

Trends in Hospitalization Expenses and Their Influencing Factors Among Patients with Schizophrenia: A Retrospective Study

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Research Article

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Abstract

Objective

To analyze the dynamic trends and core influencing factors of hospitalization expenses for patients with schizophrenia, optimize the structure of medical costs, and provide evidence-based references for rational healthcare cost control, alleviating patients' economic burden, and improving medical insurance payment policies.

Methods

A total of 5,303 inpatients with schizophrenia admitted to a tertiary A-level psychiatric hospital in Ningxia Hui Autonomous Region, Western China, from 2020 to 2025 were enrolled. Relevant information including hospitalization expenses was collected from the hospital information system. The structural change degree analysis was applied to dissect the dynamic evolution of hospitalization expense structure, and the Back Propagation (BP) neural network model was used to identify the key factors influencing hospitalization expenses.

Results

From 2020 to 2025, the average hospitalization expenses per admission for schizophrenia patients exhibited an initial increase followed by a decline and subsequent stabilization. Specifically, the proportion of pharmaceutical expenses decreased by 0.75%, rehabilitation expenses showed a negative structural change, while medical service expenses and laboratory/imaging test expenses presented positive structural changes. The contribution rate of chemical drug expenses to the overall structural change was only 2.8%. Length of hospital stay was identified as the most significant factor affecting hospitalization expenses.

Conclusion

The overall structure of hospitalization expenses for schizophrenia patients still needs further optimization. It is recommended to further promote the use of drugs from the national centralized procurement, optimize rehabilitation programs and service models, and expand the inter-provincial and inter-institutional mutual recognition of test results, so as to reduce the hospitalization burden of patients with schizophrenia.

Introduction

Schizophrenia is a severe mental disorder characterized by core abnormalities in emotion, behavior, and cognitive function, with distinct features of high prevalence, high recurrence rate, high disability rate, and substantial disease burden. Epidemiological surveys indicate that approximately 1% of the global population is affected by this disorder, with a point prevalence of 23.6 per 100,000 population and an age-standardized prevalence of 287.4 per 100,000 population [1–2]. The disease typically onsets in young adulthood, and its poor long-term prognosis not only imposes a heavy economic burden on patients' families but also poses a severe challenge to regional healthcare resource allocation and the sustainable operation of medical insurance funds.

Hospitalization expenses constitute the core component of the economic burden of schizophrenia. Their dynamic trends and internal structural characteristics directly reflect the combined effects of diagnosis and treatment models, medical insurance policies, and healthcare resource allocation. Globally, the lifetime societal costs of schizophrenia vary significantly across countries, ranging from approximately \$5,818 in Thailand to \$94,587 in Norway and as high as \$988,264 in Australia [3]. Currently, research on hospitalization expenses for schizophrenia in China still has notable limitations: most existing studies are methodologically homogeneous, and few have adopted multi-dimensional dynamic quantitative analysis combining structural change degree analysis and neural network models. This gap makes it difficult to provide precise evidence-based references for optimizing local medical insurance payment policies and implementing refined cost management. Furthermore, given the substantial disparities in economic development levels and medical insurance payment methods across different regions of China, conclusions from existing studies cannot be directly applied to guide practices in underdeveloped areas.

As an underdeveloped region in western China, the Ningxia Hui Autonomous Region has relatively limited mental health service resources, and the hospitalization expense burden for schizophrenia patients is particularly prominent. Therefore, this study enrolled inpatients with schizophrenia admitted to a tertiary A-level psychiatric hospital in Ningxia from 2020 to 2025 as the research subjects. We systematically dissected the dynamic evolution characteristics of hospitalization expense structure using structural change degree analysis, and identified key factors influencing hospitalization expenses by integrating the Back Propagation (BP) neural network model. This study aims to analyze the changing patterns of hospitalization expenses for schizophrenia patients, pinpoint the core links for cost control, provide scientific evidence for rational healthcare cost control, optimizing expense structure, improving medical insurance payment policies, and alleviating patients' economic burden, and also offer a practical reference for conducting health economics research on schizophrenia in similar underdeveloped regions in western China.

Methods

Data Source

This study was conducted at a tertiary A-level psychiatric hospital in the Ningxia Hui Autonomous Region, western China. Data were extracted from the hospital information system (HIS), including the medical record homepage information of 5,303 discharged patients with a primary diagnosis of

schizophrenia between 2020 and 2025. The collected variables covered patients' demographic characteristics, hospitalization expenses, discharge diagnoses, medical insurance payment methods, and other relevant clinical information. Hospitalization expenses were categorized into 8 components: pharmaceutical expenses (including chemical drugs and Chinese patent medicines), bed fees, laboratory and imaging examination fees, medical service fees (including general medical service fees, general therapeutic procedure fees, and clinical diagnostic fees), nursing fees, rehabilitation fees, and medical consumable fees.

Human Ethics and Consent to Participate declarations: applicable

This study was approved by the Ethics Committee of Ning'an Hospital of Ningxia Hui Autonomous Region (Ethics Approval No.: 2025-WS-055). All procedures involving human participants in this research were conducted in accordance with the Declaration of Helsinki. The requirement for written informed consent was waived due to the retrospective nature of the study and the use of de-identified medical record data.

Inclusion and Exclusion Criteria

Inclusion Criteria

Cases with a primary diagnosis of schizophrenia according to the International Classification of Diseases, 10th Revision (ICD-10) coding system.

Exclusion Criteria

- Cases with missing or duplicate information on the medical record homepage
- Cases with a length of hospital stay < 3 days (mostly patients undergoing clinical observation, transfer, or death)
- Cases with a length of hospital stay > 120 days (mostly long-term institutional care patients whose hospitalization expenses do not represent routine clinical practice)

A total of 5,303 eligible cases were finally included in this study.

Statistical Analysis

Structural change degree analysis was performed to investigate the structural changes in total hospitalization expenses among patients with schizophrenia. Univariate analysis was used to identify potential factors influencing hospitalization expenses, and factors with statistically significant differences were further incorporated into the Back Propagation (BP) neural network model to determine the degree of influence and relative importance of each factor.

Categorical variables were described using frequencies, and continuous variables including hospitalization expenses were presented as means. Taking hospitalization expenses as the dependent variable, the Mann-Whitney U test and Kruskal-Wallis ANOVA test were applied for univariate analysis. A P-value less than 0.05 was considered statistically significant.

Results

Baseline Characteristics of Hospitalized Patients with Schizophrenia

A total of 5,303 inpatients with schizophrenia discharged between 2020 and 2025 were included in this study (an initial 5,797 cases were retrieved, and 5,303 eligible cases were finally included after applying the inclusion and exclusion criteria). During the study period, no significant upward or downward trend was observed in the annual number of discharged patients. The highest number of discharges was recorded in 2021 (1,169 cases), while the lowest was in 2022 (770 cases), representing a year-on-year decrease of 34.13%.

In terms of gender distribution, there were 847 more female patients than male patients. The age distribution was dominated by young and middle-aged adults, with the highest proportion (46.33%) in the 35–54 years age group. First-time admissions accounted for 49.03% of the total, which was comparable to the proportion of non-first-time admissions.

No statistically significant difference was found in the average hospitalization expenses per admission among different age groups (Kruskal-Wallis test, $\chi^2=7.061$, $P=0.07$). The average hospitalization expenses per admission increased with the length of hospital stay, and male patients had higher average hospitalization expenses per admission than female patients. The composition of each variable and the corresponding average hospitalization expenses per admission are detailed in Table 1.

Table 1 should be placed here (Line 274–275)

Hospitalization Expenses and Their Composition

During the 2020–2025 study period, the average hospitalization expenses per admission for patients with schizophrenia exhibited an overall trend of initial increase followed by a decrease, peaking at 14,257.77 Chinese Yuan (CNY) in 2022. Regarding the expense structure, the proportion of chemical drug expenses decreased by only 0.75% and remained relatively stable overall. The proportions of medical service expenses and laboratory/imaging examination

fees showed a continuous upward trend, with increases of 28.79% and 54.29%, respectively. Nursing fees and rehabilitation expenses presented a fluctuating pattern of initial rise followed by decline, with overall decreases of 28.35% and 16.99%, respectively, over the study period. Chinese patent medicine expenses and medical consumable fees consistently accounted for a relatively small proportion of total hospitalization expenses throughout the study period, as detailed in Table 2.

Table 2 should be placed here (Line 277)

Structural Change Degree and Contribution Rate of Hospitalization Expenses for Patients with Schizophrenia

During the 2020–2025 study period, the overall structural change degree of hospitalization expenses for schizophrenia patients was 26.82%. Among them, chemical drug expenses, bed fees, nursing fees, and rehabilitation expenses showed negative structural changes, while Chinese patent medicine expenses, medical service expenses, laboratory/imaging examination fees, and medical consumable fees presented positive structural changes. The top three expense items contributing to the overall structural change were rehabilitation expenses (38.22%), medical service expenses (25.17%), and laboratory/imaging examination fees (17.82%), with a cumulative contribution rate of 81.21%, which were the primary drivers of the structural changes in hospitalization expenses. During the study period, rehabilitation expenses experienced a sharp decrease of 36.78% between 2022 and 2023. The structural contribution rate of chemical drug expenses dropped from 13.45% at the beginning of the study period to 0.56% at the end, indicating that the national centralized drug procurement policy has achieved remarkable effects in reducing the proportion of pharmaceutical expenses, as detailed in Table 3.

Table 3 should be placed here (Line 279–280)

Importance Analysis of Influencing Factors

The Back Propagation (BP) neural network is an artificial neural network model based on the error back propagation algorithm. Previous studies have demonstrated that [4–5], compared with traditional statistical methods, it has no special requirements for data distribution and excels in handling nonlinear relationships. Given the non-normal distribution characteristic of hospitalization expense data, this model exhibits higher applicability in influencing factor analysis than conventional approaches.

In this study, the BP neural network model was employed with 9 independent variables included to analyze the degree of influence of each factor on the average hospitalization expenses per admission for patients with schizophrenia. As shown in Table 4, significant differences were observed in the importance of each factor: length of hospital stay had an importance value of 0.654 and a normalized importance of 100.0%, making it the most influential factor affecting hospitalization expenses. This was followed by admission year (14.5%), discharge treatment outcome (9.2%), and marital status (8.0%). Factors with relatively minor influence on hospitalization expenses included gender (2.4%) and schizophrenia subtype (3.5%). Furthermore, the top three factors ranked by normalized importance (length of hospital stay, admission year, and discharge treatment outcome) accounted for more than 70% of the cumulative contribution, indicating that these three variables are the key determinants of hospitalization expenses for schizophrenia patients. In contrast, the normalized importance of age, number of hospitalizations, medical payment method, schizophrenia subtype, and gender were all below 10%, suggesting that their direct impact on hospitalization expenses is relatively weak. Detailed information is provided in Table 4.

Table 4 should be placed here (Line 282)

Discussion

Insignificant Decline in Pharmaceutical Expenses Following Centralized Procurement Policy: Limitations of Psychiatric Treatment

This study found that the proportion of chemical drug expenses only decreased from 12.42% in 2020 to 11.67% in 2025, with a mere reduction of 0.75%, which was significantly lower than the reductions observed in drug expenses for chronic diseases such as diabetes and hypertension [6–7]. This phenomenon is closely related to the implementation dilemmas of the national centralized drug procurement (NCDP) policy in psychiatric practice.

First, patients with schizophrenia and their families exhibit strong brand dependence and treatment inertia toward original antipsychotic drugs. Both clinicians and patients have concerns regarding the efficacy and safety of switching to generic drugs, resulting in a relatively low actual utilization rate of NCDP-winning drugs among inpatients. Second, although clinical guidelines and textbooks recommend initial treatment of schizophrenia with monotherapy at sufficient dosage and adequate duration, a high proportion of combination pharmacotherapy is commonly used in clinical practice to rapidly control symptoms during the acute phase. This demand cannot be fully met by generic drug substitution to achieve substantial price reductions. Third, the NCDP policy primarily affects outpatient medications for chronic diseases, while some injectable agents and non-NCDP drugs used by inpatients remain at their original prices. Furthermore, the shift in treatment models—the increasing proportion of non-pharmacological interventions such as rehabilitation services and psychotherapy—has diluted the proportion of pharmaceutical expenses in total hospitalization expenses. These multiple overlapping factors have collectively resulted in the insufficient manifestation of the price reduction effect of the NCDP policy on inpatient expenses in psychiatry.

Characteristics of Structural Changes in Hospitalization Expenses: Rehabilitation Expenses, Medical Service Expenses, and Laboratory/Imaging Examination Fees as the Main Contributors

During the 2020–2025 study period, the overall structural change degree of hospitalization expenses for schizophrenia patients was 26.82%. The cumulative contribution rate of rehabilitation expenses, medical service expenses, and laboratory/imaging examination fees to the overall structural change reached

81.21%, with rehabilitation expenses alone accounting for 38.22%. The initial increase followed by a decrease in the proportion of rehabilitation expenses was mainly attributed to the implementation of bundled payment for some rehabilitation projects by the medical insurance department.

The proportion of medical service expenses in hospitalization expenses for schizophrenia patients increased from 25.51% in 2020 to 32.26% in 2025. This trend intuitively reflects the gradual optimization of the revenue structure of psychiatric hospitals and the reasonable recognition of the technical and labor value of medical personnel following the implementation of the zero-markup drug policy. However, compared with findings from other studies, such as the nearly 50% proportion of medical service expenses for elderly chronic diseases in Guangdong Province [8], there is still room for improvement in psychiatric medical service expenses. It should also be noted that the internal structure of medical service expenses requires further optimization. Currently, prices for basic medical service items such as registration fees and consultation fees remain relatively low in psychiatry. Meanwhile, although prices for core psychiatric technical services such as psychotherapy and cognitive behavioral therapy (CBT) have been adjusted, they still fail to fully reflect their technical content and time cost, which is mainly restricted by regional economic development and lagging price reform.

The proportion of laboratory/imaging examination fees increased from 9.29% in 2020 to 14.07% in 2025, with a growth rate of 54.29% and a structural change contribution rate of 17.82%, making it one of the fastest-growing expense categories during the study period. This trend is consistent with the general pattern of changes in medical expense structures in public hospitals across China after the implementation of the zero-markup drug policy [9]. From the perspective of clinical diagnosis and treatment logic, the reasonable growth of examination fees for schizophrenia patients is inevitable. On the one hand, psychiatric diagnosis and treatment guidelines explicitly require all first-visit patients to undergo systematic laboratory and imaging examinations to rule out organic mental disorders, which is a core link to avoid misdiagnosis and ensure medical safety. On the other hand, although the widespread use of atypical antipsychotics has significantly improved patient prognosis, it may cause adverse reactions such as metabolic syndrome, liver and kidney function damage, and electrocardiogram abnormalities, making regular monitoring of relevant indicators a clinical routine. Meanwhile, with the increasing proportion of elderly schizophrenia patients, their high rate of physical comorbidities has further increased the demand for necessary examinations. Nevertheless, there is still room for optimization in examination services in clinical practice: homogenization of admission examination items; insufficient matching between the frequency of re-examinations and disease progression in some patients; furthermore, the coverage and implementation intensity of mutual recognition of test results across regions and different levels of medical institutions need to be strengthened. The above issues have increased patients' economic burden to a certain extent and also caused unnecessary consumption of medical resources.

Length of Hospital Stay as the Core Factor Influencing Hospitalization Expenses

The BP neural network model showed that the normalized importance of length of hospital stay reached 100.0% with a standardized regression coefficient of 0.654, making it the primary factor affecting hospitalization expenses for patients with schizophrenia. This result is consistent with the conclusions of numerous previous studies [10–11]. However, controlling the length of hospital stay in psychiatry faces unique challenges: the symptom control cycle during the acute phase of schizophrenia is relatively long, resulting in an average length of hospital stay generally higher than that in general hospitals; insufficient community rehabilitation capacity after discharge forces patients to prolong their hospital stay; inadequate family care capacity and low social acceptance of patients with mental disorders also lead to a certain degree of institutionalization by default.

It is recommended that hospitals establish an early warning mechanism for length of hospital stay based on disease severity and implement targeted management for cases with excessively long hospital stays. Meanwhile, health administrative departments should accelerate the construction of a community-based mental health rehabilitation network and provide seamless transitional rehabilitation services for patients after discharge, so as to fundamentally reduce unnecessary hospital stays.

Conclusions

In summary, the hospitalization expense structure for patients with schizophrenia requires further optimization, mainly focusing on the following aspects:

- (1) It is recommended to include high-priced long-acting injectable antipsychotics in the national centralized drug procurement (NCDP), establish a real-world evidence (RWE) database for generic psychotropic drugs to eliminate concerns among clinicians and patients, link the utilization rate of NCDP drugs to hospital performance appraisal, and set reasonable completion rate indicators;
- (2) Optimize the payment methods for rehabilitation services, promote the diversion of inpatient rehabilitation to community-based rehabilitation, and clarify the maximum duration of inpatient rehabilitation;
- (3) Take length of hospital stay management as the key approach, integrate diagnosis-related group (DRG) payment and seamless community rehabilitation linkage, implement specialized quality control for cases exceeding the standardized length of hospital stay, and achieve precision cost control;
- (4) Improve the medical insurance coverage and reimbursement rate for patients with mental disorders to alleviate the economic burden of self-paying patients.

Limitations of the Study

This study has the following limitations: First, data were obtained from a single tertiary A-level psychiatric hospital in the Ningxia Hui Autonomous Region, which limits the generalizability of the conclusions. Future studies could incorporate multi-center data for comparative analysis. Second, the analysis was only based on inpatient expenses, and outpatient expenses, long-term rehabilitation expenses, and indirect economic burdens on patients and their families were not included, which may underestimate the full-cycle economic burden of schizophrenia. Third, some variables (such as disease duration, severity of comorbidities, and specific drug types and dosages) were not included in the analysis, which may compromise the comprehensiveness of influencing factor

identification. Fourth, due to the existence of medical service price adjustments and inflation during 2020–2025, no adjustment for comparable prices was performed for annual expenses, and thus the observed trends in hospitalization expenses may be subject to bias.

Table 1

Results of univariate analysis of baseline characteristics and average hospitalization expenses per admission in patients with schizophrenia

Variable	Number of cases (n)	Average hospitalization expenses per admission (CNY)	Statistic (Z/ χ^2)	P
Age (years)			7.061	0.07
<18	118	12390.40		
18–34	2164	12824.03		
35–54	2457	12519.14		
≥ 55	564	12181.87		
Length of hospital stay (days)			4274.144	<0.001
≤ 14d	484	3743.03		
15–29d	1078	6672.35		
30–59d	2086	11787.62		
≥ 60d	1655	20090.61		
Gender			-7.668	<0.001
Male	2228	13451.20		
Female	3075	11991.57		
Admission year			92.515	<0.001
2020	867	11901.03		
2021	1169	13653.08		
2022	770	14257.77		
2023	824	11700.84		
2024	891	11748.02		
2025	782	12117.79		
Marital status			85.532	<0.001
Unmarried	2014	13311.61		
Married	2000	11558.30		
Widowed	132	12328.52		
Divorced	1056	13356.37		
Other	101	11737.28		
Schizophrenia subtype			13.908	0.001
Paranoid type	1428	12015.55		
Undifferentiated type	1093	12387.96		
Other subtypes	2782	12992.49		
Number of hospitalizations			24.893	<0.001
First admission	2600	12308.30		
Recurrent admission (2–3 times)	1822	12485.97		
Multiple admissions (≥ 4 times)	881	13725.71		
Medical insurance type			11.258	0.01
Urban employee	1090	12552.51		
Urban and rural resident	2890	12597.09		
Self-paying	881	12206.35		
Other	442	13578.58		
Treatment outcome			129.559	<0.001
Cured	2362	13581.44		

Variable	Number of cases (n)	Average hospitalization expenses per admission (CNY)	Statistic (Z/ χ^2)	P
Improved	2916	11833.86		
Other	25	10258.26		

Table 2
Hospitalization expenses and their composition for patients with schizophrenia (Amount in CNY, Proportion in %)

Expense category	2020		2021		2022		2023		2024		20
	Amount	Proportion	Amount	Proportion	Amount	Proportion	Amount	Proportion	Amount	Proportion	An
Chemical drug expenses	1478.50	12.42	1523.53	11.16	1524.50	10.69	1434.48	12.26	1367.99	11.64	14
Chinese patent medicine expenses	96.05	0.81	243.18	1.78	378.77	2.66	337.12	2.88	260.62	2.22	28
Bed fees	996.12	8.37	962.50	7.05	1137.67	7.98	939.58	8.03	890.66	7.58	89
Medical service expenses	3035.8	25.51	3412.27	24.99	3601.06	25.26	3393.46	29.00	3903.84	33.23	39
Nursing fees	930.06	7.82	879.56	6.44	1068.81	7.50	816.49	6.98	493.86	4.20	77
Laboratory and imaging examination fees	1105.17	9.29	1239.14	9.08	1643.88	11.53	1683.62	14.39	1778.61	15.14	17
Rehabilitation expenses	4114.03	34.57	5204.04	38.12	4785.25	33.56	3025.15	25.85	2909.46	24.77	29
Medical consumable fees	145.3	1.22	188.86	1.38	117.83	0.83	70.94	0.61	142.98	1.22	18
Total expenses	11901.03	100.00	13653.08	100.00	14257.77	100.00	11700.84	100.00	11748.02	100.00	12

Table 3
Value of structural variation (VSV), degree of structural variation (DSV), and contribution rate of structural variation (CSV) of hospitalization expenses for patients with schizophrenia

Expense category	2020–2021		2021–2022		2022–2023		2023–2024		2024–2025		2020–2025	
	VSV	CSV	VSV	CSV	VSV	CSV	VSV	CSV	VSV	CSV	VSV	CSV
Chemical drug expenses	-1.26	13.45	-0.47	4.21	1.57	9.30	-0.62	5.54	0.03	0.56	-0.75	2.80
Chinese patent medicine expenses	0.97	10.36	0.88	7.88	0.22	1.30	-0.66	5.90	0.15	2.81	1.56	5.82
Bed fees	-1.32	14.09	0.93	8.33	0.05	0.30	-0.45	4.03	-0.18	3.38	-0.97	3.62
Medical service expenses	-0.52	5.55	0.27	2.42	3.74	22.14	4.23	37.84	-0.97	18.20	6.75	25.17
Nursing fees	-1.38	14.74	1.06	9.49	-0.52	3.08	-2.78	24.87	2.17	40.71	-1.45	5.41
Laboratory and imaging examination fees	-0.21	2.24	2.45	21.93	2.86	16.93	0.75	6.71	-1.07	20.08	4.78	17.82
Rehabilitation expenses	3.55	37.89	-4.56	40.82	-7.71	45.65	-1.08	9.66	-0.45	8.44	-10.25	38.22
Medical consumable fees	0.16	1.71	-0.55	4.92	-0.22	1.30	0.61	5.46	0.31	5.82	0.31	1.16
DSV	9.37		11.17		16.89		11.18		5.33		26.82	

Table 4 Importance of independent variables

Abbreviations

WHO World Health Organization

NCDP National Centralized Procurement

BP Back Propagation

ICD-10 International Classification of Diseases, 10th Revision

VSV Value of Structure Variation

DSV Degree of Structure Variation

CSV Contribution of Structure Variation

DRG Diagnosis-Related Group

RWE Real-World Evidence

Declarations

Ethics approval and consent to participate

The protocol of this retrospective study was reviewed and approved by the Institutional Ethics Committee of Ning'an Hospital, Ningxia Hui Autonomous Region (Ethics Approval No. 2025–WS-055). All personally identifiable information of patients was completely removed before data extraction, and all analytical datasets were fully anonymized without any risk of personal privacy leakage. For this retrospective secondary data analysis without direct intervention on human subjects, the Institutional Ethics Committee of Ning'an Hospital, Ningxia Hui Autonomous Region formally issued a waiver of informed consent. All research procedures were performed in strict accordance with the ethical principles laid out in the Declaration of Helsinki.

Consent for publication

Not applicable. All data analyzed in this manuscript are fully de-identified aggregated statistical data; no individual patient's raw clinical information or identifiable images are presented, so additional written consent for publication from participants is not required.

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Author Contribution

Xinguo Li: Conceptualization, study design, clinical data collection, manuscript revisionWeiguo Xu: Conceptualization, statistical analysis, manuscript drafting, critical revision, corresponding authorXing Li: Data sorting, literature retrieval, partial statistical analysisMa Jun: Clinical case screening, data verificationXuebin Xi: Literature collection, supplementary data collationYuanyuan Ma: Raw data entry, preliminary data sortingXiaxia Li: Literature review, figure and table productionHaiyuan Yu: Data quality control, discussion section polishingXuebing Xu: Overall study supervision, final manuscript approval

Data Availability

All raw clinical data involved in this retrospective study are derived from the electronic medical record system of Ning'an Hospital of Ningxia Hui Autonomous Region. Restrictions apply to the availability of these patient datasets due to patient privacy protection and hospital data management regulations, so the raw data cannot be publicly shared. Researchers who meet the ethical review requirements can apply to the corresponding author for reasonable access to de-identified data after formal approval by the hospital ethics committee.

References

1. Marder SR, Cannon TD. Schizophrenia. *N Engl J Med*. 2019;381(18):1753–1761. doi:10.1056/NEJMra1808803
2. Charlson FJ, Ferrari AJ, Santomauro DF, et al. Global Epidemiology and Burden of Schizophrenia: Findings From the Global Burden of Disease Study 2016. *Schizophr Bull*. 2018;44(6):1195–1203. doi:10.1093/schbul/sby058
3. Jin H, Mosweu I. The Societal Cost of Schizophrenia: A Systematic Review. *Pharmacoeconomics*. 2017;35(1):25–42. doi:10.1007/s40273-016-0444-6
4. Liu G, Fang Q, Ji X, et al. Medical expenditure and its influencing factors of patients with hypertension in Shanxi Province, China: a study based on 'System of Health Accounts 2011' and multiple-layer perceptron neural network. *BMJ Open*. 2022;12(3):e048396. Published 2022 Mar 3. doi:10.1136/bmjopen-2020-048396
5. Guo M, Li Z, Song T, et al. Analysis of hospitalization expenditures and influencing factors for inpatients with chronic bronchitis based on SHA2011 in a central Province of China. *Sci Rep*. 2024;14(1):23495. Published 2024 Oct 8. doi:10.1038/s41598-024-74521-2
6. Li Y, Yang K, Song W, et al. Analysis of changes and influencing factors of hospitalization expenses in patients with hypertension. *Health Econ Res*. 2024;41(3):65–68, 73. doi:10.14055/j.cnki.33-1056/f.2024.03.022

7. Tarride JE, Husain M, Andersen A, et al. Hospitalization costs with degludec versus glargine U100 for patients with type 2 diabetes at high cardiovascular risk: Canadian costs applied to SAEs from a randomized outcomes trial. *J Med Econ.* 2021;24(1):1318–1326. doi:10.1080/13696998.2021.2003804

8. Dai P, Chang W, Xin Z, Cheng H, Ouyang W, Luo A. Retrospective Study on the Influencing Factors and Prediction of Hospitalization Expenses for Chronic Renal Failure in China Based on Random Forest and LASSO Regression. *Front Public Health.* 2021;9:678276. Published 2021 Jun 15. doi:10.3389/fpubh.2021.678276

9. Zang X, Zhang M, Wei S, Tang W, Jiang S. Impact of public hospital pricing reform on medical expenditure structure in Jiangsu, China: a synthetic control analysis. *BMC Health Serv Res.* 2019;19(1):512. Published 2019 Jul 23. doi:10.1186/s12913-019-4357-x

10. Wang Y, Wu X, Jin M, et al. Analysis of influencing factors of hospitalization expenses in patients undergoing lung cancer surgery at a tertiary A-level hospital. *Chinese Hospitals.* 2026;30(4):82–86. doi:10.19660/j.issn.1671-0592.2026.4.20

11. Yang X, Shi Y, Lu X. Study on hospitalization expenses and their influencing factors in patients with ischemic stroke in Changzhi City, Shanxi Province from 2018 to 2023. *Modern Preventive Medicine.* 2026;53(2):293–298, 374. doi:10.20043/j.cnki.MPM.202509099

Tables

Table 1 Results of univariate analysis of baseline characteristics and average hospitalization expenses per admission in patients with schizophrenia

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Schizophrenia subtype			13.908	0.001
Paranoid type	1428	12015.55		
Undifferentiated type	1093	12387.96		
Other subtypes	2782	12992.49		
Number of hospitalizations			24.893	≤0.001
First admission	2600	12308.30		
Recurrent admission (2–3 times)	1822	12485.97		
Multiple admissions (≥4 times)	881	13725.71		
Medical insurance type			11.258	0.01
Urban employee	1090	12552.51		
Urban and rural resident	2890	12597.09		
Self-paying	881	12206.35		
Other	442	13578.58		
Treatment outcome			129.559	≤0.001
Cured	2362	13581.44		
Improved	2916	11833.86		
Other	25	10258.26		

Table 2 Hospitalization expenses and their composition for patients with schizophrenia (Amount in CNY, Proportion in %)

Expense category	2020		2021		2022		2023		2024		2025
	Amount	Proportion	Amount	Proportion	Amount	Proportion	Amount	Proportion	Amount	Proportion	Amount
Chemical drug expenses	1478.50	12.42	1523.53	11.16	1524.50	10.69	1434.48	12.26	1367.99	11.64	1478.50
Chinese patent medicine expenses	96.05	0.81	243.18	1.78	378.77	2.66	337.12	2.88	260.62	2.22	280.62
Bed fees	996.12	8.37	962.50	7.05	1137.67	7.98	939.58	8.03	890.66	7.58	890.66
Medical service expenses	3035.8	25.51	3412.27	24.99	3601.06	25.26	3393.46	29.00	3903.84	33.23	3903.84
Nursing fees	930.06	7.82	879.56	6.44	1068.81	7.50	816.49	6.98	493.86	4.20	779.56
Laboratory and imaging examination fees	1105.17	9.29	1239.14	9.08	1643.88	11.53	1683.62	14.39	1778.61	15.14	1778.61
Rehabilitation expenses	4114.03	34.57	5204.04	38.12	4785.25	33.56	3025.15	25.85	2909.46	24.77	2909.46
Medical consumable fees	145.3	1.22	188.86	1.38	117.83	0.83	70.94	0.61	142.98	1.22	188.86
Total expenses	11901.03	100.00	13653.08	100.00	14257.77	100.00	11700.84	100.00	11748.02	100.00	12748.02

Table 3 Value of structural variation (VSV), degree of structural variation (DSV), and contribution rate of structural variation (CSV) of hospitalization expenses for patients with schizophrenia

Expense category	2020-2021		2021-2022		2022-2023		2023-2024		2024-2025		2020-2025	
	VSV	CSV	VSV	CSV	VSV	CSV	VSV	CSV	VSV	CSV	VSV	CSV
Chemical drug expenses	-1.26	13.45	-0.47	4.21	1.57	9.30	-0.62	5.54	0.03	0.56	-0.75	2.80
Chinese patent medicine expenses	0.97	10.36	0.88	7.88	0.22	1.30	-0.66	5.90	0.15	2.81	1.56	5.82
Bed fees	-1.32	14.09	0.93	8.33	0.05	0.30	-0.45	4.03	-0.18	3.38	-0.97	3.62
Medical service expenses	-0.52	5.55	0.27	2.42	3.74	22.14	4.23	37.84	-0.97	18.20	6.75	25.17
Nursing fees	-1.38	14.74	1.06	9.49	-0.52	3.08	-2.78	24.87	2.17	40.71	-1.45	5.41
Laboratory and imaging examination fees	-0.21	2.24	2.45	21.93	2.86	16.93	0.75	6.71	-1.07	20.08	4.78	17.82
Rehabilitation expenses	3.55	37.89	-4.56	40.82	-7.71	45.65	-1.08	9.66	-0.45	8.44	-10.25	38.22
Medical consumable fees	0.16	1.71	-0.55	4.92	-0.22	1.30	0.61	5.46	0.31	5.82	0.31	1.16
DSV	9.37		11.17		16.89		11.18		5.33		26.82	

Table 4 Importance of independent variables

Independent variable	Importance	Normalized importance (%)
Length of hospital stay	0.654	100.0%
Admission year	0.095	14.5%
Treatment outcome	0.060	9.2%
Marital status	0.052	8.0%
Number of hospitalizations	0.034	5.3%
Age	0.034	5.2%
Medical insurance type	0.031	4.8%
Schizophrenia subtype	0.023	3.5%
Gender	0.015	2.4%