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ORIGINAL PAPER

Compulsory admission is associated with an increased risk of readmission in patients with schizophrenia: a 7-year, population-based, retrospective cohort study

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Abstract

Purpose The aim of this study was to assess the risk of psychiatric readmission in patients with schizophrenia, compare it between patients prescribed compulsory admission and those consenting to voluntary admission, and determine risk factors for psychiatric readmission.

Methods This 7-year (2007–2013), population-based, cohort study retrospectively compared data of 2038 schizophrenic inpatients who initially underwent compulsory admission (the CA group) and of 8152 matched controls with schizophrenia who initially underwent voluntary admission (the VA group).

Results During the study period, there were 1204 and 3806 readmissions in the CA and VA groups, respectively. Compared with the VA group, the CA group was associated with a greater risk of psychiatric readmission [adjusted hazard ratio (AHR) = 1.765; 95% confidence interval (CI) 1.389–2.243; $P < 0.001$]. Stratified analyses showed that the CA group was associated with a higher risk of subsequent compulsory (AHR = 1.307; 95% CI 1.029–1.661; $P < 0.001$) and voluntary (AHR = 1.801; 95% CI 1.417–2.289; $P < 0.001$) readmissions compared to the VA group. Sensitivity analyses, after excluding data from the first year of observation, also provided significant findings with respect to compulsory and voluntary readmissions. Kaplan–Meier curves revealed that cumulative survival rates of psychiatric readmissions, compulsory and voluntary readmissions were significantly lower in the CA group than in the VA group among patients with schizophrenia (log-rank test, $P < 0.001$).

Conclusions CA was associated with higher subsequent psychiatric readmissions, compulsory, and voluntary readmissions. Clinicians would need to focus on patients undergoing CAs to reduce readmissions.

Keywords Compulsory admission · Involuntary · Risk · Readmission · Schizophrenia

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Introduction

The long-term course and outcomes of schizophrenia have been the subject of numerous studies, and psychiatric admission is a type of multiple psychiatric interventions used for crisis stabilization and safety. However, a substantial proportion of psychiatric inpatients are readmitted after discharge, and psychiatric readmission rate has been used as an index of the quality of healthcare provided [1]. In Taiwan, the overall 30-day unplanned readmission rate was 42.5% among discharged patients with schizophrenia in 2011 [2]. Psychiatric admission in patients with schizophrenia may be voluntary or compulsory, and compulsory admission (CA) is used in several countries to prevent suicide or violence and to enable clinicians to provide care and security for patients who may be in danger of harming themselves or others [3]. Although most admissions in patients with schizophrenia are voluntary (voluntary admission, VA), previous reports have estimated that 3.2–26.4% of admissions are compulsory [3–5].

In Taiwan, it has become mandatory to record CAs in the National Health Insurance Research Database (NHIRD) since 2003. According to the Taiwanese Mental Health Act 2007, only severely mentally ill patients who lack the competence to handle their own affairs and those who are a danger to themselves or others can be compulsorily admitted. CA involves two stages; first, two independent psychiatrists initiate emergency placement (for up to 5 days) and apply for CA within 2 days, and second, documents for CA are sent to the Psychiatric Disease Mandatory Assessment and Community Care Review Committee within the Ministry of Health and Welfare, which is a court-like body that examines CA application within 3 days to ensure that all criteria have been met [6]. The committee includes psychiatrists, registered psychiatric nurses, occupational therapists, psychologists, lawyers, psychiatric social workers, and representatives of patients (usually caregivers). If a patient or his/her caregiver opposes emergency placement or CA, then they can file a petition in the family courts to terminate CA.

Given the worldwide increase in CAs, several studies have investigated whether CA is a predictor of psychiatric readmission and compulsory readmission. In Israel, a population-based cohort study of patients with schizophrenia found a strong association between the first CA and both subsequent readmission and compulsory readmission [7]. However, other risk factors for psychiatric readmission were not examined by that study and the criteria used for initiating CA were not described. A more recent registry-based cohort study in Israel has reported that CA is a significant predictor of psychiatric readmission [8]. However, the cohort included patients with affective and personality disorders, apart from those with schizophrenia; additionally, the criteria for CA were not clearly stated and only a limited number of variables were examined, which may have led to confounding results. A recent retrospective cohort study in Taiwan has reported that a prior history of CA is associated with psychiatric readmission among patients diagnosed with schizophrenia or schizoaffective disorder [9], but this study was limited by its small sample size, a case–control design, and a short follow-up period (maximum 1 year).

Although multiple studies have investigated CA and its associated factors, most have been conducted in Western countries. Further, a causal relationship between CA and readmission remains unclear because current evidence is based on case–control studies with small sample sizes. Very few studies have provided data on CAs in Asian countries, and these have reported highly variable results [10, 11]. Specifically, the proportion of CA among total psychiatric admissions in Korea has ranged from 94% in 2000 to 91% in 2006 [10] and is much higher than the 4% reported in Taiwan [11], suggesting an extreme discrepancy. However, because only Taipei City was included in the Taiwanese study [11], these findings cannot be directly generalized to other regions with different backgrounds, such as rural areas. Another Korean study used a nationwide design, but the extremely high proportion of CA may indicate an excessively coercive mental health system [10], which is different from the Taiwanese system. Although conditions may vary between countries according to their legal and sociocultural contexts, national-level evidence of a greater psychiatric readmission risk after discharge from CA may encourage health providers to focus on patients undergoing CA to reduce their readmission risk.

Thus, based on findings of previous studies, we hypothesized that CA is a predictor of both psychiatric and compulsory readmissions, and the aim of this study was to use Taiwan's NHIRD, one of the largest population health databases in the world, to investigate the relationship between CA and readmission in patients with schizophrenia and to determine putative risk factors of readmission.

Methods

Study design and selection of patients

Patients were retrospectively selected from the Longitudinal Health Insurance Database (LHID, 2005), which is derived from Taiwan's NHIRD database. LHID 2005 includes registration and medical claims for 1 million individuals who have been randomly sampled from the 25.68 million beneficiaries registered in the NHIRD 2005. The database covers > 99% of the population in Taiwan and includes detailed

information regarding health insurance claims between 2000 and 2013. An analysis of sociodemographic characteristics found no significant differences in age, sex, annual births, or premiums paid among individuals in the LHID database and those in the original NHIRD database [12].

For the present study, we identified all inpatients aged ≥ 18 years with a principle diagnosis of schizophrenia [International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) code: 295] recorded in the LHID 2005 between 2007 and 2013. We excluded psychiatric patients admitted before 2007, which was the year of enactment of the Taiwanese Mental Health Act, and ensured that we only used data from patients in their first psychiatric admission during 2007–2013. If a patient underwent more than one psychiatric admission during this period, then we selected the first date and designated it as the date of first admission or as the index date.

We categorized inpatients into study and control groups according to whether their first admission was compulsory (the study or CA group) or voluntary (the control or VA group). Because the decision of whether CA is indicated for a patient is within the jurisdiction of the Psychiatric Disease Mandatory Assessment and Community Care Review Committee, treatment selection bias between the study and control groups was probably present. To reduce the impact of such bias in analyzing the treatment effects, we applied propensity score matching [13], which allows the replication of some characteristics of randomized controlled trials [14]. Propensity score is defined as an individual's probability of receiving a specific treatment based on observed covariates [15, 16]. In this study, each patient in the CA group was matched to four control patients using propensity score based on age, sex, and index year to make both groups comparable. We matched on the logit of the propensity score using calipers of width equal to 0.15 of the standard deviation of the logit of the propensity score [17]. Patients in both groups were then linked to the medical claims database to identify any psychiatric readmission between the index date and 2013. The date of any psychiatric readmission for the first time during the follow-up period (from the index date to December 31, 2013) or the end of the study period (December 31, 2013) was considered as the study endpoint.

In addition, data from inpatients aged ≥ 18 years and with a primary diagnosis of bipolar disorder (ICD-9-CM code: 296.0, 296.1, and 296.4–296.8) registered in the LHID 2005 between 2007 and 2013 were also used. Similar to the selection process in patients with schizophrenia, we also divided patients with bipolar disorder into CA and VA groups, and each patient in the CA group was propensity score-matched to four VA patients based on age, sex, and index year. The selection process of inpatients with bipolar disorder is not outlined in Fig. 1 because it is beyond the scope of this study. After completing patient selection, there were four groups, namely the bipolar CA and VA groups and the schizophrenia CA and VA groups.

Definitions of covariates and variables

Variables analyzed in this study included sex, age (years), insurance premium, catastrophic illness, suicide attempt history, medical comorbidities, season, residential location, urbanization level, hospital type, lengths of stay (LOSs), and the number of psychiatric admissions a year (excluding schizophrenia) prior to the index date. The NHIRD categorizes several diseases or injuries as catastrophic illnesses, including schizophrenia, malignant neoplasms, systemic lupus erythematous, and burns that affect > 20% of the total body surface [18]. Suicide attempt history was used to evaluate whether an individual had attempted suicide in the preceding 12 months before the index date. Urbanization level in the Taiwanese towns and cities was defined according to their population density, the proportion of population with a college education or higher, the proportion of population aged ≥ 65 years, the proportion of population employed in agriculture, and the number of physicians per 100,000 individuals [19]. Residential location was categorized as northern, central, southern, or eastern Taiwan or the outer islands. The hospital type was classified as a medical center, regional hospital, or district hospital. The number of psychiatric admissions per year indicated the number of times that an individual had been admitted to hospital with a psychiatric diagnosis other than schizophrenia in each year prior to the index date. The presence of comorbidities recorded in medical claims in the 1-year prior to the index date was assessed using the Charlson Comorbidity Index [20].

Ethical approval for the study was waived by the Institutional Review Board of Taipei Tzu Chi Hospital (Approval no.: 06-XD15-039). Patient consent was not required because of the retrospective nature of the study, and patient anonymity was protected through de-identification of the information accessed from the NHIRD.

Length of stay stratification

To examine the relationship between LOS and psychiatric readmission, patients were categorized into four LOS groups, namely ≤ 13 days (the short LOS group), 14–26 days (the medium LOS group), 27–40 days (the long LOS group), and ≥ 41 days (the very long LOS group).

Statistical analyses

For between-group comparisons, independent *t* test was used for continuous variables and the Pearson's χ^2 test was used for nominal variables. A Poisson regression model was used to estimate incidence rate ratios of psychiatric readmission.

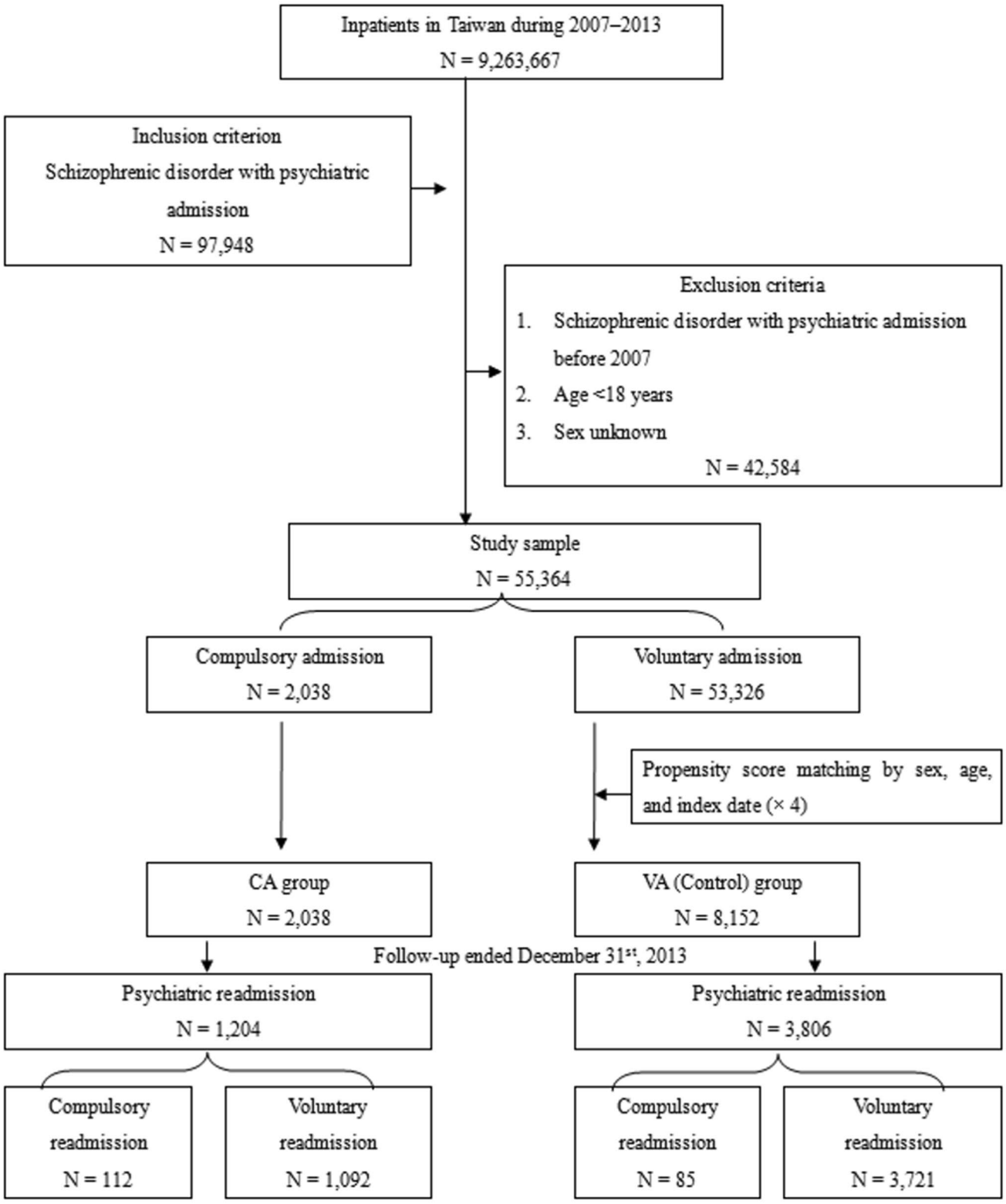

Fig. 1 Flowchart for patient selection and psychiatric readmission during the follow-up period

Cumulative incidence rates in survival curves were plotted using the Kaplan–Meier method, and differences between curves were tested using the log-rank test. Adjusted hazard ratio (AHR) for psychiatric readmission was estimated using the Cox proportional hazard regression model adjusted for potential confounders, including age, sex, insurance premium, urbanization level, catastrophic illness, hospital type, LOS, suicide attempt history, season, number of psychiatric hospitalizations in 1-year before the index date, and medical comorbidities.

The second round of analysis focused on patients with two or more psychiatric admissions, excluding data from those who were not readmitted, and assessed whether the type of second admission (voluntary or compulsory) could be predicted from the type of first admission. Stratified analyses were used to investigate the risk of psychiatric readmission in the CA and VA groups. Separate Cox regression models were estimated for patients who underwent multiple psychiatric readmissions (including the first admission) to evaluate whether risk for subsequent CAs remained while controlling for the variables listed above. Cumulative survival rates for psychiatric readmission were plotted using the Kaplan–Meier method, and differences between the curves were tested using the log-rank test. Sensitivity tests were also conducted to validate our findings after excluding data from the first year of observation. $P < 0.05$ was used to indicate statistical significance, and all statistical analyses were conducted using SPSS version 22 (IBM Corp., Armonk, NY, USA).

Results

We identified 55,364 individuals with schizophrenia with an index inpatient admission between 2007 and 2013 from the database. Of these, the first admissions were CAs for 2038 (3.7%) and VAs for 53,326 (96.3%). After propensity score matching, 2,038 individuals in the CA group were matched with 8,152 individuals, who formed the control group. Mean age in the CA and control groups was 41.36 ± 11.86 years and 41.28 ± 11.42 years, respectively. In both groups, 54.2% of patients were men. The mean follow-up period was 2.97 years in the CA group, which was significantly shorter than the 3.29 years of follow-up for the control group ($P = 0.025$; Table 1).

During the follow-up period, 1204 patients were readmitted in the CA group (readmission rate, 59.1%), whereas 3806 were readmitted in the control group (readmission rate, 46.7%; $P < 0.001$). Of the 1204 readmissions in the CA group, 112 (9.3%) were compulsory and 1092 (90.7%) were voluntary readmissions. Of the 3806 readmissions in the control group, 85 (2.2%) were compulsory and 3721 (97.8%) were voluntary readmissions (Fig. 1).

The CA group showed a significantly higher AHR for psychiatric readmission [1.765, 95% confidence interval (CI) 1.389–2.243, $P < 0.001$] than the control group. Among the different age groups, the highest AHR was obtained in the age group of 18–29 years (1.700, 95% CI 1.494–1.934, $P < 0.001$), followed by that of 30–39 years (1.517, 95% CI 1.351–1.403, $P < 0.001$), 40–49 years (1.455, 95% CI 1.298–1.631, $P < 0.001$), and 50–59 years (1.30, 95% CI 1.16–1.47, $P < 0.001$). Significant AHRs for psychiatric readmission were observed for covariates such as catastrophic illness (1.317, 95% CI 1.234–1.405, $P < 0.001$) and in patients with three or more psychiatric hospitalizations at 1 year prior to the index date (1.360, 95% CI 1.167–1.583, $P < 0.001$). The highest AHR for psychiatric readmission was seen in the very long LOS group (2.493, 95% CI 1.806–3.441, $P < 0.001$), followed by the long LOS (2.055, 95% CI 1.479–2.855, $P < 0.001$) and the medium LOS (1.519, 95% CI 1.063–2.169, $P < 0.022$) groups. Notably, significantly low AHRs (indicating decreased risk) for psychiatric readmission was observed in patients treated in a medical center hospital (0.805, 95% CI 0.731–0.885, $P < 0.001$) or a local hospital (0.801, 95% CI 0.842–0.964, $P = 0.003$) than those with first admission in a district hospital (Table 2).

Compared with the control group, the CA group was associated with a higher risk of compulsory (AHR = 1.307, 95% CI 1.029–1.661, $P < 0.001$) and voluntary (AHR = 1.801, 95% CI 1.417–2.289, $P < 0.001$) readmissions. Sensitivity analyses, after excluding data from the first year of observation, also provided significant findings with respect to compulsory and voluntary readmissions (Table 3).

Kaplan–Meier curves revealed that cumulative survival rates of psychiatric readmissions, compulsory and voluntary readmissions were significantly lower in the CA group than in the control group among patients with schizophrenia (log-rank test, $P < 0.001$; Fig. 2a–c). Among patients with schizophrenia and bipolar disorders, the cumulative survival rate of psychiatric readmission was the lowest in patients with schizophrenia undergoing CA and the highest in bipolar patients undergoing VA (log-rank test, $P < 0.001$; Fig. S).

Discussion

The findings of this study revealed that patients with schizophrenia who were initially compulsorily admitted were more likely to undergo subsequent psychiatric readmission than those voluntarily admitted, even though voluntary readmission more frequently occurred than compulsory readmission. Stratification by LOS also showed that initial CA predicted higher risks of psychiatric, compulsory, and voluntary readmissions, irrespective of the LOS, again with voluntary readmission generally more likely than compulsory readmission.

Table 1 Characteristics of the compulsory admission (CA) group and the propensity score matched voluntary admission (VA) group

Variables	Total		CA group		VA group		*P*
	n	%	*n*	%	*n*	%	
Total	10,190		2038	20.00	8152	80.00	
Sex							0.999
Male	5520	54.17	1104	54.17	4416	54.17	
Female	4670	45.83	934	45.83	3736	45.83	
Age (years)	41.29 ± 11.86		41.36 ± 11.42		41.28 ± 11.96		0.776
Age group (years)							0.999
18–29	1755	17.22	351	17.22	1404	17.22	
30–39	3090	30.32	618	30.32	2472	30.32	
40–49	3075	30.18	615	30.18	2460	30.18	
50–59	1670	16.39	334	16.39	1336	16.39	
≥ 60	600	5.89	120	5.89	480	5.89	
Insurance premium (NTD)							0.099
< 18,000	10,108	99.20	2018	99.02	8090	99.24	
18,000–34,999	74	0.73	16	0.79	58	0.71	
≥ 35,000	8	0.08	4	0.20	4	0.05	
Catastrophic illness							< 0.001
Without	3746	36.76	1123	55.10	2623	32.18	
With	6444	63.24	915	44.90	5529	67.82	
Suicide history							0.320
Without	10,125	99.36	2023	99.26	8102	99.39	
With	65	0.64	15	0.74	50	0.61	
Charlson Comorbidity Index (CCI)	0.19 ± 0.94		0.17 ± 0.98		0.20 ± 0.93		0.258
Season							0.008
Spring (March–May)	2720	26.69	590	28.95	2130	26.13	
Summer (June–August)	2395	23.50	437	21.44	1958	24.02	
Autumn (September–November)	2438	23.93	464	22.77	1974	24.21	
Winter (December–February)	2637	25.88	547	26.84	2090	25.64	
Residential location							< 0.001
Northern Taiwan	3722	36.53	575	28.21	3147	38.60	
Middle Taiwan	3021	29.65	566	27.77	2455	30.12	
Southern Taiwan	2606	25.57	831	40.78	1775	21.77	
Eastern Taiwan	783	7.68	59	2.89	724	8.88	
Outlets islands	58	0.57	7	0.34	51	0.63	
Urbanization level							0.002
1 (The highest)	2787	27.35	539	26.45	2248	27.58	
2	3532	34.66	723	35.48	2809	34.46	
3	1484	14.56	343	16.83	1141	14.00	
4 (The lowest)	2387	23.42	433	21.25	1954	23.97	
Hospital type							< 0.001
Hospital center	1612	15.82	145	7.11	1467	18.00	
Regional hospital	5487	53.85	1,279	62.76	4208	51.62	
Local hospital	3091	30.33	614	30.13	2477	30.39	
LOS							< 0.001
Short LOS	613	6.02	106	5.20	507	6.22	
Medium LOS	943	9.25	185	9.08	758	9.30	
Long LOS	2276	22.34	651	31.94	1625	19.93	
Very long LOS	6358	62.39	1096	53.78	5262	64.55	
Psychiatric admission 1 year before index date							< 0.001
0	9302	91.29	1912	93.82	7390	90.65	
1–2	655	6.43	100	4.91	555	6.81	
≥ 3	233	2.29	26	1.28	207	2.54	
Follow–up (years)	3.23 ± 4.26		2.97 ± 4.55		3.29 ± 4.68		0.025

CCI Charlson Comorbidity Index, *HR* hazard ratio, *CI* confidence interval, *LOS* length of stays, *NTD* New Taiwan Dollar

Table 2 Factors predicting psychiatric readmission for patients with schizophrenia

Variables	CHR	95% CI	*P*	AHR[a]	95% CI	*P*
Study group						
VA group	Reference			Reference		
CA group	1.918	1.797–2.047	< 0.001	1.765	1.389–2.243	< 0.001
Sex						
Male	1.010	0.955–1.068	0.733	0.985	0.931–1.042	0.596
Female	Reference			Reference		
Age group (years)						
18–29	1.842	1.625–2.089	< 0.001	1.700	1.494–1.934	< 0.001
30–39	1.641	1.465–1.838	< 0.001	1.517	1.351–1.703	< 0.001
40–49	1.542	1.378–1.726	< 0.001	1.455	1.298–1.631	< 0.001
50–59	1.373	1.218–1.548	< 0.001	1.309	1.160–1.477	< 0.001
≥ 60	Reference			Reference		
Insurance premium (NTD)						
< 18,000	Reference			Reference		
18,000–34,999	1.082	0.802–1.461	0.606	0.970	0.717–1.311	0.841
≥ 35,000	1.598	0.516–4.956	0.417	1.808	0.611–5.955	0.266
Catastrophic illness						
Without	Reference			Reference		
With	1.468	1.382–1.560	< 0.001	1.317	1.234–1.405	< 0.001
Suicide history						
Without	Reference			Reference		
With	1.308	0.769–1.401	0.808	1.034	0.765–1.397	0.828
CCI	0.869	0.836–0.903	< 0.001	0.908	0.876–1.014	0.081
Season						
Spring	Reference			Reference		
Summer	0.879	0.810–0.953	0.002	0.860	0.793–0.933	< 0.001
Autumn	0.932	0.863–1.007	0.075	0.926	0.857–1.000	0.051
Winter	0.853	0.783–0.930	< 0.001	0.881	0.808–0.961	0.004
Residential location				Collinearity with urbanization level[b]		
Northern Taiwan	Reference			Collinearity with urbanization level[b]		
Middle Taiwan	1.024	0.955–1.095	0.509	Collinearity with urbanization level[b]		
Southern Taiwan	1.195	1.104–1.271	< 0.001	Collinearity with urbanization level[b]		
Eastern Taiwan	1.057	0.949–1.178	0.311	Collinearity with urbanization level[b]		
Outlets islands	1.142	0.781–1.671	0.493	Collinearity with urbanization level[b]		
Urbanization level						
1 (The highest)	0.968	0.896–1.046	0.411	1.011	1.009–1.201	0.031
2	0.915	0.849–0.987	0.021	1.040	0.958–1.128	0.350
3	1.087	0.993–1.190	0.071	1.065	0.970–1.169	0.187
4 (The lowest)	Reference			Reference		
Hospital type						
Medical center	0.789	0.727–0.858	< 0.001	0.805	0.731–0.885	< 0.001
Regional hospital	0.946	0.889–1.007	0.081	0.801	0.842–0.964	0.003
District hospital	Reference			Reference		
LOS						
Short	Reference			Reference		
Medium	1.540	1.079–2.197	0.017	1.519	1.063–2.169	0.022
Long	2.208	1.591–3.063	< 0.001	2.055	1.479–2.855	< 0.001
Very long	2.891	2.100–3.980	< 0.001	2.493	1.806–3.441	< 0.001

Table 2 (continued)

Variables	CHR	95% CI	*P*	AHR[a]	95% CI	*P*
Psychiatric hospitalizations in the year before index date						
0	Reference			Reference		
1–2	1.066	0.963–1.181	0.216	1.071	0.967–1.186	0.189
≥3	1.404	1.207–1.634	<0.001	1.360	1.167–1.583	<0.001

Dependent variable: psychiatric readmission

AHR adjusted hazard ratio, *CA* compulsory admission, *CHR* crude hazard ratio, *CI* confidence interval, *HR* hazard ratio, *LOS* length of stays, *VA* voluntary admission

[a]Adjusted for the variables listed in Table 2

[b]Spearman correlation coefficient: 0.898 ($P<0.001$)

Table 3 Hazard ratios for compulsory readmission, stratified by initial CA and VA

Initial CA versus initial VA	Sensitivity test	CHR	95% CI	*P*	AHR[a]	95% CI	*P*
Initial CA	Overall	1.784	1.410–2.309	<0.001	1.307	1.029–1.661	<0.001
	Tracking > 1 year	1.562	1.307–2.009	0.001	1.111	1.011–1.597	0.026
Initial VA		Reference	–	–	Reference		–
Hazard ratios for voluntary readmission, stratified by initial CA and VA							
Initial CA	Overall	1.941	1.817–2.074	<0.001	1.801	1.417–2.289	<0.001
	Tracking > 1 year	1.780	1.522–1.896	<0.001	1.684	1.317–1.978	<0.001
Initial VA		Reference	–	–	Reference	–	–

Dependent variable: psychiatric readmission

AHR adjusted hazard ratio, *CA* compulsory admission, *CCI* Charlson Comorbidity Index, *CHR* crude hazard ratio, *CI* confidence interval, *HR* hazard ratio, *LOS* length of stay, *NTD* New Taiwan Dollar, *VA* voluntary admission

[a]Adjusted for the variables listed in Table 2

We report that the proportion of patients who underwent initial CA was 3.7%, which was toward the lower range of results reported by previous studies, which range between 3.2 and 26.4% [3–5]. The low figure in the present study may be due to differences among these studies in the assessment criteria used and regulations for CA. Taiwan has stricter criteria for CA, and mental illness with psychotic features, non-compliance with treatment, and dangerous behavior are all legal and mandatory requirements for CA [6]. This contrasts with requirements in some EU countries, where broader criteria are applied for CA, including mental illness, dangerous behavior, and/or the need for treatment [4]. In addition, 5 days are allowed after the initiation of emergency placement for the approval of CA in Taiwan, which is longer than that in other countries [4]. During the period between emergency placement and the final approval of CA by the multidisciplinary committee, lengthy and complex documents must be submitted, such as the provision of a medical certificate confirming that the patient is suffering from mental illness with psychotic features, a comprehensive medical note, the selection of an appropriate protector for the patient (after involving the patient and his/her family members in a collaborative discussion), and signing of the official consent form by the designated protector. Thus, these narrower assessment criteria and the lengthy and complex procedure and paperwork necessary for detainment may have led to the low proportion of patients being compulsorily admitted. Additionally, in Taiwan, the process of CA must be initiated by two independent board-certified psychiatrists, who may be deterred by the complex procedures outlined above for CA and may instead encourage VA.

The finding that initial CA was associated with future psychiatric readmission is consistent with the results of Hung et al. [9], who have demonstrated that a prior history of CA is associated with an increased risk of 1-year readmission. However, that study was limited by its small sample size, short follow-up period, and the lack of a control group, which could have led to selection bias. We used data from the Taiwanese nationwide database to form cohorts involving nearly all first psychiatric CAs in patients diagnosed with schizophrenia and a comparable control group, along with tracking of these patients over a long period and a sufficient

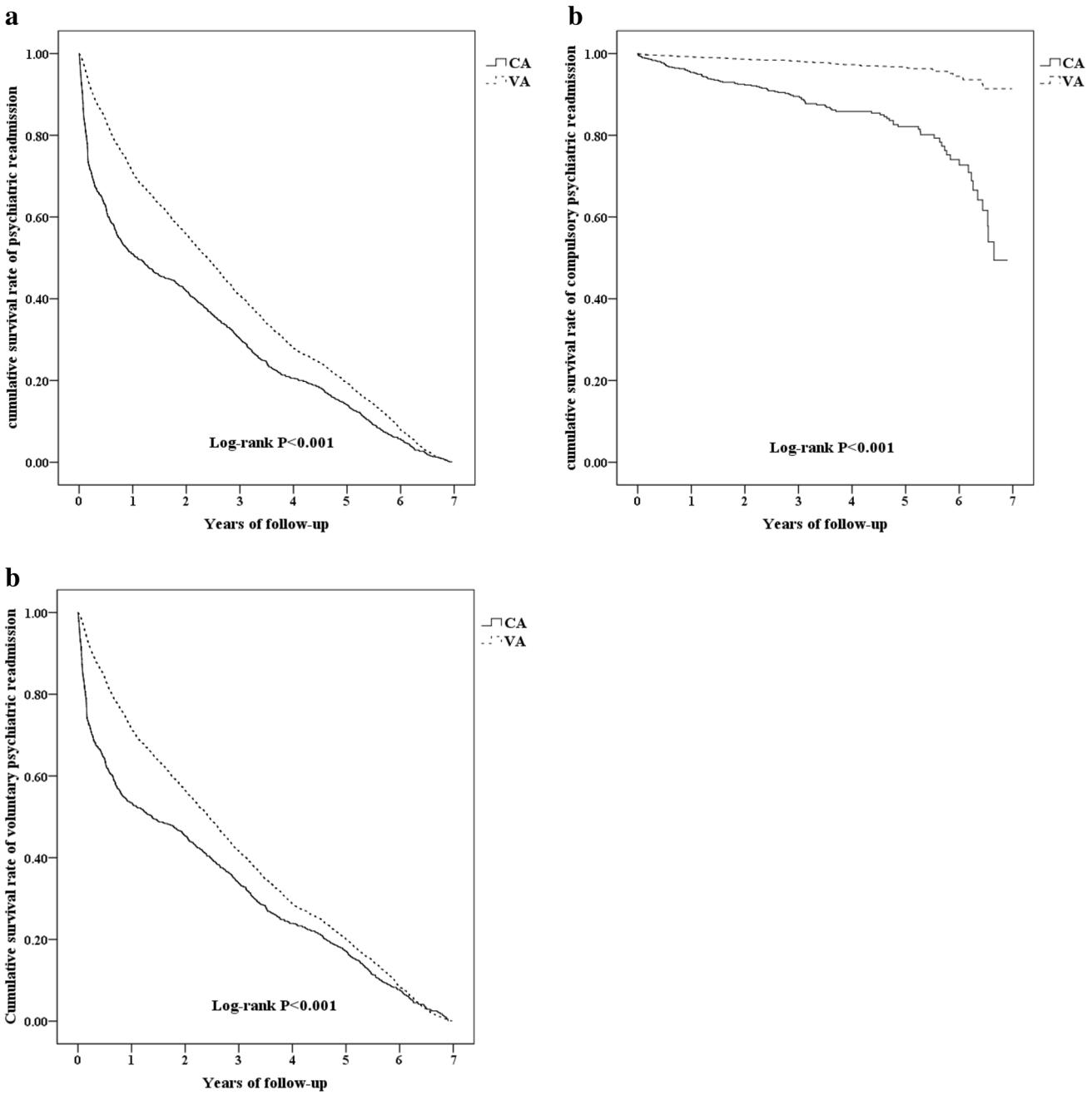

Fig. 2 Kaplan–Meier survival analyses in patients with schizophrenia undergoing compulsory admission (CA) or voluntary admission (VA). **a** Cumulative risk for psychiatric readmission. **b** Cumulative risk for compulsory psychiatric readmission. **c** Cumulative risk for voluntary psychiatric readmission

follow-up of each year's cohort to generate information regarding psychiatric readmission. Undergoing CA could imply that a patient has a poor insight into his/her illness along with a possibly higher severity of psychotic symptoms [21], which may then lead to readmission.

The finding that initial CA was a predictor of subsequent compulsory readmission is consistent with the results of a Danish study in 53 first-admission patients with schizophrenia [22]. This study by Munk-Jorgenson et al. demonstrated that CAs are more frequent during the first half of the follow-up period and correlated to previous CA [22]. However, unlike our study, the sample size in the Danish study was small and a diagnosis of schizophrenia at first admission was not initially confirmed for some patients, which may have

reduced the validity of the study. Fennig et al. have reported a positive association between compulsory first and second admissions after controlling for age, sex, education, and religion [7], and the strength the study was that its cohort was selected from a national population. However, only limited clinical and socio-environmental variables were examined, including medical comorbidities, suicide attempt history, income-related insurance premiums, and residential location. In addition, only one CA group was included, which may have led to selection bias. Our study counts as one of the few that was conducted in a non-Western country [10] that investigated risk factors for subsequent CA with a large sample size and adjusted for factors related to CA.

In contrast with previous studies that have demonstrated that a shorter LOS is associated with a higher risk of readmission in patients with schizophrenia [2, 23], we found that a longer LOS increased the risk of psychiatric readmission. The positive relationship between LOS and readmission risk suggests that a longer period of admission is not an indicator of adequate treatment, and rather it indicates a more severe or refractory disease, a poorer understanding of the disease, and/or less effective psychosocial support.

Our study demonstrated that cumulative survival rate after psychiatric readmission in patients with schizophrenia was significantly lower than that for patients with bipolar disorder undergoing CA or VA. Few studies have reported on the characterization of patients with bipolar disorder who have been compulsorily admitted as inpatients versus those who have been voluntarily admitted. This is particularly concerning because patients with bipolar mania may be unusually resourceful in presenting themselves such that they appear not to meet the legal criteria for CA [24, 25]. To the best of our knowledge, this is the first study that compared patients with schizophrenia and bipolar disorders who were compulsorily admitted versus those who have been voluntarily admitted. However, it is essentially difficult to confirm whether the risk of psychiatric readmission is higher in patients with schizophrenia than in those with bipolar disorders undergoing CA or VA because of the observational/non-interventional study design used here; therefore, it is not possible to compare treatment groups using stringent between-group analyses.

This study had several limitations. First, the diagnosis of schizophrenia relied on ICD-9-CM codes, which may not have diagnostic validity. However, the diagnoses were not based only on clinical criteria, rather, there was also concomitant psychiatric admission. We therefore, believe that our diagnoses of schizophrenia are likely to be reliable. Second, some patients who met the criteria for CA did not undergo CA, which may have resulted in some misrepresentation of CA group patients in the control group. Third, we applied an observational design that may have not identified important, unmeasured differences between the treatment groups, which may have affected the results.

Nonetheless, this study provides insight into prognosis following CA for schizophrenia. Our approach minimizes selective attrition while maintaining low study costs. Importantly, our findings suggest that clinicians need to focus on patients undergoing CAs to reduce the frequency of future readmissions.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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