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ORIGINAL RESEARCH

Patients' Preference for Long-Acting Injectable versus Oral Antipsychotics in Schizophrenia: Results from the Patient-Reported Medication Preference Questionnaire

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Introduction: Understanding patients' preferences for long-acting injectable (LAI) or oral antipsychotics (pills) could help reduce potential barriers to LAI use in schizophrenia.

Methods: Post hoc analyses were conducted from a double-blind, randomized, non-inferiority study (NCT01515423) of 3-monthly vs 1-monthly paliperidone palmitate in patients with schizophrenia. Data from the Medication Preference Questionnaire, administered on day 1 (baseline; open-label stabilization phase), were analyzed. The questionnaire includes four sets of items: 1) reasons for general treatment preference based on goals/outcomes and preference for LAI vs pills based on 2) personal experience, 3) injection-site (deltoid vs gluteal), 4) dosing frequency (3-monthly vs 1-monthly). A logistic regression analysis was performed to assess the effect of baseline variables on preference (LAIs or pills).

Results: Data from 1402 patients were available for analysis. Patients who preferred LAIs recognized these outcomes as important: "I feel more healthy" (57%), "I can get back to my favorite activities" (56%), "I don't have to think about taking my medicines" (54%). Most common reasons for medication preference (LAI vs pills) were: "LAIs/pills are easier for me" (67% vs 18%), "more in control/don't have to think about taking medicine" (64% vs 14%), "less pain/sudden symptoms" (38% vs 18%) and "less embarrassed" (0% vs 46%). Majority of patients (59%) preferred deltoid over gluteal injections (reasons: faster administration [63%], easier [51%], less embarrassing [44%]). In total, 50% of patients preferred 3-monthly over 1-monthly (38%) or every day (3%) dosing citing reasons: fewer injections [96%], fewer injections are less painful [84%], and fewer doctor visits [80%]. From logistic regression analysis, 77% of patients preferred LAI over pills; culture and race appeared to play a role in this preference.

Conclusion: Patients who preferred LAI antipsychotics prioritized self-empowerment and quality-of-life-related goals. When given the option, patients preferred less-frequent, quarterly injections over monthly injections and daily oral medications.

Keywords: long-acting injectable antipsychotics, oral antipsychotics, paliperidone palmitate, patient preference, quality-of-life

Introduction

Medication nonadherence and subsequent relapses amplify the disease burden and contribute to worsening symptomatology and prognosis in schizophrenia.^{1,2} Continuous antipsychotic treatment is therefore a formidable goal in schizophrenia management. Long-acting injectable (LAI) antipsychotics reduce adherence demands

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by eliminating the need for daily dosing and maintaining stable therapeutic drug levels for longer intervals and lower the risk of relapse and rehospitalization due to treatment discontinuation.^{2–4} Despite these benefits, LAI prescription rates in clinical practice in most Western countries are low and vary between 20% and 33% and are restricted to patients who are previously nonadherent to oral antipsychotics and those who prefer and most likely would accept LAIs.^{5–8} The disparity in percentage of patients currently being treated with LAIs and the rate of nonadherence in patients with schizophrenia (40% to 80%) indicates underutilization of LAIs.⁹

Patients' perceptions and attitudes are critical factors that determine medication adherence and are also recognized as potential barriers to LAI usage, thus underscoring the relevance of patient-centric care in schizophrenia.^{10–12} Although several studies have centered on clinician's and caregiver's perspective, fewer studies highlight the perspective of patients with schizophrenia on choice of LAIs or oral antipsychotic pills. In a population-based survey of patients with schizophrenia, patients' acceptance of LAI antipsychotics was found to be higher than the prescription rate.¹³ Further, a dichotomy in appraising treatment goals has been observed between patients and clinicians that could have an impact on treatment selection and continuity.^{14,15} Given the wide-ranging symptomatic and functional effects of antipsychotic medications, understanding the patient's treatment expectations and medication preference could help achieve concordance between treatment goals, enhance patient engagement and facilitate utilization of LAIs in schizophrenia.¹⁵

The aim of this analysis was to assess factors that determine patient's preference for LAI or oral antipsychotics (pills) in schizophrenia. Patient-reported outcomes to the Medication Preference Questionnaire (MPQ) collected during a phase 3, randomized, double-blind (DB) study of 3-monthly paliperidone palmitate (PP3M) and 1-monthly paliperidone palmitate (PP1M) were analyzed to assess preference to LAI versus oral antipsychotics (pills) in schizophrenia.

Patients and Methods

Study Overview

This was a post hoc analysis of MPQ data derived from a phase 3 (NCT01515423), randomized, multicenter, non-inferiority study of PP3M versus PP1M.¹⁶ Detailed methods have been reported elsewhere. Briefly, the study included adult patients with schizophrenia (Diagnostic and Statistical Manual of Mental Disorders, 4th Edition,

DSM-IV criteria), a Positive and Negative Syndrome Scale total score between 70 and 120 at screening and baseline and worsening of symptoms. After an approximately 3-week screening phase, all patients were stabilized on PP1M in a 17-week open-label (OL) phase. Clinically stabilized patients were then randomized to receive fixed dose of either PP3M (175, 263, 350, or 525 mg eq.) or PP1M (50, 75, 100, or 150 mg eq.) as deltoid or gluteal injections in the 48-week DB treatment phase. The study was conducted in accordance with the Declaration of Helsinki. The protocol was approved by the relevant Independent Ethics Committee or Institutional Review Board (listed in [Supplementary material](#)) for each country in which the trial was conducted and all patients provided written informed consent.

The MPQ was administered on day 1 (first visit of the OL phase); day 120 (first visit of the DB phase); and at the end of study visit to assess medication preferences of patients for PP3M relative to prior oral and/or LAI antipsychotics.

Medication Preference Questionnaire

The MPQ is a 4-page questionnaire to be completed by patients ([Figure 1](#)). Items in page 1 gauged the importance of general treatment goals/outcomes including symptoms, side effects, and general well-being with regard to treatment preference. Responses were captured as "Important," "Not Important" and "Not sure." In page 2, patients were asked to indicate specific reasons (eg convenience, pain, etc.) for their preference for LAI or oral/pills. Page 3 included questions to understand the reasons (eg pain, comfort, etc.) for the patient's preference for deltoid vs gluteal injections. Items on page 4 collected information on patient's preference based on dosing frequency (daily, every month or every 3 months) and reasons for preference for 1-monthly vs 3-monthly injections. Responses for items on pages 2, 3 and 4 were captured as "Yes," "No" and "Not sure."

Analysis

MPQ data collected on day 1 were used for this post hoc analysis to minimize bias. Since the study disallowed LAI use within 4 weeks prior to entry, we focused our MPQ analyses on the day 1 visit. As the study utilized a double-dummy technique, the baseline (day 1) visit is the only timepoint when patients would not have received any study medication. Patients were further grouped by baseline preference (either oral or LAI).

Individual items on page 1 were grouped to give a clear understanding on the importance of specific treatment

1. Reasons for general treatment preference based on goals/outcomes (Page 1)

Medication Preference Questionnaire for Patients

This questionnaire asks you about the medicine you take for your illness. For each question, please tick the box that best describes your opinion.

How important is each of the following statements?

	Not important	Not sure	Important
1. I can get back to my favorite activities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. I feel like myself again	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. It makes my symptoms (such as hearing voices) go away	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. I feel more healthy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. I feel less confused	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. I feel my symptoms (such as hearing voices) will not suddenly come back	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. I feel more in control over the medicine I take	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. I have few side effects from my medicine	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. I don't have to think about taking my medicine	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2. Preference based on personal experience (Page 2)

Based on your experience with both pills and injections, which ONE you prefer?

	Pills	Injection
Why do you prefer PILLS?	<input type="checkbox"/>	<input type="checkbox"/>
Why do you prefer INJECTIONS?	<input type="checkbox"/>	<input type="checkbox"/>

↓ Answer the following questions ↓ Answer the following questions

I prefer PILLS because:

- A) Pills are easier for me
- B) Pills work better for my symptoms (such as hearing voices)
- C) I have less side effects from my medicine
- D) I feel more in control when taking pills
- E) I feel less pain when taking pills
- F) I feel less embarrassed when taking pills

I prefer INJECTIONS because:

- A) Injections are easier for me
- B) Injections work better for my symptoms (such as hearing voices)
- C) I have less side effects from my medicine
- D) I don't have to think about taking my medicine
- E) I don't worry about sudden symptoms from my illness

If you have other reasons why you prefer pills or injections, please describe them:

3. Preference based on injection-site: deltoid vs gluteal (Page 3)

Based on all your experiences in this research study, which injection site would you prefer?

	Arm	Buttock
Why do you prefer injections in the ARM?	<input type="checkbox"/>	<input type="checkbox"/>
Why do you prefer injections in the BUTTOCK?	<input type="checkbox"/>	<input type="checkbox"/>

↓ Answer the following questions ↓ Answer the following questions

I prefer injections in the ARM because:

- A) Arm injections are easier for me
- B) Arm injections work better for my symptoms (such as hearing voices)
- C) It is faster than a buttock injection
- D) I have less side effects from my arm injections
- E) I feel less pain from arm injections
- F) I feel less embarrassed by arm injections

I prefer injections in the BUTTOCK because:

- A) Buttock injections are easier for me
- B) Buttock injections work better for my symptoms (such as hearing voices)
- C) It is faster than an arm injection
- D) I feel less side effects from buttock injections
- E) I feel less pain from buttock injections
- F) I feel less embarrassed by buttock injections

If you have other reasons why you prefer arm or buttock injections, please describe them:

4. Preference based on dosing frequency: Daily vs 1-monthly vs 3-monthly (Page 4)

Would you prefer to receive your medication every day, every month, or every 3 months?

Every month	Every 3 months	Everyday	No preference
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

If you have a preference for every Month or 3 Months, please tell us the reasons below

Every month	Every 3 months
Why do you prefer injections every month?	Why do you prefer injections every 3 months?

↓ Please answer the following questions ↓ Please answer the following questions

I prefer injections every month because:

- A) I like to have injections more often because if I have a problem, my dose can be changed
- B) I am used to injections every month and don't mind them
- C) I like to see the doctor more often
- D) I don't like taking much medicines at once
- E) Taking my medicines every month means less conflict or talking with my family or caregivers about medicines

I prefer injections every 3 months because:

- A) I like to have fewer injections
- B) It is less painful to have fewer injections
- C) I don't have to see my doctor as often
- D) Fewer injections means fewer reminders about my illness
- E) There is less conflict or talking about my medicines with my family or caregiver
- F) There are fewer problems with transportation

If you have other reasons why you prefer injections every month or every 3 months, please tell us:

Figure 1 Medication preference questionnaire.

outcomes for patients. The patient preference domains were grouped into categories as follows: 1) patient empowerment 2) quality-of-life and treatment adherence and 3) symptom

improvement. The categories were created in accordance with clinical judgment based largely on how the individual MPQ items covered the same construct.

Responses of “Not sure” were grouped with “Not Important” (page 1) or “No” (pages 2/3/4) under the premise that any non-positive value is considered a negative response.

Descriptive analyses of the baseline variables were performed with categorical variables summarized as frequencies and proportions and continuous variables as means and standard deviations. Patients’ responses to items of MPQ were summarized descriptively.

A logistic regression analysis was conducted to assess the effect of selected baseline variables on preference for LAIs/pills. Continuous variables were initially categorized (Table 1). These categorized baseline predictor variables were first fitted individually into each model to assess their univariate (unadjusted) effect, and then together to assess their adjusted effect on preference for LAIs/pills.

Results

Patient Disposition

Of 1429 patients who enrolled and were dosed in the OL phase, data were available for 1402 patients for this analysis. Patients had a mean (SD) age of 38.4 (11.9) years and the majority were men (55%). Patients were mostly White (54%); 8% of patients were Black or African American and 38% belonged to other races (mostly Asian). Twelve percent (12%) of patients were from the United States (Table 1).

Medication Preference Questionnaire

Page 1: General Treatment Preference Based on Goals/Outcomes

Patients who preferred LAIs regarded these outcomes as important: “I feel more healthy” (57%), “I can get back to my favorite activities” (56%), “I don’t have to think about taking my medicines” (54%) (Figure 2). Overall, outcomes related to patient empowerment and quality-of-life were regarded as important among patients who preferred LAIs.

Page 2: Preference Based on Personal Experience

Most common reasons quoted for medication preference (LAI vs pills) were: “LAIs/pills are easier for me” (67% vs 18%), “more in control/don’t have to think about taking medicine” (64% vs 14%), “less pain/sudden symptoms” (38% vs 18%) and “less embarrassed” (0% vs 46%) (Figure 3). The most common reason cited by patients who preferred oral pills was “I feel less embarrassed while taking pills” (46%) and “I feel less pain while taking pills” (18%).

Table 1 Demographics and Baseline Characteristics

Characteristics	Preference		Total n=1402
	LAI n=1082	Oral (Pills) n=320	
Age (years), mean (SD)	38.2 (11.8)	39.0 (12.1)	38.4 (11.9)
Sex, n (%)			
Men	575 (53.1)	187 (58.4)	762 (54.4)
Race, n (%)			
White	640 (59.1)	120 (37.5)	760 (54.2)
Black	64 (5.9)	47 (14.7)	111 (7.9)
Others	378 (34.9)	153 (47.8)	531 (37.9)
Age at schizophrenia diagnosis (years), mean (SD)	27.6 (9.1)	27.2 (9.3)	27.5 (9.2)
Number of prior hospitalizations, n (%)			
None	340 (31.4)	105 (32.8)	445 (31.7)
One	329 (30.4)	92 (28.8)	421 (30.0)
≥Two	413 (38.2)	123 (38.4)	536 (38.2)
Duration of prior hospitalizations (days), n (%)			
0–14	419 (47.6)	124 (51.4)	543 (48.4)
15–30	102 (11.6)	26 (10.8)	128 (11.2)
>30	359 (40.8)	91 (37.8)	450 (40.1)
BMI, n (%)			
Normal	472 (43.6)	140 (43.8)	612 (43.7)
Overweight	351 (32.4)	101 (31.6)	452 (32.2)
Obese	259 (23.9)	79 (24.7)	338 (24.1)
Country/Region, n (%)			
North America (USA)	97 (8.9)	67 (20.9)	164 (11.7)
Europe	557 (51.5)	76 (23.8)	633 (45.1)
Other	428 (39.6)	177 (55.3)	605 (43.2)

Abbreviations: BMI, body mass index; SD, standard deviation; USA, United States of America.

Page 3: Preference Based on Injection-Site: Deltoid vs Gluteal

The majority of patients (59%) preferred deltoid over gluteal injections and cited faster administration (63%), easier use (51%) and less embarrassing (44%) as reasons for their choice (Figure 4). Among patients who favored gluteal injections, similar reasons were cited: faster (47%), easier for me (35%) and less painful (34%).

Page 4: Preference Based on Dosing Frequency: Daily vs 1-Monthly vs 3-Monthly

In total, 50% of patients preferred 3-monthly over 1-monthly (38%) or every day (3%) dosing (Figure 5). “Fewer injections” (96%), “fewer injections are less painful” (84%) and

“fewer doctor visits” (80%) were the common reasons for inclination toward the 3-monthly option. Patients who preferred 1-monthly LAI cited “my dose can be changed” and “don’t like taking much medicine at once” as reasons.

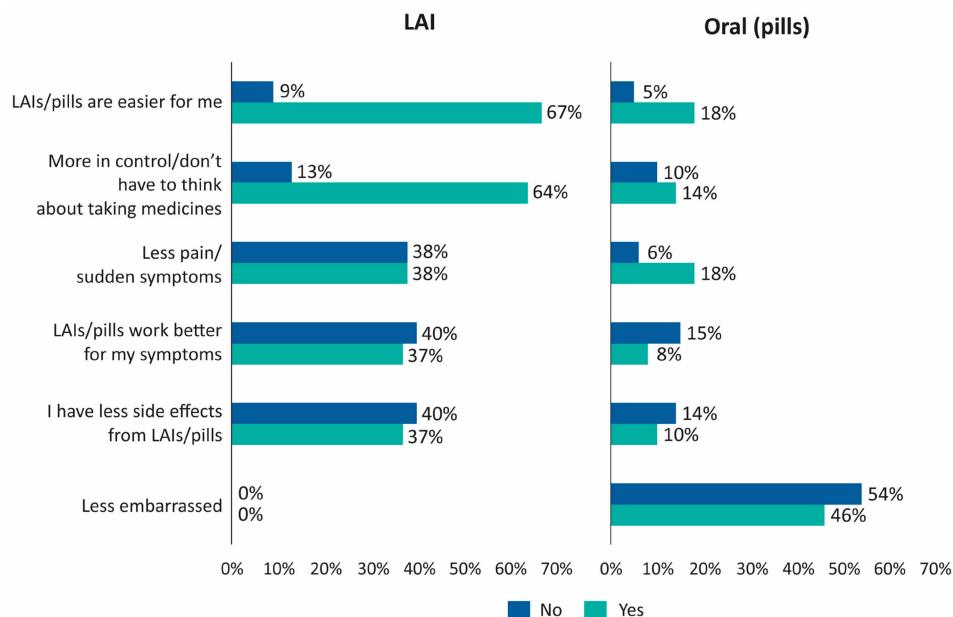
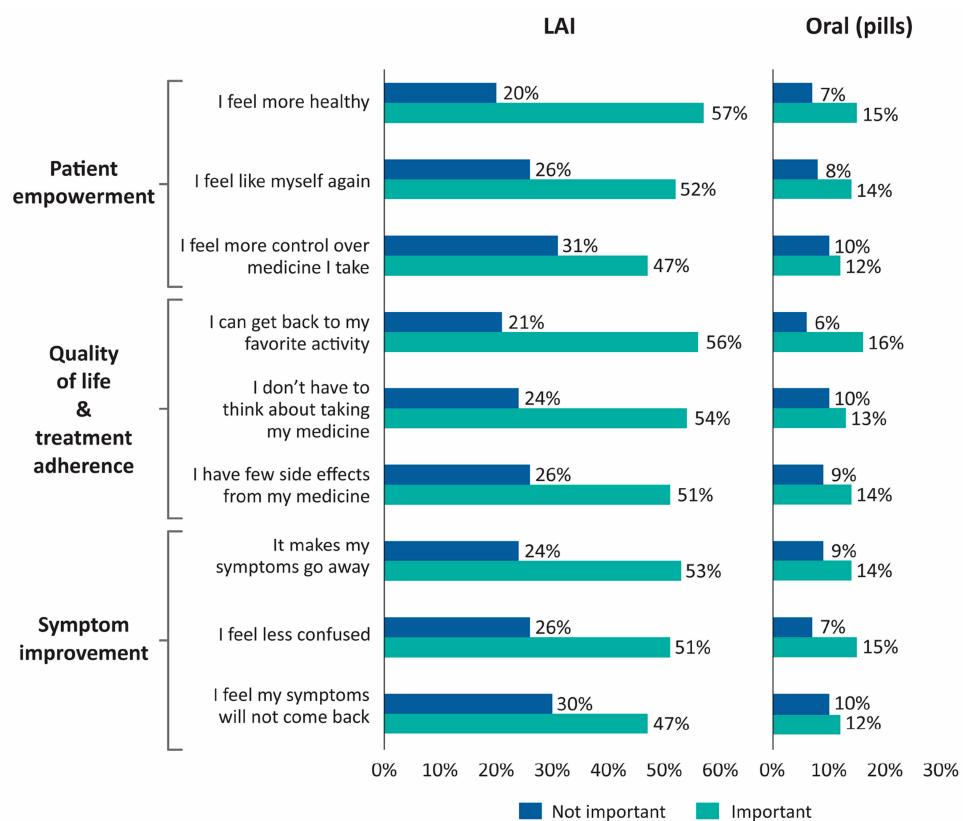
Medication Preference and Baseline Characteristics

A total of 1080 (77%) patients included in the logistic regression analysis preferred LAIs over pills (Table 1). Preference for LAI was highest among White (84.2%) followed by other racial groups (71.2%) and Black (57.7%) patients. When compared by geographic region, preference was highest in patients from Europe (88.0%) as compared with patients from the United States (59.1%), and rest of the world (70.7%). In the United States, preference for LAIs was comparable across different racial groups (Blacks, 59.6%; Whites, 58.8% and others, 57.1%). In the logistic regression analysis, race (White) and country (United States) showed a significant association ($p<0.001$) with patient preference for LAIs or pills, suggesting the role of culture or race in preference to LAIs/pills. The unadjusted and adjusted results (odds ratio and their statistical significance) were comparable (Table 2).

Discussion

Results from this post hoc analysis of patient-reported MPQ provide insights into factors that influence a patient’s inclination for treatment with either LAI or oral antipsychotics (pills) in treatment of schizophrenia. The analysis emphasized the delineation of different segments of treatment goals that patients regard as meaningful and expect to achieve from their treatment. Overall, in this study, the attitude of patients with schizophrenia regarding LAI antipsychotics was positive.

Patient empowerment and quality-of-life-related goals were important for patients who preferred LAI antipsychotics over oral pills. The majority of interviewed patients who preferred LAIs considered general well-being, attainment of clinical goals (eg reduction in symptoms), enhanced self-sufficiency (eg better control over medications) and functional improvements (eg ability to get back to their hobbies or favorite activities) as priorities. These observations were similar to findings from a survey in people with recent-onset schizophrenia who recognized the importance of symptom alleviation and its influence on day-to-day activities and social interactions.¹⁵ Conversely, psychiatrists acknowledge symptom control, relapse prevention and magnitude of side

**Figure 2** Treatment goals/outcomes cited as important or not important for medication preference.**Abbreviation:** LAI, long-acting injectable.

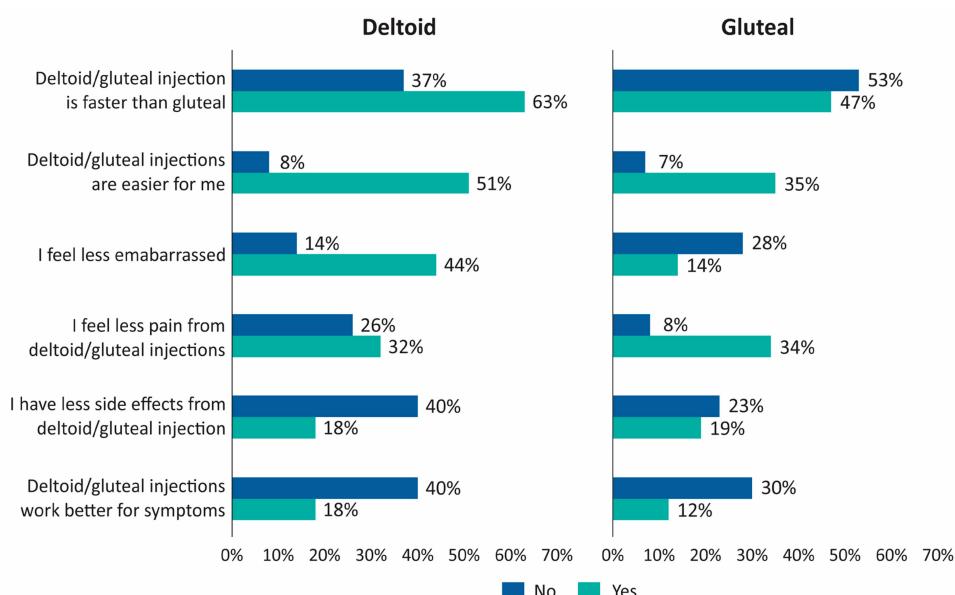


Figure 4 Reasons for injection-site preference: deltoid vs gluteal.

effects as primary factors driving LAI use and often undervalue improvements in ability to work and perform chores of daily living and importance of independent living.^{14,17}

Although healthcare professionals often consider fear of needles or injection pain as a salient barrier to LAI use, only 18% of patients in this study cited less pain as the reason for choosing oral pills over LAI antipsychotics.^{18,19} Embarrassment and vulnerability during administration of injections (especially gluteal) have a coercive influence on patients' choice of mode of administration.^{20,21} As anticipated, embarrassment was cited as a common reason for choosing oral antipsychotics over LAIs by patient respondents in this study. Furthermore, a majority of patients preferred the less intrusive deltoid arm injections over gluteal buttock injections and cited the reasons for their preference as faster, easier and less embarrassing. This observation concurs with our previous study of PP1M in patients with schizophrenia who preferred deltoid over gluteal injections, quoting similar reasons in their responses to the MPQ.²² There were no gender differences with regard to the preference for site of administration and both men (60%) and women (57%) preferred deltoid injections. Thus, availability of LAI antipsychotics as deltoid and gluteal injections is perceived as an important advantage by patients and psychiatrists alike and is expected to enhance LAI acceptability.^{17,21}

Extended dosing intervals of LAIs offer convenient dosing and objective monitoring of adherence.² Infrequent doctor visits and its negative impact on the doctor-patient

alliance, restrictions with dose titration, and possibility of not identifying early signs of adverse events or worsening of symptoms have been perceived as possible challenges with LAIs.²³ As PP3M is the only available LAI with a 3-monthly dosing option, the MPQ included questions to gauge patient's preference for dosing frequency.²⁴ It was observed that given a choice, patients preferred less-frequent, quarterly injections over monthly injections and daily oral medications. Patients had a higher inclination to prefer PP3M over PP1M; fewer injections, experiencing less pain due to fewer injections and reduced doctor visits were cited as reasons driving their choice. Patients preferring PP1M considered the flexibility to change dose as an advantage over the longer dosing interval of PP3M.

Notably, this is the largest study to date where patient preference for LAIs was collected in a systematic and controlled fashion. Observations from the current analysis support the recent guideline issued by the American Psychiatric Association, which briefly mentions LAI use in the context of patient preference for LAIs, frequency of dosing and site of injection.²⁵ It recommends the use of LAI antipsychotics in patients who prefer LAIs or who have a history of compromised adherence.²⁵ We suggest that international guidelines should place greater emphasis on patient preference, as this ultimately will lead to greater adherence, treatment satisfaction and better treatment outcomes.

In the logistic regression analysis, among the socio-demographic factors, only race and geographic region

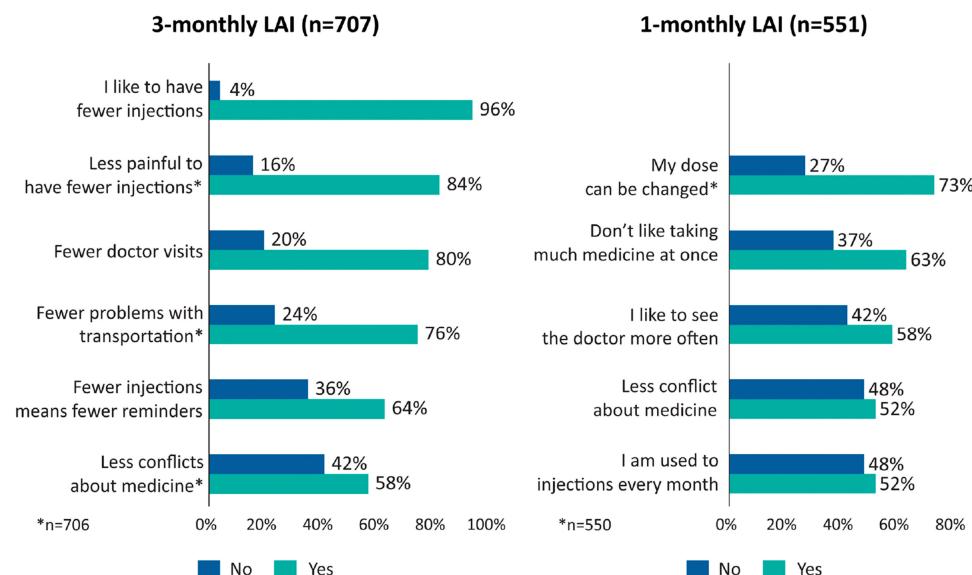
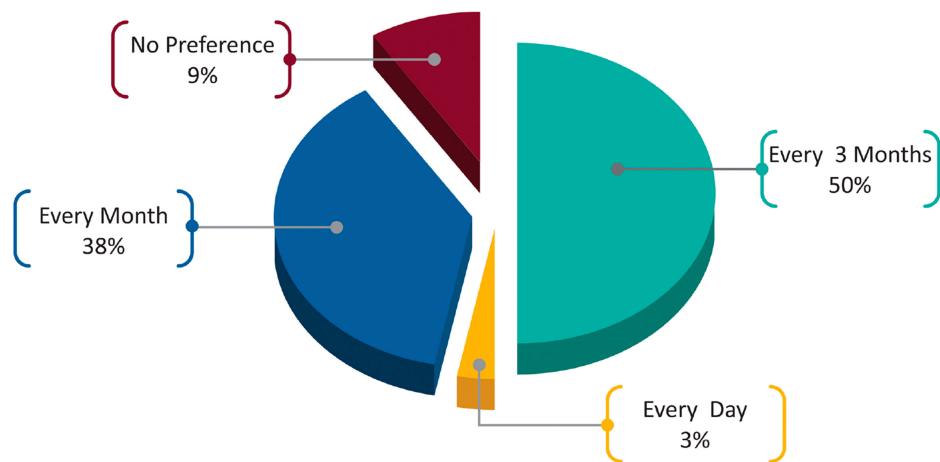


Figure 5 Medication preference based on dosing frequency and reasons for preference.
Abbreviation: LAI, long-acting injectable.

appeared to have a significant influence suggesting the role of race and culture in patient preference. Preference for LAI was highest among Whites followed by other racial groups. When compared by geographic region, preference for LAIs was highest in Europe compared to the United States or the rest of the world. In this study, preference for LAIs was comparable between the racial groups in the United States. However, in a chart-based retrospective analysis in the United States, Whites were less likely to receive LAI anti-psychotics as compared to non-Whites and Blacks.²⁶

The current results may have potential limitations inherent to a post hoc analysis. As the analysis involved patients

enrolled in a randomized study, the assessment of pragmatic viewpoint may be missing as the patients were willing to participate in the study, thereby excluding patients with poor treatment adherence.²³ Additionally, the study population does not accurately represent the real-word scenario as patients at risk of suicide and those with recent substance dependence, or clinically relevant medical diagnoses were excluded.¹⁶ To provide a comprehensive perspective on patient preference, additional studies are needed that include patient populations closely representing clinical practice and real-world settings. In addition, these studies should also examine the adverse event profile and efficacy of LAI

Table 2 Effect of Baseline Characteristics on Patients' Medication Preference (LAI vs Pills)

Variable	Unadjusted		Adjusted	
	Odds Ratio (95% CI)	p-value	Odds Ratio (95% CI)	p-value
Race (White)	2.41 (1.87; 3.12)	<0.001	2.39 (1.77; 3.23)	<0.001
Country (USA)	0.87 (0.81; 0.92)	<0.001	0.41 (0.27; 0.62)	<0.001
Sex (Women)	1.24 (0.96; 1.60)	0.095	1.25 (0.92; 1.70)	0.150
Age (18–50 years)	1.05 (0.80; 1.38)	0.696	1.08 (0.73; 1.59)	0.710
BMI (normal)	0.99 (0.77; 1.28)	0.968	0.95 (0.70; 1.30)	0.745
Age of diagnosis (\leq 25 years)	0.81 (0.63; 1.03)	0.088	0.88 (0.65; 1.19)	0.410
Number of prior psychiatric hospitalizations (none)	0.94 (0.72; 1.22)	0.639	1.38 (0.91; 2.09)	0.127
Duration of prior hospitalizations (\leq 30 days)	0.88 (0.65; 1.18)	0.394	1.09 (0.71; 1.66)	0.699

Abbreviations: BMI, body mass index; CI, confidence interval; USA, United States of America.

antipsychotics versus oral antipsychotics considering the pharmacokinetic differences associated with route to administration and its potential impact on tolerability and adherence.^{27,28} Furthermore, it has been observed that patient acceptance of LAIs improves with experience.¹³ Thus, as MPQ responses collected only on day 1 (before administration of PP3M and PP1M) were analyzed, patient acceptance of LAI antipsychotics would be expected to improve over time.

Conclusions

Patients who entered this study in general preferred LAIs over oral antipsychotics as a treatment choice. Patients who preferred LAI antipsychotics focused on achieving patient empowerment and quality-of-life-related goals. Additionally, patients showed a higher preference for PP3M (3-monthly LAI) than PP1M (1-monthly LAI), citing convenience and better control as reasons for their choice. Better understanding of patients' treatment priorities and perspective could help overcome barriers to LAI use and inform the best course of personalized schizophrenia treatment for improved patient satisfaction and medication adherence. LAIs have been historically underutilized to address adherence in schizophrenia, mainly because of the perception that patients are less accepting. Our study shows that when given an option, patients are very willing to consider LAI antipsychotics. Thus, clinicians should initiate open communication with patients as well as their caregivers at the start of treatment to become more attuned to patients' treatment preferences and foster patient-centric management. Face-to-face discussion using simple in-clinic semi-structured interviews could help gauge patients' preferences, fears and quandaries related to route of treatment administration and educate patients about LAIs

and discuss the possible risks and benefits. By addressing patients' concerns and treatment objectives, clinicians can encourage adherence and increase the likelihood of achieving the targeted goals.

Prior Publications

Data from this post hoc analysis were presented as a poster at the Psych Congress 2019, October 03–06, San Diego, California and e-posters were presented at the Society of Biological Psychiatry (SOBP) and Schizophrenia International Research Society (SIRS) 2020 Virtual Annual Meetings.

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Author Contributions

All authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically for important intellectual content; gave final approval of the version to be published; and agree to be accountable for all aspects of the work.

Disclosure

PS, IN, AK, AS, MM and SG are employees of Janssen Research & Development, LLC and hold company stocks.

CB is a student at Pennsylvania State University and was working as a summer intern at Janssen Research & Development, LLC. The authors report no other conflicts of interest in this work.

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