating with olanzapine. In total, 64.8% of patients show improvement in the prescribed medications within one year of treatment (Kaplan-Meier estimate 35.2%) for haloperidol, 31 (26.3%) for chlorpromazine, 30 (34.1%) for Fluphenazine, 19 (39.6%) for risperidone, 51 (40.5%), and 83 (36.4%) for olanzapine. Effectiveness was assessed using the Clinical Global Impressions-Improvement (CGI-I); the overall improvements like negative, positive, depressive, and cognitive symptoms were significantly higher for olanzapine, followed by haloperidol (p < .001). Good adherence (AHR = 0.63; 95% CI 0.5–0.78), history of relapse (AHR = 1.43; 95% CI 1.13–1.82), unemployment (AHR = 1.4; 95% CI 1.06–1.85), and history of suicidal ideation (AHR = 1.79; 95% CI 1.24–2.58) were significant predictors of symptoms improvement. The study found olanzapine is more effective in improving schizophrenia symptoms than other antipsychotic drugs. Medication adherence, symptom relapse, and suicidal thoughts significantly impacted antipsychotic effectiveness in individuals with schizophrenia disorder.

Keywords Effectiveness, Antipsychotic, Schizophrenia, Ethiopia

Schizophrenia is a mental illness marked by detachment from reality that is characterized by severe impairments in social and occupational functioning and a high rate of co-morbid mental and physical health conditions,

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whose symptoms include positive, negative, disorganized, cognitive, and emotional disturbance<sup>1-3</sup>. Antipsychotic medications are a crucial component of treating schizophrenia, many antipsychotics have been produced since the debut of chlorpromazine in the 1950s, and 15–40 of these medications are marketed globally<sup>4</sup>.

Antipsychotic drugs fall into two main categories: atypical antipsychotics and typical antipsychotics like chlorpromazine, the first medication inadvertently found to have antipsychotic properties that demonstrated effectiveness in treating psychotic disorders<sup>5,6</sup>. As a growing number of mental illnesses, including schizophrenia, are treated with antipsychotic drugs, professional bodies have created guidelines and treatment algorithms for the early care of acute psychosis in several countries<sup>7,8</sup>. Antipsychotic medications are high-affinity antagonists of dopamine D2 receptors that are particularly effective against psychotic symptoms but have a high rate of neurological adverse effects, such as extrapyramidal signs and tardive dyskinesia<sup>9,10</sup>. When antipsychotic efficacy increases, extrapyramidal side effects arise<sup>11</sup>. Although they are useful in treating the positive symptoms of schizophrenia, standard antipsychotic drugs like haloperidol and chlorpromazine are connected to side effects such as extrapyramidal symptoms, hyperprolactinemia, and anticholinergic effects<sup>12,13</sup>.

The clinical effects of antipsychotic medicines are thought to occur quicker than previously assumed, with the greatest therapeutic benefit occurring within 2–4 weeks, challenging that theory by proving that the most significant symptom reduction happened during the initial weeks of treatment<sup>14,15</sup>. Clinicians can link rating scales such as the Positive and Negative Syndrome Scale (PANSS) and the Brief Psychiatric Rating Scale (BPRS) to Clinical Global Impressions (CGI) assessments, which rate the current level of illness on a 7-point scale from "normal" to "extremely ill" and follow patients' overall improvement<sup>16–18</sup>. However, the lack of clarity on the definitions of early improvement and later response studies classified early improvement and/or later response as  $a \ge 20\%$  reduction in total score on the Positive and Negative Syndrome Scale (PANSS), while others used  $a \ge 30\%$ ,  $\ge 40\%$ , or  $\ge 50\%$  score reduction<sup>2,19,20</sup>. So the treatment goals have evolved from containment to recovery, emphasizing functionality and meaningful outcomes for patients and families<sup>21,22</sup>.

In recent years, the treatment of schizophrenia and related psychotic diseases has shifted to novel antipsychotic medications<sup>23,24</sup>. Compared to its predecessors, clozapine is more successful in treating both positive and negative symptoms of schizophrenia, especially in patients who are not responding well to neuroleptic treatments<sup>12,25,26</sup>. Atypical antipsychotics are more effective than conventional drugs in reducing negative symptoms (e.g., loss of emotion, interest, and expression), which may be due to the absence of extrapyramidal symptoms or other secondary causes of negative symptoms (e.g., depression) rather than direct therapeutic effects<sup>27,28</sup>. Atypical antipsychotic medications such as clozapine, risperidone, olanzapine, and quetiapine have distinct receptor-binding characteristics and clinical effects, prompting some researchers to dispute their benefits beyond tolerance and recommend the continued use of conventional antipsychotics<sup>29,30</sup>.

Most antipsychotics can induce a several adverse effects, including restlessness, jitteriness, sleeplessness, focus, dizziness, endocrine problems, and sexual dysfunction, while extrapyramidal side effects have decreased in patients with schizophrenia treated with new antipsychotic medicines (risperidone, quetiapine, clozapine, or olanzapine) as compared to traditional antipsychotics<sup>31–33</sup>. As a result, most patients have unpleasant side effects, which frequently lead to an early medication discontinuation or switch<sup>34</sup>. Medication adherence refers to how well a patient follows their prescriber's advice, while nonadherence encompasses both underuse and overuse, which has been acknowledged as an issue globally and may be the most difficult component of treating people with schizophrenia<sup>35–37</sup>. Thus, noncompliance with treatment has a deleterious impact on the course of illness, resulting in relapse, hospitalization, prolonged time to remission, and attempted suicide<sup>38</sup>. Furthermore, patients with schizophrenia have a greater prevalence of various medical disorders due to their lifestyle (high rates of smoking and a high-fat diet), intrinsic disrespect for personal hygiene, and hurdles to seeking medical care for physical illnesses and non-adherence is a key impediment to effective schizophrenia treatment, as it can have a detrimental impact on both the patient's health and finances<sup>39–41</sup>.

Even though a high proportion of the world's population has been living with schizophrenia disorder and there is a different level of drug effectiveness as well as a different side effect profile within antipsychotic medications, in this population, these problems, especially antipsychotic effectiveness and side effect profile, are not well investigated in our country. There have not been studies conducted in Ethiopia; overall data on the effectiveness of antipsychotics and the factors that influence them are still needed. Above all, there is still much to learn about the effectiveness of antipsychotic medication type, adherence, social support, disease severity, and co-occurring medical conditions on antipsychotic efficacy in patients with schizophrenia. The study's objective is to ascertain the effectiveness of antipsychotic medication as well as factors for individuals with schizophrenia disorder.

## Methods and materials

An institutional-based retrospective cohort study was conducted from April 1 to June 30, 2024, with a review of medical charts and clinician assessments of patients from April 1, 2023, to March 1, 2024, of individuals with schizophrenia who had taken antipsychotic medication and had regular follow-up charts at the University of Gondar Compressive Specialized Hospital in the psychiatry clinic, which is located in Gondar town. Gondar town is a historical town in northern Ethiopia, Amhara national regional state, which is about 750 km from Addis Ababa. It is one of the higher education institutions founded in 1954. It has seven Colleges, and from those, the College of Medicine and Health Science serves both teaching and hospital services. This hospital serves over 7 million people and has outpatient departments (OPDs), inpatient departments, and emergency OPD. On average, nearly 9,000 patients visit outpatient psychiatry clinics each year, and around 4000 schizophrenia patients were OPD visit psychiatry clinics. Improvement was defined as a clinically significant reduction in symptom severity and functional impairment as measured by the Clinical Global Impressions-Improvement scale (CGI-I): very much improved or much improved were indicating a significant positive change compared to baseline.

Good medication adherence is defined as the extent to which a patient takes their prescribed antipsychotic medications correctly, both in terms of timing and dosage, as agreed with their healthcare provider; by using the Medication Adherence Rating Scale (MARS-10), a score of  $\geq 8$  is commonly considered indicative of good adherence.

## **Participants**

Eligible patients were between the ages of 18 and 65 years old and had a diagnosis of schizophrenia based on the Diagnostic and Statistical Manual of Mental Disorders 5-text revision (DSM-5-TR) and could take antipsychotic medication as determined by the study physician, who received antipsychotic medication for at least a month and who were regular follow-ups for the last year. Patients who had been diagnosed with schizoaffective disorder, bipolar disorder, intellectual disability, or other cognitive abnormalities were excluded. Additionally, patients who had been treated with ECT and clozapine were also excluded. A medical record review of 633 people with schizophrenia disorder who were taking antipsychotics and had regular follow-up charts from April 1, 2023, to March 1, 2024, and 608 individuals with schizophrenia who had taken antipsychotic medication and had regular follow-up charts with complete information were included in the study, with a 96% response rate. This research was conducted after receiving an ethical clearance letter from the University of Gondar, College of Medicine and Health Science, institutional review board committee with Ref No; CMHSSH-UOG IRERC/2/15/2024; date of issue: 03/15/2024. The title: effectiveness of antipsychotic medication on schizophrenia patients who were regularly followed-up at psychiatry clinics from April 1 to June 30, 2024. The study was approved by the institutional review board at each site, and written informed consent was obtained from the patients or their attendants. The University of Gondar Specialized Hospital clinical director gave a permission letter. The study was conducted according to the recommendations of the Declaration of Helsinki Declaration Statement to the 2013 version<sup>42</sup>. Participants had the option to decline or withdraw at any point and could ask questions about the study. Throughout the study period, all personal information was kept entirely anonymous, and confidentiality was ensured. Participants were neither forced nor compensated for their involvement, and it was purely voluntary. The primary investigators handled and safeguarded all of the data collected.

## Instruments

The Clinical Global Impression-Schizophrenia Scale (CGI-SCH) measures the positive, negative, depressive, cognitive, and overall severity of schizophrenia<sup>43,44</sup>. The Schizophrenia Outpatient Health Outcomes (SOHO) Study was designed to assess the efficacy of antipsychotic treatment in schizophrenia through observation. The CGI-SCH is a simplified scale, with only two categories: severity of illness and degree of change after initiating antipsychotic medication<sup>45</sup>. The severity of illness category analyzes the state prior to commencing the antipsychotic medicine retrospectively for the patients and reviewing medical charts, whereas the degree of change category assesses the change from the previous evaluation following the initiation of the antipsychotic for the appropriate period. This is based on clinical judgment in psychiatry professional practice, with a scale ranging from 1 (healthy and not ill) to 7 (among the most gravely ill). The CGI-I uses the following scores to determine whether the patient has improved or worsened since the start of the study: 1 = very greatly improved; 2 = much improved, 3=minimally improved, 4=no change, 5=minimally worse, 6=much worse and 7=very much worse. A third item of the CGI that attempts to relate therapeutic effects and side-effects, the efficacy index, was not used for the analysis. The CGI has been used in various efficacy and effectiveness studies in schizophrenia and the Interrater reliability was total Clinical Global Impression Schizophrenia Scale scores (ICC=0.81)<sup>45,46</sup>. The Glasgow antipsychotic side-effects scale (GASS) has 22 questions in simple English, takes 5 min to complete, and is easily comprehended by patients. When compared to the Antipsychotic Non-Neurological Side-Effects Rating, the GASS is the only self-reported antipsychotic side effects scale that involves mental health consumers and professionals in the item generation process. The GASS Cronbach's alpha (0.793) suggested that the survey had good reliability<sup>47,48</sup>.

## Data processing, management, and analysis

The collected data were coded and reviewed for clarity, consistency, and completeness up to the end of each data collection period, and Epi data was used for data entry. The entered data was exported to SPSS version 21. The descriptive statistics of numeric variables were presented in medians with interquartile range (IQR), categorical variables were presented using frequency and percentages, and the outcomes of each patient were dichotomized into good response or non-response for different types of antipsychotic medication. The Kaplan–Meier failure curve and log-rank test were employed. The Cox proportional hazards regression model's assumptions were excluded from the model, and missing data was removed from the bivariate and multivariable analyses. The effectiveness of antipsychotic medication rates among first-time schizophrenia patients was assessed using summary metrics of estimated crude hazard ratios (CHR) and adjusted hazard ratios (AHR) with a 95% confidence interval with statistical significance (P-value < 0.05).

## Results

## Demographic and clinical factors of the participants

A total of 608 participants (96% response rate) were included in this study. Over half (52.3%) of the respondents were female, with a mean age of ( $\pm$ SD) of 32.82 ( $\pm$ 9.74) years, with the age range between 18 and 65 years. The majority (61.7%) of the participants were urban residents. Regarding the educational status, the majority (29.1%) of the participants were in primary school. About 44.1%) of the marital status of participants were single, and 40% of the participants were private workers. The majority (55.4%) currently live with their families. Regarding monthly income, 40% of the participants were paid less than 1000 birr (Table 1). Around 52.3% of patients have at least once hospital admission in history. Regarding suicidal behavior, 28.3% have recurrent suicidal ideation,

Variables	Categories	Frequency	Percent
Sex	Male	290	47.3
	Female	318	53.7
Age	18-30	318	52.3
	31-40	170	28
	41-64	120	19.7
Marital status	Single	269	44.2
	Married	162	26.6
	Divorced	135	22.2
	Widowed	42	6.9
Educational level	No formal education	127	20.9
	Primary school	177	29.1
	Secondary school	133	21.9
	College and above	171	28.1
Occupational status	un employed	137	22.5
	Government employed	117	19.2
	Student	111	18.3
	Private employed	243	40
Residence	Urban	375	61.7
	Rural	233	38.3
Current living condition	With family	337	55.4
	Alone	172	28.3
	With friends	94	16.3
Monthly income per month	<1000 birr	243	40
	1000-3000 birr	185	30.4
	3001-5000 birr	86	14.1
	Above 5000 birr	94	15.5

**Table 1**. Sociodemographic factors of the participants in the University of Gondar Specialized Hospital,Northwest Ethiopia (n = 608).

and 16.4% have a history of suicidal attempts. Around 11.5% of the participants had a comorbid medical illness; whereas 19.4% of the participants were currently drinking alcohol and 18.6% were currently chewing khat. Regarding family history, 44.2 had a family history of mental illness, 20.7% had a family history of suicidal attempts and crimes, and 25.5% had a family history of substance use (Table 2).

## Effectiveness

Within one year of treatment, there was a different degree of symptom improvement in the olanzapine (36.8%) with the haloperidol (22.1%), risperidone (19%), chlorpromazine (14.7), or Fluphenazine decanoate (7.4%) medications (p < .001) (Fig. 1). Patients with schizophrenia who received olanzapine showed considerably higher improvement in all symptom domains than those who received haloperidol, risperidone, or chlorpromazine (Figs. 2 and 3). The majority of 70.4% of the participants experienced mild side effects; of those, around 34.6% who took olanzapine had mild side effects. Regarding medication adherence, above half of 51.2% of the participants had good medication adherence; 38.9% of participants took olanzapine, followed by risperidone. 21.9% of patients had good adherence (Table 3).

## Discussion

The findings show that antipsychotic drugs, particularly olanzapine, are more effective and well tolerated than other antipsychotics drugs such as haloperidol, risperidone, Fluphenazine and chlorpromazine. Olanzapine showed significant advantages in all efficacy parameters when compared to other types of prescribed antipsychotic medications. In addition to differences in the effectiveness of antipsychotic medication on treatment response, medication adherence, a history of recurrent symptom relapse, unemployment, and patients with recurrent suicidal ideation were all predictors of treatment response in schizophrenia patients.

Recognizing the limits and inherent challenges of observational studies, such as the lack of randomization and the absence of measurements that might be viewed as intervention, retrospective cohort studies offer valuable insights into antipsychotic medication effectiveness, but they have limitations like selection bias, data quality and completeness issues, and lack of randomization that can affect the reliability and generalizability of our findings<sup>49,50</sup>. Recall bias occurs when patients whose severity of illness differs significantly from those symptoms reduce while time of ongoing treatment, making it harder to differentiate the true change of treatment response<sup>51–53</sup>. Data quality and completeness also affect the study's internal validity of our findings. While retrospective cohort studies can give useful observational data on the effectiveness of antipsychotics, their

Variables	Categories	Frequency	Percent
Comorbid modical illnoor	Yes	70	11.5
Comorbid medical inness	No	538	88.5
History of avisidal idea in an array	Yes	172	28.3
Thistory of suicidal idea in one year	No	436	71.7
History of quisidal attempt in one year	Yes	100	16.4
ristory of suicidal attempt in one year	No	508	83.6
Alcohol history	Currently drink	118	19.4
	Former drink	226	37.2
	Never drink	264	43.4
Khat history	Currently chew	113	18.6
	Former chew	131	21.5
	Never chew	364	59.9
Tites and the emitted a device in a	Yes	290	47.7
ristory of nospital admission	No	318	55.8
Pauvilu kistome montol illuoso	Yes	339	44.2
ranniy history mental inness	No	269	30.4
Family history of substance use	Yes	155	25.5
	No	453	74.5
Family histomy of anisidal attempt on second its d	Yes	126	20.7
ranny moory or succed attempt or committee	No	482	79.3

**Table 2**. Clinical factors of the participants in the University of Gondar Specialized Hospital, Northwest Ethiopia (n = 608).

limitations—including potential biases, confounding factors, and data quality issues—mean that their findings should be evaluated with caution.

In terms of antipsychotic medication effectiveness for schizophrenia, our findings support previous research that consistently shows olanzapine to be superior to currently prescribed antipsychotic medications such as haloperidol, risperidone, fluphenazine deaconate, and chlorpromazine for the treatment of overall schizophrenia symptoms<sup>5,54</sup>. Olanzapine, an antagonist of serotonin 5HT2A receptors, lowers positive symptoms in patients such as hallucinations and delusions by binding loosely to D2 and 5HT2A and olanzapine on serotonin action reduces negative symptoms such as anhedonia, flat affect, alogia, avolition, and poor concentration<sup>55-57</sup>. Atypical antipsychotics are similar to first-generation antipsychotics in reducing psychotic symptoms and producing few neurologic effects, but their efficacy has not been consistent or robust, except for clozapine, which has severe side effects: Second-generation antipsychotics appear more effective in reducing negative symptoms<sup>58–60</sup>. In another clinical antipsychotic trial of intervention effectiveness (CATIE) study comparing olanzapine and haloperidol found a lower effectiveness rate: 66.5% of olanzapine patients and only 46.8% of haloperidol patients within six weeks of treatment<sup>27,61</sup>. Olanzapine is more effective than haloperidol for treating both positive and negative symptoms of schizophrenia; it leads to higher reductions in both the BPRS-positive and BPRS-negative subscales<sup>62,63</sup>. Another multiphase randomized clinical trial of antipsychotic drugs, olanzapine and risperidone were more successful than quetiapine and ziprasidone, as seen by a longer period until discontinuation for any reason<sup>64</sup>. A meta-analysis found that antipsychotic medications were significantly more effective than placebo in reducing relapse rates in schizophrenia patients<sup>65</sup>. Currently, there are no particular biomarkers or pharmacokinetic testing to help guide treatment for schizophrenia or the first episode of psychosis<sup>66</sup>. The response to treatment is extremely diverse, with the bulk occurring during the first week<sup>67</sup>. If a patient does not respond after 4-6 weeks, they should try a different antipsychotic medicine<sup>68,69</sup>. It is critical to ensure patient compliance and prevent medication intolerance.

Patients who adhered to their prescribed antipsychotics were 37% more likely to see symptoms improvement than those who did not. Antipsychotic medication efficacy has been demonstrated in trials, but actual effectiveness is lower due to adherence concerns; nonadherence is common in schizophrenia patients, with rates ranging from 20 to 89%, with an estimated 50% nonadherence<sup>70,71</sup>. Suboptimal adherence has been connected to a longer duration of inpatient treatment, and worse symptomatic outcomes, and has been found as the best predictor of relapse in patients with a first episode of psychosis<sup>72–74</sup>. Assessing patient adherence to antipsychotic medication can be challenging, despite various methods like self-reporting, pill counts, and electronic monitors, as recurrence may lack treatment effectiveness, with adverse effects being the major reason for discontinuation, accounting for over half of all patients examined.

Patients who had a history of recurrent symptoms relapse were 1.43 times more risky for treatment response as compared with no history of relapse. Schizophrenia patients have a high chance of relapse, with 3.5% relapsing per month following discharge<sup>78</sup>. Approximately one-third of patients are fully adherent, one-third are somewhat adherent, and one-third are nonadherent; treatment discontinuation rates are similarly significant, with up to 40% of patients stopping their prescription within a year<sup>79,80</sup>. Improving adherence to medication among two



# **Fig. 1**. Kaplan–Meier survival estimates illustrating the time to all-cause treatment discontinuation among patients prescribed antipsychotic medications. The x-axis represents time with 20 months were mid survival time and the y-axis represents the probability of continuing treatment at university of Gondar specialized hospital.

thirds of patients who are nonadherent or partially adherent is one means of preventing, or at least postponing, relapse<sup>75,77</sup>. These findings emphasize the necessity of consistent definitions and procedures in adherence behavior that leads to symptoms relapse.

This study found that those with schizophrenia who were unemployed had a 1.4 times higher risk of treatment response than those who were employed. The work functioning and socioeconomic effect of schizophrenia patients are critical to their outcomes, and programs aimed at improving social rehabilitation and work functioning have advanced in sophistication<sup>81–83</sup>. Patients with schizophrenia frequently experience unemployment, which has financial and social ramifications; they frequently live in impoverished environments, such as vegetative homes or on the streets; this results in poor medication adherence, leading to poor treatment response<sup>84,85</sup>. During the global economic crisis, efficient use of healthcare resources is critical for maximizing health benefits while minimizing emotional discomfort and financial consequences; antipsychotics may raise disease costs<sup>86,87</sup>.

On the other hand, patients who had recurrent suicidal ideation were 1.79 times more risky of treatment response as compared with those who had recurrent suicidal ideation. Previous suicide attempts and hopelessness are significant risk factors for schizophrenia patients; this reduces access to experiences, which can affect social functioning and medication adherence, because of helplessness and hopelessness, which leads to the worsening of symptoms<sup>88–90</sup>. Suicide risk factors for schizophrenia include recurring relapses, severe illness severity, societal and professional changes, and an understanding of the disorder's negative impact: delusions, animosity during hospitalization, and failure to take antipsychotic medications can all raise the risk of suicide<sup>91–93</sup>. Recurrent relapses, a significant severity of the illness, a decline in social and occupational functioning, and a true and

## Survival Functions



## TotaldurationsincepatientstartTreatment\_A

**Fig. 2**. Kaplan–Meier curves depicting time to medication discontinuation for patients treated with olanzapine, haloperidol, fluphenazine decanoate, chlorpromazine, and risperidone. The x-axis represents time 48 months since initiation of treatment and the y-axis represents the proportion of patients remaining on therapy.

realistic realization of the disorder's negative influence are considered effectiveness of antipsychotics-specific risk factors for schizophrenia disorder.

## Strength and limitation

The study provides valuable insights into the treatment outcomes for patients with schizophrenia in an Ethiopian population, contributing to the understanding of regional difference in antipsychotic effectiveness and tolerability. This study has a few drawbacks that should be noted: First, as a retrospective observational design, the study is inherently subject to potential biases, including selection and recall biases, which may influence the findings. Second, this study can provide useful insights into the effectiveness and side effects of antipsychotic drugs in schizophrenia patients: While not as rigorous as RCTs, these studies are useful and give evidence from real-world settings. Third, rigorous monitoring of patient adherence to prescribed antipsychotic medication was not done, which may impair the veracity of conclusions about antipsychotic effectiveness. Finally, the study missed important features of schizophrenia, such as cognitive performance and the subjective perspective of patients on the effectiveness, which are important for assessing the overall impact of antipsychotic therapies.

## Conclusion

The study found that olanzapine was significantly more effective in improving overall, positive, negative, depressive, and cognitive symptoms of schizophrenia compared to other antipsychotic drugs. Moreover, medication adherence, symptom relapse, and suicidal thoughts all have a significant impact on the effectiveness of antipsychotic drugs in the treatment of schizophrenia. These findings emphasize the crucial relevance of both pharmaceutical and behavioral components in effectively controlling schizophrenia in the Ethiopian context. Implement routine follow-ups and mental health check-ups to monitor patients for early symptoms of relapse and adapt treatment strategies as necessary, and incorporate suicide risk assessment and crisis intervention



## Survival Functions

TotaldurationsincepatientstartTreatment\_A

**Fig. 3.** Kaplan-Meier graphs show the time to discontinue antipsychotic treatment, stratified by adherence level. The "Good Adherence" category (green) contains patients who have a medication possession ratio that indicates they use their medications consistently. The "Poor Adherence" category (blue) contains patients whose medication possession ratio indicates inconsistent medication use. The x-axis depicts time 48 months, while the y-axis reflects the fraction of patients who have not stopped taking their medications.

Variables	Categories	Frequency	Percent
Types of prescribed antipsychotic medication	Haloperidol	118	19.4
	Chlorpromazine	88	14.5
	Fluphenazine	48	7.9
	Risperidone	126	20.7
	Olanzapine	228	37.5
Antipsychotic side effect profile	Mild side effect	428	70.4
	Moderate side effect	142	23.3
	Severe side effect	38	6.3
Medication adherence	Good adherence	311	51.2
	Poor adherence	297	48.8

**Table 3.** Type antipsychotic medication and adherence of the participants in the University of GondarSpecialized Hospital, Northwest Ethiopia (n = 608).

measures into psychiatric treatment. Additionally, longitudinal studies should explore the long-term outcomes of using olanzapine and other antipsychotics in diverse Ethiopian populations to ensure culturally specific barriers and contextually appropriate interventions.

#### Data availability

All related data has not been presented within the manuscript. The data set that supports the conclusion of this work is accessible from the corresponding author upon reasonable request.

Received: 15 November 2024; Accepted: 6 January 2025 Published online: 07 February 2025

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## Acknowledgements

We would like to thank the University of Gondar Compressive Specialized Hospital for allowing the study and for their willingness to give important information on the study area and population. Finally, we extend our heartfelt gratitude to the study participants who volunteered their time to participate in this study, as well as the psychiatry clinicians.

## **Author contributions**

MK(PI): Writing—original draft, validation, methodology, formal analysis, conceptualization. MM: Software, Investigation. GK: Resources, Methodology. MA: Validation, data curation. SF: Writing—review & editing, validation. WE: Writing—review & editing. GT: validation, conceptualization. MB: software and conceptualization. GR: writing the original draft and formal analysis. DG: validation and methodology.

## Declarations

## **Competing interests**

The authors declare no competing interests.

## Additional information

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