European Archives of Psychiatry and Clinical Neuroscience (2024) 274:1417–1426
https://doi.org/10.1007/s00406-023-01697-5

ORIGINAL PAPER

Gender differences and clinical correlates in the age of the first hospitalization in patients with drug-naïve schizophrenia in China: a cross-sectional study

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Received: 22 May 2023 / Accepted: 20 September 2023 / Published online: 13 October 2023

Abstract

Gender differences in the onset age of schizophrenia have been reported in many studies, but differences in the age of the first hospitalization and associated factors have not been explored. The present study investigated gender differences and clinical correlates in the age of the first hospitalization in drug-naïve schizophrenia (DNS). A total of 144 DNS patients and 67 health controls were included. Demographic information, duration of untreated psychosis (DUP), Positive and Negative Symptom Scale (PANSS) scores, the Brief Psychiatric Rating Scale (BPRS) scores, Global Assessment of Functioning (GAF) scores, and MATRICS Consensus Cognitive Battery (MCCB) scores were collected and analyzed. The age of the first hospitalization was significantly earlier in males than in females ($P<0.01$). In addition, there were significant differences in the age of the first hospitalization in terms of marital status, occupation, family ranking, suicide attempt, and place of residence (all $P<0.05$). After Bonferroni correction, only DUP had a positive correlation with the age of the first hospitalization ($P_{Bonferroni}<0.05/6=0.0083$). Multivariate linear regression analysis showed that gender ($\beta=0.141$, $t=2.434$, $P=0.016$), marital status ($\beta=0.219$, $t=3.463$, $P=0.001$), family ranking ($\beta=0.300$, $t=4.918$, $P<0.001$), suicide attempt ($\beta=0.348$, $t=5.549$, $P<0.001$), and DUP ($\beta=0.190$, $t=2.969$, $P<0.004$) positively predicted the age of the first hospitalization. The age of the first hospitalization in male DNS was earlier than in females. In addition, gender, marital status, suicide attempt, DUP, and family rank were independent risk factors for the age of the first hospitalization.

Keywords Gender differences · Schizophrenia · Hospitalization · Drug-naïve

Introduction

Schizophrenia is a severe chronic mental illness that can lead to cognitive deficits, impaired social functioning, and reduced life expectancy, and is a major contributor to the disease burden [1, 2]. Reducing the number of hospitalizations associated with schizophrenia is an important goal [3]. Multiple hospitalizations can increase medical costs and reduce the quality of life [4]. Current research on the mechanisms of hospitalization for schizophrenia is inadequate [5], resulting in more emergency department visits and repeated hospitalizations, [6] which highlights the need to explore the reasons that influence hospitalizations for schizophrenia to inform reductions in hospitalizations.

Gender differences may yield clues about the etiology and pathogenesis of schizophrenia [7]. Past studies have investigated almost all gender differences in schizophrenia regarding prevalence, incidence, age of onset, severity, illness duration, and treatment response [8]. For example,

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women with schizophrenia have better premorbid functioning, later age of onset, shorter duration of untreated psychosis, and lower scores on the PANSS negative, general, and total scores [8, 9], as well as better performance in verbal learning and memory [9]. However, gender differences in hospitalization characteristics are still poorly reported.

Previous studies have reported some gender differences in the inpatient treatment of patients with schizophrenia [10]. For example, women have fewer rehospitalizations and shorter hospital stays than men [11], which significantly impacts antipsychotic treatment, social functioning, and prognosis of schizophrenia in women [12]. Possible reasons include male patients having an earlier age of onset, more severe clinical symptoms, and a less adequate response to antipsychotic medications [9]. However, other studies have reported opposite or no gender differences in hospital admissions for schizophrenia [13, 14]. For example, one study found no gender differences in the risk of rehospitalization [14]. These conflicting results support the need for further investigation of gender differences in schizophrenia hospitalizations.

In addition, studies have found gender differences in the long-term outcomes of hospitalization for schizophrenia [15, 16]. Evidence from hospitalization data suggests that women have better long-term outcomes of hospitalization, while men have poorer outcomes of hospitalization and higher rates of mortality, suicide, and homelessness [15]. Previous studies have also focused on differences between countries in the age of the first hospitalization. For example, Hambrecht and the World Health Organization report that patients with schizophrenia from developing countries tend to be hospitalized at a younger age than those from developed countries [17, 18]. However, these studies did not focus on gender differences in the age of the first hospitalization. In particular, previous studies have not explored the factors influencing the first hospitalization in drug-naïve schizophrenia.

Few studies have been conducted on gender differences in schizophrenia in China [15], and gender differences in the first hospitalization and the associated factors have not been explored. Hence, this study aimed to investigate (1) factors influencing the first hospitalization of schizophrenia; and (2) gender differences in the age of the first hospitalization and clinical characteristics in patients with drug-naïve schizophrenia (DNS) in China. We hypothesize that the factors influencing hospitalization for schizophrenia are clinical severity, suicide, social function, and cognitive function. In addition, we propose a hypothesis that there is a gender difference in the age of the first hospitalization for schizophrenia.

Method

Research subjects

All patients signed a written informed consent prior to this study. The protocol was approved by the Medical Ethics Committee of Tianjin Anding Hospital (approval number: 2017-03).

One hundred and forty-four DNS patients with schizophrenia were enrolled. They were admitted to Tianjin Anding Hospital from November 2017 to October 2019. The inclusion criteria were as follows: (1) diagnosed with schizophrenia according to the Diagnostic and Statistical Manual of Mental Disorders (DSM) -5 criteria; (2) never taking anti-psychotic drugs; (3) aged 18–65 years; (4) agreed to participate and signed the informed consent.

Patients who met the following conditions were excluded: (1) Patients with severe medical conditions, including uncontrolled hypertension, severe cardiovascular disease, cerebrovascular disease, pulmonary disease, thyroid disease, diabetes, epilepsy, and metabolic syndrome; (2) Diagnosed with substance abuse, delusional disorder, transient psychosis, mood disorder; (3) Received non-pharmacological interventions such as electroconvulsive therapy and transcranial magnetic stimulation that affect mental symptoms; (4) Pregnant and lactating women; (5) have any psychiatric symptoms that prevent them from providing informed consent or participating in the study.

Sixty-seven age- and gender-matched healthy controls were recruited from the community of Tianjin. Healthy controls met the following criteria: (1) Neither current nor past met the DSM-5 criteria for psychiatric diagnosis; (2) had no history of suicide; (3) had no family history of mental illness; (4) agreed to participate and signed the informed consent.

Data collection

Data were collected using questionnaires that included general information, sociodemographic characteristics, history of smoking and alcohol consumption before admission, and medical status. Additional information was collected from medical records, including medical history, physical examination, and laboratory tests. All information was collected from patients and primary caregivers during the first week of hospitalization.

Clinical measurement

The study was conducted in accordance with the Declaration of Helsinki. Assessments included the Positive and Negative

Symptoms Scale (PANSS) to assess the patient's psychopathology [19, 20]. In addition, the Brief Psychiatric Rating Scale (BPRS) was used to evaluate the severity of symptoms of schizophrenia. The PANSS and BPRS are the most routinely used scales to assess the symptoms of schizophrenia [21].

The Global Assessment of Functioning (GAF) scale was used to evaluate the patient's overall psychological, social, and occupational functioning, including the Global Assessment Functioning Current (GAFC) Score and GAF score over the past year (GAFP) [22, 23].

To evaluate the patient's cognitive function, the Measurement and Treatment Research to Improve Cognition in Schizophrenia (MATRICS) Consensus Cognitive Battery (MCCB) was employed [24]. It is divided into nine neuropsychological tests: (1) Trail Making Test-A (TMT); (2) Brief Assessment for Cognition in Schizophrenia: Symbol Coding (BACS-SC); (3) Hopkins Verbal Learning Test-Revised (HVLT-R); (4) Wechsler Memory Scale-Third Edition: Spatial Span (WMS-III-SS); (5) Neuropsychological Assessment Battery: Mazes (NAB-M); (6) Brief Visual-Spatial Memory Test-Revised (BVMT-R); (7) Category Fluency: Animals (CF); (8) Mayer–Salovey–Caruso Emotional Intelligence Test: Managing Emotions (MSCEIT-ME); (9) Continuous Performance Test: Identical Pairs (CPT-IP). MCCB can systematically measure seven cognitive domains: processing speed (including TMT, BACS-SC, CF), attention/vigilance (CPT-IP), reasoning and problem-solving (NAB-M), visual learning (BVMT-R), working memory (WMS-III-SS), social cognition (MSCEIT-ME), verbal learning (HVLT-R). We used the Chinese version of the MCCB, which had good reliability and validity [25].

Two senior trained psychiatrists assessed PANSS, BPRS, GAF, and MCCB through face-to-face interviews. The two psychiatrists were blinded to clinical status and treatment conditions, and the intra-class correlation coefficient was more than 0.83 when the scales were repeatedly assessed throughout the study.

Suicide attempt

In this study, attempts at suicide were defined as any potentially harmful actions that participants took with some degree of death purpose but without succeeding in killing themselves [26]. Every participant was asked the same question during interviews to gather data on suicide attempts: "Have you attempted suicide in your lifetime?" Those who replied "yes" were classified as suicide attempters. Further details were then asked, including the number of suicide attempts, the date of each attempt, and the specific method. In addition, we further asked if there had been any attempted suicides in the last two weeks, one month, and the last year.

Statistical analysis

SPSS 17.0 was used to perform the statistical analysis. Descriptive data were presented as percentages, and continuous data were presented as mean ± standard deviation. We used the Shapiro–Wilk test for the normality of continuous variables and log-transformed continuous variables that were not normally distributed. All demographic data were normally distributed. Therefore, we analyzed gender differences using the independent sample t-test for continuous variables. Categorical variables were analyzed by the chi-square test. To adjust for multiple testing, the Bonferroni correction was used. Pairwise comparisons between groups were performed using the Tukey-type test of proportions if the overall chi-square value was statistically significant. Pearson's linear correlation was used to examine factors affecting the age of the first hospitalization. Further, we used multivariate linear regression to explore the strength of the correlations and prediction equations. All P values are two-tailed with a significance level of 0.05.

Results

Characteristics of DNS

Demographic and clinical characteristics of DNS patients and HC are summarized in Table 1. Among the 144 DNS patients, 53 (36.8%) were male, and 91 (63.2%) were female, with a mean age of 38.29 ± 10.86 years and 11.65 ± 3.94 years of education. In addition, 25.7% of DNS patients had attempted suicide. DNS patients had lower BMI, years of education, neurocognitive, social cognitive, and total MCCB scores than HC (all $P < 0.001$). After Bonferroni correction, these differences remain significant (all $P_{Bonferroni} < 0.05/9 = 0.0056$).

Factors associated with the age of the first hospitalization in DNS patients

As shown in Table 2, the age of the first hospitalization was significantly different in terms of gender, marital status, occupation, family ranking, and place of residence (all $P < 0.01$). Males, unmarried individuals, students, first-borns, suicide attempters, and urban DNS patients were hospitalized earlier than their counterparts. After Bonferroni correction, these differences remain significant (all $P_{Bonferroni} < 0.05/6 = 0.0083$). However, no significant differences were observed for the age of the first hospitalization concerning smoking, alcohol drinking, health insurance, and family history (all $P > 0.05$).

The age of the first hospitalization was not correlated with years of education, BMI, the total score of PANSS, the total

Table 1 Demographic and clinical characteristics between DNS and HC

	DNS ($N=144$)	HC (N=67)	x^2/F	P
Demographic characteristics				
Sex (male)	53 (36.8)	30 (44.8%)	1.217	0.270
BMI (kg/m^2)	22.22 ± 3.41	24.61 ± 5.19	3.963	**0.001**
Education (years)	11.65 ± 3.94	13.58 ± 3.98	3.301	**0.001**
Age of first hospitalisation (years)	38.09 ± 10.86	NA		
DUP (years)	4.65 ± 5.96	NA		
Age of first onset (years)	33.69 ± 10.42	NA		
Suicide attempter (%)	37 (25.7)	NA		
Smoker (%)	27 (18.8)	12 (17.9)	0.021	0.884
Alcohol drinker (%)	22 (15.3)	6 (9.0)	1.588	0.208
Clinical characteristics				
PANSS		NA		
Total score of PANSS	86.52 ± 12.68			
Positive symptoms	25.44 ± 4.94			
Negative symptoms	19.29 ± 6.11			
General psychopathology	41.63 ± 6.85			
Total score of BPRS	45.78 ± 8.61	NA		
GAF		NA		
GAFC	33.91 ± 13.78			
GAFP	54.81 ± 18.31			
MCCB				
Neurocognition	28.97 ± 11.52	47.64 ± 10.64	11.059	**< 0.001**
Social cognition	30.23 ± 7.92	35.83 ± 7.48	4.828	**< 0.001**
Total score	26.12 ± 11.24	44.55 ± 10.34	11.193	**< 0.001**

The significance highlighted in bold is $P < 0.05$

DNS drug-naïve schizophrenia, *HC* health control, *BMI* body mass index, *DUP* duration of untreated psychosis, *PANSS* the positive and negative syndrome scale, *BPRS* Brief Psychiatric Rating Scale, *GAF* Global Assessment of Functioning, *GAFC* GAF score of current, *GAFP* GAF score of past year, *MCCB* MATRICS Consensus Cognitive Battery, *NA* not applicable

score of BPRS, or the total score of MCCB (all P > 0.05). In addition, there was a correlation between patients' age of the first hospitalization and GAFC (R = − 0.169, P < 0.043), GAFP (R = − 0.166, P < 0.047), and DUP (R = 0.387, P < 0.001). However, after Bonferroni correction, only DUP positively correlated with the age of the first hospitalization ($P_{Bonferroni} < 0.05/6 = 0.0083$).

The risk factors of the age of the first hospitalization in DNS patients

Furthermore, we used multivariate linear regression to analyze the risk factors for the age of the first hospitalization for patients with DNS, in which the age of the first hospitalization was used as the dependent variable, and variables that were significant in the univariate analysis were used as independent variables. The results of the multivariate linear regression model are shown in Table 3. Gender (β = 0.141, t = 2.434, P = 0.016), marital status (β = 0.219, t = 3.463, P = 0.001), family ranking (β = 0.300, t = 4.918, P < 0.001), suicide attempt (β = 0.348, t = 5.549, P < 0.001), and DUP (β = 0.190, t = 2.969, P < 0.004) significantly and positively predicted the age of the first hospitalization (Fig. 1). The regression equation was significant (F = 21.951, P < 0.001). These factors contributed to 56.9% of the difference in the age of the first hospitalization in DNS patients.

Gender differences in DNS patients

In addition, we analyzed the gender differences in the demographic and clinical characteristics of patients with DNS. As shown in Table 4, there were significant differences between male and female patients in terms of age (F = 3.326, P = 0.001), age of the first hospitalization (F = 3.164, P = 0.002), marital status ($\chi^2 = 19.314$, P < 0.001), occupation ($\chi^2 = 6.938$, P = 0.031), smoking rate ($\chi^2 = 23.984$, P < 0.000), alcohol drinking rate ($\chi^2 = 18.283$, P < 0.001), and social cognition (F = 2.117, P = 0.036). However, after Bonferroni correction, only the gender differences in age, age of the first hospitalization, marital status, smoking rates, and alcohol drinking rates remained significant

Table 2 Factors related to the age of first hospitalisation in the DNS

Variables	Age of first hospitalisation	*F*	*P*
Sex		3.164	**0.002**
Male	34.45 ± 10.64		
Female	40.21 ± 10.46		
Marital status		30.153	**< 0.001**
Unmarried	30.78 ± 8.43		
Married	42.61 ± 9.99		
Divorced or widowed	43.71 ± 8.12		
Occupation		10.925	**< 0.001**
Students	22.77 ± 8.87		
Employed	38.78 ± 9.67		
Unemployed	39.33 ± 10.61		
Family ranking		22.077	**< 0.001**
1	33.39 ± 9.14		
2	39.78 ± 10.85		
≥ 3	46.32 ± 8.82		
Suicide attempter		9.582	**< 0.001**
Yes	27.59 ± 7.01		
No	41.71 ± 9.51		
Place of residence		2.938	**0.004**
Urban	35.35 ± 9.89		
Rural	40.53 ± 11.15		

Variables	Age of first hospitalisation	
	R	*P*
DUP (years)	0.387	**< 0.001**
GAFC	− 0.169	**0.043**
GAFP	− 0.166	**0.047**
Total score of PANSS	− 0.006	0.944
Total score of BPRS	− 0.122	0.146
Total score of MCCB	− 0.014	0.875

The significance highlighted in bold is $P < 0.05$

DNS drug-naïve schizophrenia, *DUP* duration of untreated psychosis, *PANSS* the positive and negative syndrome scale, *BPRS* Brief Psychiatric Rating Scale, *GAF* Global Assessment of Functioning, *GAFC* GAF score of current, *GAFP* GAF score of past year, *MCCB* MATRICS Consensus Cognitive Battery

($P_{Bonferroni} < 0.05/10 = 0.005$). However, there were no gender differences in other demographic and clinical characteristics.

Discussion

To our knowledge, this is the first study to explore the influencing factors of the age of the first hospitalization in DNS patients. The following are the main findings of the current research: (1) the age of the first hospitalization was significantly earlier in males than in females with DNS; (2) the risk factors influencing the age of the first hospitalization were gender, marital status, suicide, DUP, and family ranking. (3) Male DNS patients had lower marriage rates and higher rates of smoking and alcohol drinking than females.

The main finding of the current study was that male patients with DNS were admitted to the hospital earlier than females. To our knowledge, this is the first study to report an earlier age of the first hospitalization for male patients with schizophrenia than for females. This finding supports the results of a previous study that the peak age of first hospital admission among schizophrenia patients was ten years earlier in males than in females [27]. This disparity may arise from gender differences in marriage rates. Several studies have shown significant gender differences in the marital status of patients with schizophrenia [28, 29]. Women with schizophrenia have a higher marriage rate and a better

Table 3 Regression analysis of factors influencing age of first hospitalisation

Model	Unstandardized coefficient		Standardized coefficient	*t*	*P*	95% confidence interval for B		VIF
	B	Standard Error	Beta			Lower	Upper	
Age of first hospitalisation								
Constant	5.791	4.430		1.307	0.193	−2.971	14.553	
Sex	3.169	1.302	0.141	2.434	**0.016**	0.594	5.744	1.117
Marital status	3.421	0.988	0.219	3.463	**0.001**	1.468	5.375	1.325
Family ranking	3.963	0.806	0.300	4.918	**< 0.001**	2.369	5.557	1.232
Suicide attempter	8.627	1.555	0.348	5.549	**< 0.001**	5.552	11.702	1.308
DUP (years)	0.347	0.117	0.190	2.969	**0.004**	0.116	0.578	1.361

The significance highlighted in bold is $P < 0.05$

DUP duration of untreated psychosis

$R^2 = 0.596$, $\Delta R^2 = 0.569$, $F = 21.951$, $P < 0.001$

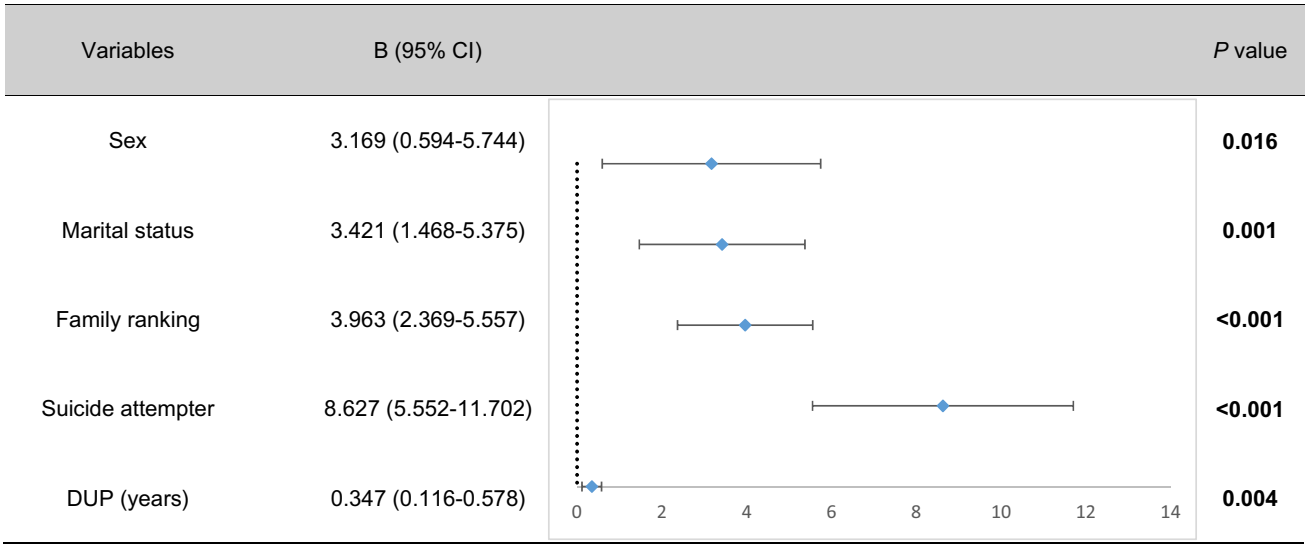

Fig. 1 The risk factors of the age of first hospitalization in drug-naïve schizophrenia patients. DUP, duration of untreated psychosis

prognosis [30], suggesting that marriage may have a protective effect on schizophrenia. Similarly, our findings also found that women with schizophrenia had a higher marriage rate than men with schizophrenia. However, another study did not support the hypothesis that marriage has a protective effect on psychosis [27]. In fact, married individuals may be more opposed to the decision to be hospitalized [30], leading to a delay in the age of the first hospitalization.

Furthermore, we found that female patients had significantly higher unemployment rates than males. While patient employment is associated with symptom relief [31], the higher unemployment rate among female patients may indicate social bias and result in poorer long-term outcomes. In addition, consistent with previous findings [32, 33], we found that alcohol drinking and smoking rates were higher in male patients. It is well established that substance abuse has a profound negative impact on psychiatric disorders and affects relapse and readmission rates [34]. Therefore, smoking and alcohol cessation for male individuals with schizophrenia is of great importance.

It is unclear why the age of first hospitalization for male patients with schizophrenia is earlier than that of females. Several possible reasons exist: first, gender differences in the demographic characteristics of patients with schizophrenia. For example, both our study and previous research have shown that men have higher rates of smoking and alcohol drinking, as well as higher rates of being unmarried than women [33]. These factors may affect the social support, self-medication awareness, and daily living ability of male individuals, leading to an earlier age of hospitalization [35]. Second, there are gender differences in brain neurotransmitter and receptor function in schizophrenia [36]. Numerous

Table 4 Sex differences in the demographic and clinical characteristics of patients with DNS

Demographic characteristics	Sex		x^2/F	*P*
	Male	Female		
Years of education	11.49 ± 3.56	11.74 ± 4.16	0.376	0.708
DUP (years)	4.95 ± 6.73	4.46 ± 5.48	0.472	0.638
Age of first hospitalization	34.45 ± 10.64	40.21 ± 10.46	3.164	**0.002**
BMI (kg/m^2)	22.39 ± 3.56	22.12 ± 3.32	0.461	0.646
Marital status (N, %)				
Unmarried	33 (62.3)	24 (26.4)	19.314	**< 0.001**
Married	13 (24.5)	53 (58.2)		
Divorced or widowed	7 (13.2)	14 (15.4)		
Occupation (N, %)				
Students	7 (13.2)	2 (2.2)	6.938	**0.031**
Employed	19 (35.8)	36 (39.6)		
Unemployed	27 (50.9)	53 (58.2)		
Smoker (yes, %)	21 (39.6)	6 (6.6)	23.984	**< 0.001**
Alcohol drinker (yes, %)	17 (32.3)	5 (5.5)	18.283	**< 0.001**
Suicide attempter (yes, %)	18 (34.0)	19 (20.9)	3.003	0.083
Clinical characteristics	Male	Female	*F*	*P*
PANSS				
Total score of PANSS	85.51 ± 9.63	87.11 ± 14.17	0.804	0.423
Score of positive symptoms	25.15 ± 5.19	25.61 ± 4.81	0.543	0.588
Score of negative symptoms	19.18 ± 5.89	19.35 ± 6.26	0.154	0.878
Score of General psychopathology	41.31 ± 5.05	41.82 ± 7.71	0.490	0.625
GAF				
GAF Score of current (GAFC)	34.66 ± 15.16	33.46 ± 12.97	0.502	0.616
GAF Score of past year (GAFP)	54.47 ± 19.06	54.98 ± 17.95	0.163	0.871
Total score of BPRS	45.91 ± 7.14	45.71 ± 9.39	0.128	0.898
MCCB				
Total score of MCCB	27.27 ± 10.74	25.45 ± 11.54	0.809	0.375
Neurocognition	29.83 ± 10.85	28.48 ± 11.93	0.645	0.520
Social cognition	32.10 ± 6.86	29.16 ± 8.32	2.117	**0.036**

The significance highlighted in bold is $P < 0.05$

DNS drug-naïve schizophrenia, *DUP* duration of untreated psychosis, *BMI* body mass index, *PANSS* the positive and negative syndrome scale, *BPRS* Brief Psychiatric Rating Scale, *GAF* Global Assessment of Functioning, *GAFC* GAF score of current, *GAFP* GAF score of past year, *MCCB* MATRICS Consensus Cognitive Battery

studies have indicated gender-based differences in clinical symptoms, course, and treatment outcomes in schizophrenia due to variations in brain neurotransmitters [37]. Finally, other possible explanations include gender differences in genetics, gender hormones, comorbidities, and social stress [38, 39]. For example, estrogen may exert a protective effect by inhibiting dopamine transmission, and cyclic estrogens may sensitize dopamine nerve cells, which could be linked to a later onset of schizophrenia in women [38]. Furthermore, prior studies have postulated that gender differences in schizophrenia are likely due to the multifaceted effects of estrogen and its intricate interactions with neurotransmitter receptors and brain development in utero [40, 41]. A comprehensive examination of gender differences in the age of the first hospitalization can contribute to comprehending the pathogenesis of schizophrenia and bridging the gap between social psychiatry and biological psychiatry [42]. Therefore, elucidating the exact mechanisms behind gender differences in the age of the first hospitalization and rehospitalizations requires further investigation.

There is a high prevalence of suicide in schizophrenia [43–45]. A meta-analysis and systematic review found that the lifetime prevalence of suicidal ideation and suicide planning was 34.5% and 44.3%, respectively [43]. In rural areas of China, the lifetime prevalence of suicide among individuals with chronic schizophrenia is 22.2%. In addition,

17.87% of elderly schizophrenic patients in China reported one month of suicidal ideation, and 7.60% attempted suicide during their lifetime [45]. Our study discovered that 25.7% of people with DNS had attempted suicide, consistent with previous research findings [43–45]. It is well known that active hallucinations and delusions are risk factors for suicide [46]. However, the relationship between suicide and schizophrenia admissions remains ambiguous. Our study found that suicide attempts were a risk factor for hospitalization of DNS patients. Suicide is an urgent issue, often associated with violence, elopement, and necessitating involuntary hospitalization [47]. Earlier studies have found that numerous suicides occur during hospital admission or shortly after discharge [48]. Hence, managing suicide risk for individuals with schizophrenia is imperative both during hospitalization and post discharge.

Most researchers and clinicians believe that early detection and intervention of psychosis can yield better long-term outcomes [49]. Our study found that DUP was positively associated with the age of the first hospitalization and that DUP was an independent risk factor for the age of the first hospitalization. A Chinese study unveiled that patient with a longer DUP before initial treatment experienced poorer long-term social functioning, despite displaying similar levels of psychotic symptoms to those with a shorter DUP [50]. This outcome underscores the clinical significance of promptly identifying and treating patients with chronic psychosis [51]. Investigating the causes and consequences of DUP is warranted, as its reduction may positively impact the prognosis and long-term trajectory of mental illnesses, including schizophrenia and major depressive disorder [52].

Family structure can significantly impact schizophrenia [53, 54]. For example, family structure can influence relapse in people with first-episode schizophrenia [54]. In addition, first-born individuals are at elevated risk of developing schizophrenia [53]. However, no previous study has explored the effect of family ranking on the age of the first hospitalization. To our knowledge, this is the first study to find that family rankings are associated with psychiatric hospitalizations. Our study found an earlier age of first hospitalization for first-born individuals, consistent with previous studies [53]. Given that China's one-child policy was implemented nearly 40 years ago [55, 56], the number of people with schizophrenia in one-child households is considerable. Sibling rivalry is thought to be strongly associated with mental illness [57], especially schizophrenia [58]. However, the impact of the one-child policy on mental health has not been studied. The effect of family ranking on schizophrenia onset and hospitalization warrants further study. For example, studies of family rankings can illustrate the impact of family support and sibling rivalry on mental illness [59]. This study uniquely ascertained that family ranking independently influenced the risk of the age of the first hospitalization. Future studies of family ranking in patients with schizophrenia and their unaffected relatives may help elucidate genetic and environmental susceptibility to schizophrenia [60, 61].

Limitations

This study has several limitations. First, the study's cross-sectional design provides a snapshot of the disease progression, and future longitudinal studies may illuminate the impact of disease evolution. Future follow-up studies are urgently needed to reveal causal relationships between variables. Second, the study population was all drug-naïve inpatients, potentially limiting the generalization of the results to all patients with schizophrenia. Third, we collected information on suicide through research-based interviews with patients and families using a self-administered questionnaire rather than a structured instrument, possibly introducing bias during the data collection stage. Forth, the one-child policy may affect family rankings. The sample was comprised of middle-aged individuals, with an average age of 38 and a standard deviation of 10 years. Nonetheless, the effect of the one-child policy on family ranking remains unknown. Consequently, future analyses with larger sample sizes are warranted. Fifth, the modest sample size of healthy controls may have diminished the statistical robustness. Future studies could expand the sample size. Sixth, we confirmed patient's lack of prior hospitalization and medication usage by reviewing medical attendance records and interviewing primary caregivers. While all patients were indeed antipsychotic-naive at the time of recruitment, some patients may have experienced symptoms and sought treatment in alternative settings that were not accounted for in our study. Seventh, several clinical outcomes may influence hospitalization, such as violence and agitation. Future studies might employ the Modified Overt Aggression Scale (MOAS) and the Overt Agitation Severity Scale (OASS) to further elucidate factors influencing hospitalization. Eighth, differences in years of education and BMI may impact cognitive function. While we utilized statistical techniques to reveal factors affecting age at first hospitalization, education- and BMI-matched healthy controls might better mitigate the influence of confounding variables. Furthermore, there exist disparities in the sample sizes of patients and controls to this study. This discrepancy in sample size may affect statistical power and potentially introduce bias in the study findings. Thus, the conclusions drawn should be approached with caution. Finally, the core symptoms of schizophrenia, such as hallucinations and delusions, may be somewhat covert, difficult to discern by patients or caregivers, particularly in the initial stages of the illness. This may lead to inaccurate estimates of DUP.

Conclusion

In summary, our findings suggest that the age of the first hospitalization in male DNS patients is earlier than in females. Additionally, gender, marital status, suicide, DUP, and family ranking were independent risk factors for the age of the first hospitalization. Clinicians should be more vigilant towards female, unmarried patients with a history of suicide attempts.

Acknowledgements We extend our gratitude to Yongping Zhao, Shu Yang, Ying Gao, Siying Kong, and Xiaoxiao Sun from the Tianjin Anding Hospital for their assistance in data collection.

Funding This study was supported by the Tianjin Key Project for Chronic Diseases Prevention (2017ZXMFSY00070) from the Tianjin Municipal Science and Technology Bureau, the Tianjin Key Medical Discipline (Specialty) Construction Project (TJYXZDXK-033A), and a hospital-level project from the Tianjin Anding Hospital (ADYKHT2021012). These funding sources had no involvement in the study design, data collection, statistical analysis, manuscript drafting, or paper submission for publication.

Data availability The data supporting the findings of this study are available on request from the corresponding author.

Declarations

Conflict of interests The authors declare they have no conflicts of interest.

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