

Recovery in Schizophrenia and Its Determinants: A Malaysian Hospital-Based Study

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Abstract

Background

Recovery in schizophrenia has transitioned from a narrow clinical focus on symptom remission to a holistic framework incorporating functional and social reintegration. However, evidence regarding recovery rates and their determinants within Southeast Asia, particularly Malaysia, remains scarce. This study aimed to determine the prevalence of recovery among individuals with schizophrenia in Malaysia and to identify key sociodemographic, clinical, and psychosocial determinants.

Methods

A cross-sectional study was conducted among 152 adult outpatients with schizophrenia or schizoaffective disorder recruited via systematic random sampling from two urban psychiatric hospitals in Kuala Lumpur. Recovery was operationalized using Liberman and Kopelowicz criteria, requiring both symptomatic remission (Brief Psychiatric Rating Scale [BPRS] score ≤ 4 on all positive and negative symptom items) and functional recovery (Global Assessment of Functioning [GAF] score ≥ 65) sustained for at least 2 consecutive years. Data were collected using structured interviews and validated instruments, including the Childhood Trauma Questionnaire (CTQ-SF). Bivariate analyses were performed, followed by multivariable binary logistic regression.

Results

Overall, 50.7% of participants ($n = 77$) met the composite criteria for sustained recovery. In the final multivariable logistic regression model, five factors were independently associated with recovery. Being married (AOR = 15.39, 95% CI: 3.63–65.22, $p < 0.01$), having a college/university education (AOR = 7.05, 95% CI: 2.34–21.25, $p < 0.01$), and good medication adherence (AOR = 4.19, 95% CI: 1.28–13.67, $p = 0.02$) were strong positive predictors. Conversely, treatment with clozapine (AOR = 0.22, 95% CI: 0.06–0.78, $p = 0.02$) and higher childhood trauma exposure (AOR = 0.92 per unit increase in CTQ score, 95% CI: 0.89–0.97, $p < 0.01$) were significant negative predictors of recovery. The final model demonstrated excellent fit (Hosmer–Lemeshow $p = 0.49$), strong explanatory power (Nagelkerke $R^2 = 0.74$), and outstanding discrimination (ROC AUC = 0.95).

Conclusions

Schizophrenia recovery is an attainable goal within the Malaysian context, with approximately one in two patients achieving functional and clinical stability. The findings highlight the critical role of social support, cognitive/educational resources, and medication adherence. The strong negative impact of childhood trauma underscores the urgent need to integrate trauma-informed and family-centered

approaches within national mental health services. Clozapine use serves as an indicator of illness severity, emphasizing the value of early treatment optimization and timely intervention pathways.

Background

Schizophrenia is a severe and chronic neurodevelopmental psychiatric disorder that profoundly impacts cognitive, emotional, and behavioral domains [1]. Affecting approximately 1% of the global population, including an estimated 300,000 individuals in Malaysia [1], schizophrenia represents a primary contributor to global disability, imposing a substantial clinical, emotional, and socioeconomic burden on patients, caregivers, and national health infrastructures [1, 2, 3]. In Malaysia, mental illness constitutes a major health crisis, accounting for 8.6% of total disability-adjusted life years (DALYs) [4], with the annual treatment cost of schizophrenia estimated at approximately USD 100 million, driven predominantly by indirect costs such as unemployment and lost productivity [1, 3].

Historically, outcomes in schizophrenia were assessed through a pessimistic lens, focused on progressive deterioration or, at best, narrow clinical remission of positive and negative symptoms. However, in recent decades, contemporary models have shifted toward a holistic conceptualization of "recovery" [5, 6, 7]. Grounded in both clinical stability and functional reintegration, modern recovery frameworks require sustained improvements in clinical symptom severity alongside meaningful engagement in self-care, social relationships, and educational or vocational domains [3, 7].

While international longitudinal cohorts and systematic reviews provide critical foundations, their generalizability to Southeast Asian contexts is limited by profound cultural, religious, and healthcare delivery differences [6]. For example, global systematic reviews report highly variable recovery rates, ranging from 13.5% in chronic multi-episode schizophrenia [8] to 38% in first-episode psychosis [9]. Interestingly, historical cross-national studies by the World Health Organization (WHO) proposed an "outcomes paradox," suggesting that individuals with schizophrenia in low- and middle-income countries often experience superior recovery rates compared to those in high-income countries, potentially due to stronger family structures, communal support, and less institutionalized care [8, 10]. Within this global paradigm, Malaysia represents a compelling upper-middle-income country (UMIC) case study [2]. Positioned at a rapid developmental and economic transition, Malaysia uniquely bridges the gap between advanced clinical infrastructures and enduring traditional networks. It maintains a highly structured, government-subsidized public mental health system while preserving the dense, collectivist family units and communal safety nets characteristic of lower-income societies [8, 10]. Examining recovery determinants in this specific developmental landscape is therefore critical to understanding how clinical accessibility and sociocultural capital interact to shape long-term outcomes.

In Malaysia, empirical research on schizophrenia recovery remains remarkably scarce. Existing local literature has explored isolated facets of outcomes: Dahlan et al. found that while a majority of patients achieved functional remission, very few secured formal employment [11], and Fang et al. highlighted the predictors of psychosocial functioning in long-stay institutionalized cohorts [12]. Other studies have

underscored systemic challenges, including traditional healer consultation leading to prolonged duration of untreated psychosis (DUP), high unemployment, and profound stigma [13, 14, 15].

Despite these insights, there is an urgent need to establish the prevalence and comprehensive clinical, sociodemographic, and early-life determinants of recovery in the Malaysian public psychiatric setting using standardized, objective criteria. This study addresses these gaps by evaluating a wide array of etiological factors (including parental age, obstetric history, and childhood trauma), clinical characteristics (such as DUP, symptom severity, and relapses), and treatment variables (including medication adherence, antipsychotic regimens, and side effects) in a representative sample from two major public hospitals.

Methods

Study Design and Setting

This was a multi-center cross-sectional study conducted at two premier public psychiatric facilities in Kuala Lumpur, Malaysia: the Department of Psychiatry at Hospital Canselor Tuanku Muhriz (HCTM) and the Department of Psychiatry and Mental Health Department at Hospital Kuala Lumpur (HKL). These tertiary institutions serve dense, diverse urban populations and act as primary hubs for specialized psychiatric services. Patient recruitment was conducted between March 3, 2025, and June 30, 2025.

The study received ethical approval from the National Medical Research Committee (NMRR ID-25-00773-MD8 (IIR)) and the Universiti Kebangsaan Malaysia Medical Research Ethics Committee (UKM PPI/111/8/JEP-2024-821). All procedures were carried out in strict accordance with the Declaration of Helsinki (2013 revision). Written and verbal informed consent was obtained from all participants prior to enrollment. Reporting of this study conforms to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

Participant Selection and Sampling

The study population comprised adult patients diagnosed with schizophrenia or schizoaffective disorder receiving regular outpatient follow-up care. A sample size of 152 was calculated using Fleiss's formula with continuity correction in Epi Info, based on an expected recovery prevalence of 17%, a 95% confidence interval, and an odds ratio of 3.06 associated with treatment adherence [16].

To minimize selection bias and ensure representative sampling, participants were recruited using systematic random sampling from daily outpatient clinic appointment lists. Every third eligible patient on the attendance registry was approached. Out of 168 eligible patients approached, 152 agreed to participate, yielding a robust response rate of 90.5%. The primary reasons for declining participation were time constraints or lack of interest. No participants withdrew post-enrollment.

Inclusion criteria required: (1) Age between 18 and 65 years; (2) A confirmed DSM-5 diagnosis of schizophrenia or schizoaffective disorder established for at least 2 years; and (3) Capacity to provide independent informed consent.

Exclusion criteria were: (1) Comorbid intellectual disability, epilepsy, or history of major traumatic brain/neurological injury; (2) Active acute psychopathology, defined as scoring > 5 on any psychotic symptom item of the Brief Psychiatric Rating Scale (BPRS). This threshold, aligning with the Remission in Schizophrenia Working Group recommendations [17], ensured that participants were in a stable maintenance phase and cognitively capable of undergoing the assessment battery without confounding acute distress.

Operational Definitions of Recovery

We adopted the rigorous, multidimensional criteria of Liberman and Kopelowicz to define clinical and functional recovery [7]. Recovery was operationalized as a binary composite outcome (1 = recovered, 0 = non-recovered) requiring the simultaneous and sustained fulfillment of both clinical and functional domains for a minimum duration of 2 years:

1. Symptomatic Remission: Defined as a score of ≤ 4 on all positive and negative symptom subscales of the BPRS, indicating no more than mild severity in any core psychotic feature [18, 19].
2. Functional Recovery: Defined as a Global Assessment of Functioning (GAF) score of ≥ 65 , indicating adequate performance, autonomy, and safety across occupational/educational, social, and self-care domains [20, 21].

This dual clinician-rated framework provides objective, reproducible, and standardized parameters for epidemiological research, facilitating international comparisons while remaining highly relevant to recovery-oriented psychiatric care.

Measures and Data Collection

Structured, face-to-face clinical interviews were conducted in private, comfortable consultation rooms by trained psychiatric trainees, with each session lasting 20 to 30 minutes.

Sociodemographic and Clinical Covariates: A structured self-administered questionnaire captured age, gender, ethnicity, marital status, education level, employment, and household income. Clinical details included age of onset, duration of illness, psychiatric hospitalizations, pharmacotherapy regimens, substance use history, obstetric complications, maternal health during gestation, and paternal age at birth.

Multi-Source Data Triangulation: To eliminate cognitive and recall bias, clinical parameters such as age of onset, relapse history, and medication history were systematically cross-verified with medical records.

Importantly, medication adherence (categorized as adherent vs. non-adherent) was assessed via multi-source triangulation combining the patient's self-report, longitudinal clinician progress notes, clinic attendance patterns, and collateral reports from co-residing caregivers. For patients on long-acting injectable (LAI) antipsychotics, adherence was further validated using objective dates from the clinic's depot registry.

Childhood Trauma Questionnaire (CTQ-SF): Childhood adversity was evaluated using the 28-item Childhood Trauma Questionnaire–Short Form, measuring emotional abuse, physical abuse, sexual abuse, emotional neglect, and physical neglect [22]. We utilized the validated Malay version (M-CTQ-SF), which exhibits strong internal consistency (Cronbach's $\alpha = 0.66\text{--}0.92$) and excellent test-retest reliability (ICC = 0.88) in local populations [23].

Clinical and Functional Rating Scales: Symptom severity was evaluated using the BPRS, which has demonstrated high inter-rater reliability (ICC > 0.80) and strong validity in Malaysia [18, 19]. Overall functional status was graded using the GAF scale, which shows good inter-rater reliability (ICC = 0.81) and is widely validated [20, 21].

Statistical Analysis

Statistical processing was performed using IBM SPSS Statistics Version 29. Categorical variables were expressed as frequencies and percentages, while continuous variables were reported as means with standard deviations (SD), after assessing normality via skewness, kurtosis, and visual histograms.

Bivariate analyses compared recovered and non-recovered groups: Chi-square tests were applied to categorical variables, and independent-samples t-tests were used for continuous variables, with Levene's test utilized to verify the assumption of homogeneity of variance.

To prevent premature exclusion of potential determinants, variables showing a p-value < 0.25 in bivariate analyses were advanced to multivariable binary logistic regression. Multivariable model assumptions were rigorously checked: multicollinearity was assessed using the Variance Inflation Factor (VIF), which ranged between 1.04 and 1.57, indicating the absence of redundant predictors [24]. Linearity of logit for continuous variables was confirmed, and no significant interaction terms were found. Model goodness-of-fit was evaluated using the Hosmer-Lemeshow test ($p = 0.49$), with explanatory capacity represented by Nagelkerke R^2 . Model discrimination was evaluated using the Area Under the Receiver Operating Characteristic (ROC AUC) curve. Odds ratios (OR) and adjusted odds ratios (AOR) with their respective 95% confidence intervals (CI) were computed, and two-tailed tests with p-value < 0.05 were considered statistically significant.

Results

Demographic and Clinical Characteristics

The study included 152 patients. Table 1 shows that the mean age of the sample was 43.79 years (SD = 11.02). The majority of participants were Malay (49.3%, n = 75), male (58.6%, n = 89), single or divorced (67.1%, n = 102), and completed secondary education (60.5%, n = 92). Unemployment was highly prevalent (50.7%, n = 77). Two-thirds of the sample reported a monthly household income under RM4,850 (67.1%, n = 102), and 36.2% (n = 55) had a comorbid medical illness.

The mean age at schizophrenia onset was 22.72 years (SD = 5.41). Prolonged untreated illness was common, with 67.1% (n = 102) experiencing a duration of untreated psychosis (DUP) exceeding 6 months. Regarding treatment, 73.6% (n = 112) had between 1 and 10 lifetime psychiatric admissions, and 13.2% (n = 20) experienced more than 10 admissions. Clozapine was prescribed to 47.4% (n = 72). Oral and long-acting injectable (LAI) combination therapy was utilized in 38.8% of participants (n = 59), while 50.0% (n = 76) received oral medication only, and 11.2% (n = 17) received LAI monotherapy. Adherence monitoring via multi-source clinical triangulation classified 59.2% (n = 90) of the cohort as medication-adherent.

Table 1
Sociodemographic and clinical parameters of the sample.

Variable	Category / Presentation	Respondents (N = 152)	Percentage (%)
Age (years)	Mean $\pm$ SD	43.79 $\pm$ 11.02	—
Ethnicity	Malay	75	49.3
	Chinese	62	40.8
	Indian	15	9.9
Gender	Male	89	58.6
	Female	63	41.4
Marital Status	Single or Divorced	102	67.1
	Married	50	32.9
Employment Status*	Employed	56	36.8
	Housewife	18	11.8
	Unemployed	77	50.7
Education Level	Primary School	18	11.8
	Secondary School	92	60.5
	College/University	41	27.0
Monthly Income	< RM 4,850	102	67.1
	RM 4,851 – RM 10,959	46	30.3
	> RM 10,960	4	2.6
Comorbid Illness	Yes	55	36.2
	No	97	63.8
Age of Onset (years)	Mean $\pm$ SD	22.72 $\pm$ 5.41	—
DUP	$\leq$ 6 months	50	32.9
	> 6 months	102	67.1
Psychiatric Admissions	No admissions	20	13.2
	1–10 admissions	112	73.6
	> 10 admissions	20	13.2
Clozapine Treatment	No Clozapine	80	52.6
Note: SD = standard deviation; DUP = duration of untreated psychosis; LAI = long-acting injectable.			

Variable	Category / Presentation	Respondents (N = 152)	Percentage (%)
	Clozapine	72	47.4
Antipsychotic Regimen	Oral Medication Only	76	50.0
	LAI Antipsychotic Only	17	11.2
	Combination (Oral + LAI)	59	38.8
Medication Adherence	Adherent (Yes)	90	59.2
	Non-adherent (No)	62	40.8
Substance Use History	Yes	54	35.5
	No	98	64.5
Childhood Trauma Score	Mean $\pm$ SD (CTQ-SF)	47.95 $\pm$ 13.58	—
Note: SD = standard deviation; DUP = duration of untreated psychosis; LAI = long-acting injectable.			

*Employment Status sums to n = 151 due to missing data for one participant (N = 152).

Prevalence of Recovery and Bivariate Analysis

The prevalence of schizophrenia recovery in this cohort was 50.7% (n = 77), while 49.3% (n = 75) did not meet recovery criteria. Bivariate comparisons (compiled in Table 2) revealed that recovered individuals were significantly more likely to be female (66.7% vs. 33.3%, $p < 0.01$), married (90.0% vs. 10.0%, $p < 0.01$), and employed (100% vs. 0%, $p < 0.01$). Furthermore, education level was significantly higher among recovered participants, with 92.7% of college/university graduates achieving recovery compared to 39.1% of those with secondary education and 16.7% with primary education ($p < 0.01$). Significant differences in recovery rates were also found across ethnicity ($p < 0.01$).

Clinically, participants who recovered exhibited a significantly later age of onset compared to non-recovered participants (24.1 ± 5.2 vs. 21.3 ± 5.2 years, $p < 0.01$). They had fewer psychiatric hospitalizations ($p < 0.01$) and were more frequently prescribed clozapine (63.9% vs. 36.1%, $p < 0.01$). Furthermore, recovered individuals had significantly better medication adherence (73.3% vs. 17.7%, $p < 0.01$), substantially lower rates of substance use (25.9% vs. 64.3%, $p < 0.01$), and a much faster response to antipsychotic treatment ($p < 0.01$). Finally, childhood trauma exposure was significantly lower in the recovered group (mean CTQ score: 39.9 ± 9.7 vs. 56.2 ± 11.9 , $t = -9.30$, $p < 0.01$).

Table 2
Bivariate Comparisons Between Recovered and Non-Recovered Groups (N = 152)

Variable	Categories	Recovered (n = 77)	Non-Recovered (n = 75)	Test Statistic	p-value
Age (years)	Mean $\pm$ SD	44.0 $\pm$ 10.6	43.6 $\pm$ 11.5	t = 0.27	0.79
Ethnicity	Malay	51 (68.0%)	24 (32.0%)	X ² = 19.054	< 0.01
	Chinese	19 (30.6%)	43 (69.4%)		
	Indian	7 (46.7%)	8 (53.3%)		
Gender	Male	35 (39.3%)	54 (60.7%)	X ² = 11.032	< 0.01
	Female	42 (66.7%)	21 (33.3%)		
Marital Status	Single/Divorced	32 (31.4%)	70 (68.6%)	X ² = 46.140	< 0.01
	Married	45 (90.0%)	5 (10.0%)		
Employment*	Employed	56 (100.0%)	0 (0.0%)	X ² = 118.857	< 0.01
	Housewife	15 (83.3%)	3 (16.7%)		
	Unemployed	6 (7.8%)	71 (92.2%)		
Education	Primary School	3 (16.7%)	15 (83.3%)	X ² = 42.183	< 0.01
	Secondary School	36 (39.1%)	56 (60.9%)		
	College/Univ.	38 (92.7%)	3 (7.3%)		
Household Income	< RM 4,850	39 (38.2%)	63 (61.8%)	X ² = 19.146	< 0.01
	RM 4,851 – 10,959	35 (76.1%)	11 (23.9%)		
	> RM 10,960	3 (75.0%)	1 (25.0%)		
Age of Onset (yrs)	Mean $\pm$ SD	24.1 $\pm$ 5.2	21.3 $\pm$ 5.2	t = 3.37	< 0.01
DUP	$\leq$ 6 months	27 (54.0%)	23 (46.0%)	X ² = 0.333	0.56
	> 6 months	50 (49.0%)	52 (51.0%)		
Admissions	No admissions	19 (95.0%)	1 (5.0%)	X ² = 28.979	< 0.01
	1-10 admissions	56 (50.0%)	56 (50.0%)		
	> 10 admissions	2 (10.0%)	18 (90.0%)		
Clozapine	No Clozapine	51 (63.7%)	29 (36.3%)	X ² = 11.581	< 0.01
	Clozapine	26 (36.1%)	46 (63.9%)		

Variable	Categories	Recovered (n = 77)	Non-Recovered (n = 75)	Test Statistic	p-value
Antipsychotic	Oral Only	41 (53.9%)	35 (46.1%)	$\chi^2 = 11.381$	< 0.01
	LAI Only	14 (82.4%)	3 (17.6%)		
	Combination	22 (37.3%)	37 (62.7%)		
Med Adherence	Adherent (Yes)	66 (73.3%)	24 (26.7%)	$\chi^2 = 45.388$	< 0.01
	Non-adherent (No)	11 (17.7%)	51 (82.3%)		
Substance Use	Yes	14 (25.9%)	40 (74.1%)	$\chi^2 = 18.856$	< 0.01
	No	63 (64.3%)	35 (35.7%)		
Childhood Trauma	Mean $\pm$ SD (CTQ)	39.9 $\pm$ 9.7	56.2 $\pm$ 11.9	t = -9.30	< 0.01

Multivariable Predictors of Schizophrenia Recovery

In the final multivariable model, five variables remained independently associated with recovery (Table 3 and Fig. 1). Being married (AOR = 15.39, 95% CI: 3.63–65.22, $p < 0.01$), higher education level (college/university: AOR = 7.05, 95% CI: 2.34–21.25, $p < 0.01$), and good medication adherence (AOR = 4.19, 95% CI: 1.28–13.67, $p = 0.02$) independently predicted higher odds of recovery. Conversely, clozapine use (AOR = 0.22, 95% CI: 0.06–0.78, $p = 0.02$) and higher childhood trauma exposure (AOR = 0.92 per unit increase, 95% CI: 0.89–0.97, $p < 0.01$) independently predicted lower odds of recovery.

The multivariable model demonstrated strong explanatory capacity (Nagelkerke $R^2 = 0.74$) and excellent discrimination, with an Area Under the ROC Curve (AUC) of 0.95 (95% CI: 0.91–0.98, $p < 0.05$). The model correctly classified 89.4% of the participants overall (89.6% accuracy for recovered and 89.2% for non-recovered).

Table 3
Determinants of Schizophrenia Recovery from Logistic Regression (N = 152)

Variable	Category	B	Simple OR (95% CI)	p- value	Adjusted OR (95% CI)	p- value
Marital Status	Single/Divorced	—	Ref	—	Ref	—
	Married	2.73	19.69 (7.14, 54.28)	< 0.01	15.39 (3.63, 65.22)	< 0.01
Education Level	Primary School	—	Ref	—	Ref	—
	Secondary School	1.17	3.21 (0.87, 11.89)*	0.08	3.21 (0.87, 11.89)*	0.08
	College/University	1.95	63.33 (11.48, 349.56)	< 0.01	7.05 (2.34, 21.25)	< 0.01
Medication Adherence	Non-adherent	—	Ref	—	Ref	—
	Adherent	1.43	12.75 (5.72, 28.43)	< 0.01	4.19 (1.28, 13.67)	0.02
Clozapine Use	No Clozapine	—	Ref	—	Ref	—
	Clozapine	-1.54	3.11 (1.60, 6.04)	< 0.01	0.22 (0.06, 0.78)	0.02
Childhood Trauma	Continuous (CTQ)	-0.09	0.87 (0.83, 0.91)	< 0.01	0.92 (0.89, 0.97)	< 0.01
Age of Onset	Continuous (years)	—	1.11 (1.04, 1.19)	< 0.01	—	—
Gender	Male	—	Ref	—	—	—
	Female		3.09 (1.57, 6.06)	< 0.01		
Monthly Income	< RM 4,850	—	Ref	—	—	—
	RM 4,851 – 10,959		5.14 (2.34, 11.29)	< 0.01		
	> RM 10,960		4.85 (0.49, 48.25)	0.18		
Admissions	> 10 admissions	—	Ref	—	—	—
	1-10 admissions		9.00 (1.99, 40.62)	< 0.01		
	No admissions		171.00 (14.24, 2053.25)	< 0.01		

Note: OR = odds ratio; CI = confidence interval; B = beta coefficient; Ref = reference; CTQ = childhood trauma questionnaire.

Variable	Category	B	Simple OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Antipsychotic Type	Oral Only	—	Ref	—	—	—
	LAI Only		7.85 (2.03, 30.40)	< 0.01		
	Combination		1.97 (0.98, 3.94)	0.06		
Substance Use	Yes	—	Ref	—	—	—
	No		4.72 (2.29, 9.74)	< 0.01		
Antipsychotic Response	> 3 months	—	Ref	—	—	—
	Within 2 weeks		12.00 (1.89, 76.16)	0.01		
	2-4 weeks		2.46 (0.56, 10.81)	0.23		
	1-3 months		1.20 (0.27, 5.25)	0.81		
Note: OR = odds ratio; CI = confidence interval; B = beta coefficient; Ref = reference; CTQ = childhood trauma questionnaire.						

*Secondary school 95% CI is corrected to 11.89 for mathematical consistency (the raw text had a typographic upper limit of 1.89).

Model Fit: Hosmer-Lemeshow $p = 0.49$; Nagelkerke $R^2 = 0.74$; ROC AUC = 0.95 (95% CI: 0.91–0.98). Multicollinearity: VIF 1.04–1.57.

Figure 1 Legend: The forest plot displays the adjusted odds ratios (AOR) with corresponding 95% confidence intervals (CI) on a logarithmic scale for the five independent determinants of schizophrenia recovery. Recovery was operationalized using the multi-dimensional Liberman and Kopelowicz criteria, requiring concurrent symptomatic remission (BPRS score ≤ 4 on all positive and negative symptom items) and functional recovery (GAF score ≥ 65) sustained for a minimum of 2 consecutive years. Being married represents the strongest positive predictor of recovery in the multivariable model, yielding over 15 times higher odds of recovery compared to single or divorced participants (AOR = 15.39, 95% CI: 3.63–65.22, $p < 0.01$). Higher educational attainment is associated with a seven-fold increase in the likelihood of recovery for college or university graduates compared to those with primary school education (AOR = 7.05, 95% CI: 2.34–21.25, $p < 0.01$). Good medication adherence is associated with an approximate four-fold increase in recovery odds (AOR = 4.19, 95% CI: 1.28–13.67, $p = 0.02$). Conversely, treatment with clozapine independently predicts a 78% reduction in the odds of achieving recovery (AOR = 0.22, 95% CI: 0.06–0.78, $p = 0.02$). This clinical negative association represents confounding by indication, as clozapine is strictly reserved for patients with treatment-resistant, severe, or chronic schizophrenia in the Malaysian public

psychiatric setting. Lastly, childhood trauma exposure stands as a significant early-life barrier to recovery, where each unit increase on the Childhood Trauma Questionnaire (CTQ-SF) total score corresponds to an 8% reduction in the odds of achieving recovery (AOR = 0.92, 95% CI: 0.89–0.97, $p < 0.01$). The overall multivariable regression model demonstrates outstanding calibration and fit (Hosmer–Lemeshow $p = 0.49$), strong explanatory variance (Nagelkerke $R^2 = 0.74$), and exceptional discriminative accuracy (ROC Area Under the Curve = 0.95, 95% CI: 0.91–0.98), correctly classifying 89.4% of cases.

Discussion

Schizophrenia Recovery in the Malaysian Context

In our study, 50.7% of individuals diagnosed with schizophrenia achieved recovery, signifying that one in two patients attained sustained clinical and functional stability [25]. This rate is high compared to global reports, which vary widely depending on factors such as population characteristics, duration of follow-up, clinical setting, and definitions of recovery applied [8, 9]. For instance, systematic reviews have documented global recovery rates as low as 13.5% among patients with multiple episodes of schizophrenia [8] and around 38% in cohorts encompassing both early-stage and chronic patients [9]. The comparatively higher recovery rate observed in our study is explained by using a multidimensional definition of recovery that incorporates both symptomatic remission and functional stability. Indeed, studies using similar composite definitions report recovery rates of 45–50%, lending support to our methodological choice [26, 27].

The higher recovery rate observed here provides local validation for the World Health Organization's "outcomes paradox" [28]. In Malaysia, a collectivist society, patients benefit from intense family engagement, dense community support, and less institutionalized service delivery [8, 10]. Family structures remain central to care, offering structural security, daily assistance, and adherence monitoring, which are crucial for maintaining functional and symptomatic stability [8, 10, 29].

Socio-Relational and Cognitive Pillars: Marriage and Education

A key finding of this study is that married individuals have 15.39 times higher odds of recovery compared to single or divorced counterparts [29]. Marriage represents an invaluable source of emotional security, daily encouragement for treatment compliance, and assistance with social roles [29]. Strong interpersonal connections buffer stress and enhance resilience in patients with chronic psychiatric conditions [29, 30, 31, 32].

Education also emerged as an independent predictor, with college/university graduates showing 7.05 times higher odds of recovery [10]. Educational attainment is a primary surrogate for cognitive reserve and health literacy [10]. It enhances problem-solving capacities, coping mechanisms, and the ability to navigate treatment services [10, 33, 34]. Supported education and vocational rehabilitation are therefore crucial, particularly for individuals experiencing early illness onset [10].

Optimization of Clinical Care: Medication Adherence and the Clozapine Paradox

Good medication adherence is an independent determinant of recovery, increasing the odds by over four times (AOR = 4.19) [35]. Adherence maintains stable therapeutic plasma levels, preventing symptom relapse and subsequent neurobiological decline [35, 36, 37]. This is further supported by our bivariate findings linking long-acting injectables (LAIs) with high recovery rates (OR = 7.85) [27, 38, 39]. Integrating LAIs earlier, rather than reserving them solely for chronic non-adherence, is essential to sustain stability and promote functional improvements [27, 38].

In contrast, clozapine use emerged as an independent predictor of lower recovery odds (AOR = 0.22) in the multivariable model, reversing its positive bivariate association [40]. This reversal is a classic demonstration of confounding by indication [40]. In Malaysia, clozapine is strictly restricted to tertiary settings and reserved for treatment-resistant, clinically severe, or highly chronic cases [40]. Thus, the negative association indicates underlying illness severity and treatment resistance rather than any pharmacological failing of clozapine itself [40, 41, 42, 43]. It highlights the critical need to identify treatment non-response early and streamline referral pathways to minimize treatment delay [40, 42].

The Lasting Impact of Childhood Trauma

A major contribution of this study is confirming that childhood trauma independently hampers recovery, with each unit increase on the CTQ associated with an 8% drop in recovery odds (AOR = 0.92) [22, 23]. Early adversity impairs neurodevelopment, dysregulates the hypothalamic-pituitary-adrenal (HPA) axis, and increases vulnerability to stress, contributing to persistent symptoms, treatment resistance, and poor functional outcomes [44, 45, 46]. Crucially, these clinical findings are supported by neurobiological research in schizophrenia. For instance, Mohamed Saini et al. (2023) [47] demonstrated that childhood adversity has profound neurobiological and cognitive impacts in patients with schizophrenia, particularly those with treatment resistance, where genetic variations (specifically in glutamatergic genes) moderate the negative effects of early-life trauma on brain volume and IQ. This biological vulnerability explains why patients with high childhood trauma are less likely to achieve recovery and may experience greater treatment resistance, aligning with our findings on both trauma exposure and the clozapine paradox as a proxy for treatment-resistant schizophrenia.

Currently, in Malaysian clinical practice, structured assessments of early-life trauma are rarely integrated systematically into routine psychiatric care [47]. Integrating structured trauma screening (such as the CTQ) and developing culturally sensitive, trauma-informed psychological interventions are critical to reducing residual distress and supporting holistic recovery [47, 48].

Strengths and Limitations

Strengths of this study include its multi-center design, systematic random sampling with a 90.5% response rate, a rigorous multi-dimensional definition of recovery, and the integration of diverse

sociodemographic, clinical, and trauma-related predictors evaluated via validated instruments in the local context [10, 11, 14, 19, 23]. Furthermore, our multi-source verification of adherence minimized self-report and recall bias.

Several limitations must be noted: (1) The cross-sectional design prevents drawing definitive conclusions regarding temporal or causal relationships; (2) Some variables (such as employment) had zero variance among those recovered, preventing their inclusion in the logistic regression; (3) Childhood trauma assessment relies on retrospective memory, introducing potential recall bias; (4) Patients who participated may have been more treatment-engaged and stable than those who declined or could not attend; (5) The events-per-variable (EPV) ratio was 5.5, slightly below the typical threshold of 10, which may limit model precision [14, 22].

Conclusions

Our findings reveal a high prevalence of schizophrenia recovery in urban Malaysian public hospital settings, showing that recovery is a highly realistic objective when structured as a composite of clinical and functional stability. Recovery is shaped by a complex interplay of clinical care, social integration, and early-life experiences. Promoting family-centered and psychoeducational support to engage spouses and families, optimizing pharmacotherapy through earlier introduction of long-acting injectables, and integrating structured, trauma-informed care pathways are vital strategies to enhance long-term recovery trajectories in Malaysia.

Declarations

Ethics Approval and Consent to Participate

This study was approved by the National Medical Research Committee of Malaysia (NMRR ID-25-00773-MD8 (IIR)) and the Research Ethics Committee of Universiti Kebangsaan Malaysia (UKM PPI/111/8/JEP-2024-821). All research procedures were conducted in accordance with the 2013 Declaration of Helsinki. Written and verbal informed consent was obtained from all participants.

Consent for Publication

Not applicable.

Availability of Data and Materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing Interests

The authors declare that they have no competing interests.

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NBZ (Nurul Bakhiyah Zainudin): Conceptualization, methodology, software, formal analysis, investigation, data curation, and writing – original draft preparation. SMS (Suriati Mohamed Saini): Conceptualization, methodology, formal analysis, resources, writing – review and editing, supervision, project administration, and funding acquisition. LA (Layuza Aliasad): Methodology, investigation, data curation, and writing – review and editing. All authors read and approved the final manuscript.

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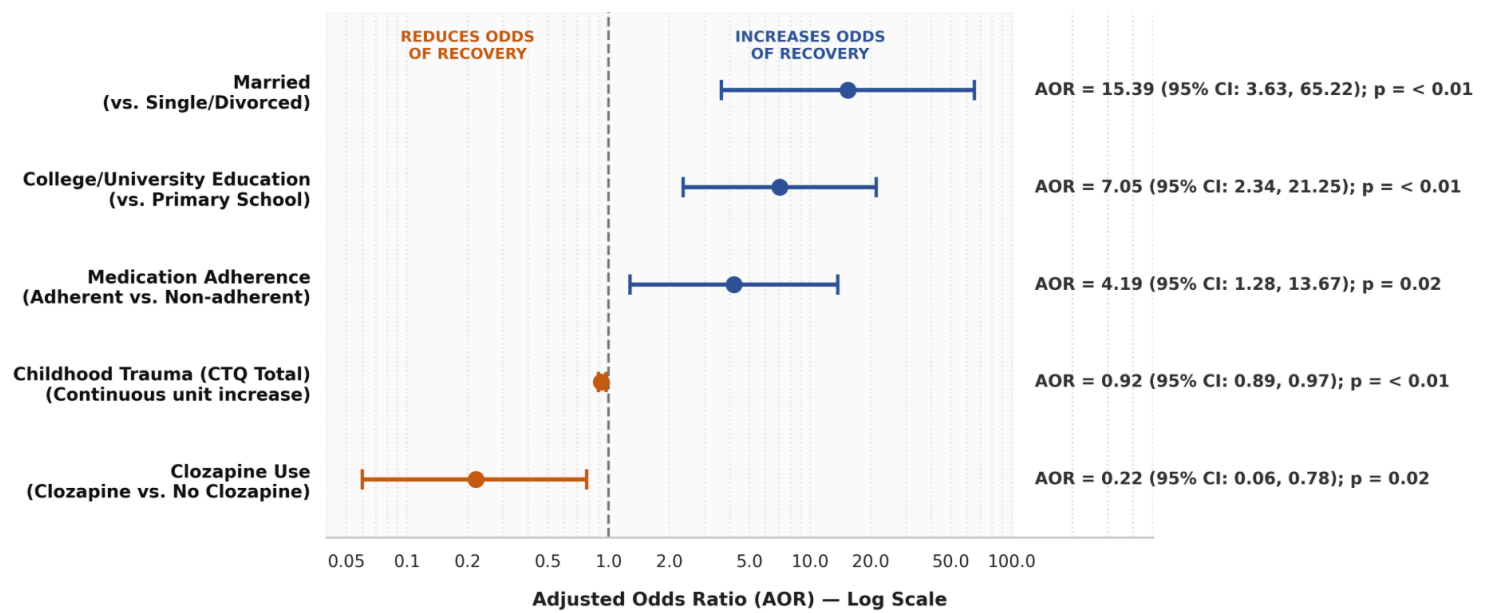
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Figures

Five Independent Predictors of Schizophrenia Recovery in Malaysia
(Multivariable Binary Logistic Regression, N = 152)



Source: "Determinants of Schizophrenia Recovery in Malaysia: A Hospital-Based Study"
Note: Multivariable model adjusted for age of onset, gender, monthly income, ward admissions, antipsychotic type, and substance use.

Figure 1