International Journal of Nursing & Clinical Practices
Review Article Open Access

Effectiveness of Home Care Case Management on Long-Term Rates of Psychiatric Hospitalization and Suicide Attempts in Patients with Schizophrenia

Cheng-Yi Huang[1,#], Wan-Hsiang Tai[2,#], Jin-Biau Li[3], Yu-Hsuan Joni Shao[4,5], Chi-Ling Chou[6], Jui-Chen Liao[7], Sheng-Miauh Huangh[8,9], Su-Chen Fang[7,*]

[1]*Department of Community Psychiatry, Bali Psychiatric Center, Ministry of Health and Welfare, New Taipei City, Taiwan*
[2]*Department of General Psychiatry, Bali Psychiatric Center, Ministry of Health and Welfare, New Taipei City, Taiwan*
[3]*Department of Nursing, Cardinal Tien Junior College of Healthcare and Management, New Taipei City, Taiwan*
[4]*Graduate Institute of Biomedical Informatics, College of Medical Science and Technology, Taipei Medical University, Taipei, Taiwan.*
[5]*Clinical Big Data Research Center, Taipei Medical University Hospital, Taipei, Taiwan*
[6]*Department of Nursing, Bali Psychiatric Center, Ministry of Health and Welfare, New Taipei City, Taiwan*
[7]*Department of Nursing, MacKay Medical University, New Taipei City, Taiwan*
[8]*College of Nursing, Yang-Ming Campus, National Yang Ming Chiao Tung University, Taipei, Taiwan*
[9]*Department of Nursing, National Yang Ming Chiao Tung University Hospital, Yilan, Taiwan*

Abstract

Background and objectives: Home care case management (CM) shows promise in reducing psychiatric hospitalizations. However, the optimal frequency of home care CM and its impact on long-term outcomes in patients newly diagnosed with schizophrenia remain uncertain. To investigate the association between varying intensities of home care CM treatments and their effects on long-term rates of rehospitalization and suicide attempts.

Method: Using Taiwan National Health Insurance data, we conducted a population-based cohort study of 9,578 newly diagnosed schizophrenia patients who received home care CM from January 1, 2002, to December 31, 2012. Patients were grouped by their first-year treatment intensity: high (> 12 times/year), intermediate (7-12 times/year), and low (< 7 times/year) groups. The Cochran–Armitage trend test was used to assess annual changes in psychiatric hospitalization and suicide attempts. Generalized estimation equation models tracked these outcomes over time between groups. The Cox proportional hazards model assessed psychiatric hospitalization risk among the three groups.

Results: During the follow-up period, the annual incidence of psychiatric hospitalization reduced significantly among the 3 groups. Patients receiving high or intermediate treatment intensity showed lower psychiatric hospitalization risks than the low-intensity group. Patients with co-occurring substance use disorder and bipolar disorder exhibited a 1.77- and 1.3-fold increase in relapse risk over those without co-occurring conditions.

Conclusion: The high-intensity home care CM is associated with a lower likelihood of subsequent psychiatric hospitalization and greater long-term effectiveness of such hospitalizations.

Publication History:

Received: August 23, 2025
Accepted: September 09, 2025
Published: September 11, 2025

Keywords:

Schizophrenia, Home care Case management, Relapse, Hospitalization, Suicide attempt

Introduction

Schizophrenia is a severe mental illness that affects approximately 24 million people worldwide [1], causing substantial disability [2] in patients and imposing a considerable economic burden on society [3,4]. With the peak onset age of schizophrenia around adolescence and early adulthood [5], most patients with schizophrenia have the disability in many domains such as cognition, self-care, occupation, sexual and social relationships for a long time [2,6-8] and experience significant distress which leads to a much higher suicide rate compared to that for the general population [9].

Patients with schizophrenia exhibit high rates of relapse and repeated psychiatric hospitalizations [10,11]. The risk factors of relapse following treatment for the first episode of psychosis include lack of insight, non-adherence with antipsychotics, comorbid substance use disorder, poor premorbid adjustment and care givers' criticism [12-14]. Considering these findings, the World Health Organization (2021) and National Institute for Health and Care Excellence (2014) have recommended providing continual treatment for community-dwelling individuals with severe mental illnesses who have been discharged from psychiatric hospitals. In Taiwan, the revised version of the Mental Health Act (MHA) was implemented in 2008. The MHA amendment promoted a major paradigm shift of Taiwan's mental health system from the medical institutionalized system to community-oriented service. Subsequently, more resources were provided to the community-oriented services models to encourage and assist individuals with severe mental illness to return and stay in the community [17].

The home care case management (CM) model is one of the community care models aiming to support and treat patients with severe mental

*Corresponding Author: Prof. Su-Chen Fang, Department of Nursing, MacKay Medical University No.46, Section 3, Zhongzheng Road, Sanzhi District, New Taipei City 252, Taiwan, Tel: 886-2-2636-0303.

#Dr. WHT and Dr. CYH contributed equally to this paper as co-first authors

Citation: Huang CY, Tai WH, Li JB, Shao YHJ, Chou CL, et al. (2025) Effectiveness of Home Care Case Management on Long-Term Rates of Psychiatric Hospitalization and Suicide Attempts in Patients with Schizophrenia. Int J Nurs Clin Pract 12: 423. doi: https://doi.org/10.15344/2394-4978/2025/423

illness who live in the community [18]. The service contents and type of community care models vary depending on the country where the services are provided. In Taiwan, the home care CM model is similar to the non-intensive CM model, whose caseload is over 20 per nurse and receives a maximum of two monthly home care services. The home care CM team mainly includes trained psychiatrists and psychiatric nurses which aim to provide long-term medical services such as delivering antipsychotic drugs, monitoring drug compliance, checking physical and mental status, giving information, and supporting caregivers for patients with mental disorders [19]. Patients also can be referred to other paramedical staff, such as social workers, psychologists, and occupational therapists, if required.

Previous studies with short follow-up showed that patients with severe mental illness who received CMH services had fewer deaths [20], lower hospital admission rates [20-22], and a shorter length of hospital stay [23,24] than those who did not. A recent study by Chen et al. using Taiwan's nationwide medical claims database reported that non-intensive case management that provides direct service delivery and linkages to other service providers could reduce the frequency of psychiatric hospitalization and shorten inpatient stay duration in patients with severe mental illness [19]. However, the study focused on psychiatric hospitalization, length of stay, and 2-year follow-up. To date, few studies have explored the effects of the home care CM treatment on suicide attempts in patients with schizophrenia; moreover, the literature regarding this topic appears to be inconsistent [20,25].

Additionally, treatment intensity may play a critical role in the effectiveness of home care CM. Determining the optimal frequency could lead to more efficient resource allocation and improved patient outcomes. Moreover, understanding the relationship between the frequency of home care CM and relapse is essential for developing evidence-based guidelines for schizophrenia care.

Our study aims to address this knowledge gap by investigating the association between varying frequencies of home care CM and long-term clinical outcomes in patients newly diagnosed with schizophrenia. By conducting a 5-year population-based cohort study, we seek to provide comprehensive insights into the effectiveness of different intensive home care CM treatments and their impact on patient outcomes. The findings from this study have the potential to inform clinical practice and health policy, ultimately improving the care and quality of life for individuals with newly diagnosed schizophrenia.

Methods

Data source

We conducted a population-based cohort study using the Taiwan National Health Insurance Research Database (NHIRD) from January 1, 2002, to December 12, 2017. The NHIRD is a nationwide health care utilization dataset from Taiwan's single-payer compulsory National Health Insurance (NHI) program, which covers more than 99.6% of the 23 million people in Taiwan [26,27]. The NHIRD is a de-identified dataset and contains all medical information such as disease diagnoses, treatment procedures, prescriptions, demographics, and enrollment profiles of all NHI beneficiaries 27,28. In addition, we also linked the NHIRD to the Taiwan Death Registry (TDR) database to ascertain the vital status and date of death.

Study design and population

This cohort study included patients with newly diagnosed schizophrenia (*International Classification of Diseases, Ninth Revision, Clinical Modification* [ICD-9-CM] code 295; *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision* [ICD-10] codes F20 and F25) [29] who began receiving home care CM treatment (procedure codes: 05404C, 05405C, and 05406C) [30] between January 1, 2002, and December 31, 2012. The study design is summarized in Figure 1. This study was reviewed and approved by the institutional review board of Bali Psychiatric Center, Taiwan (approval number: 1110314-06).

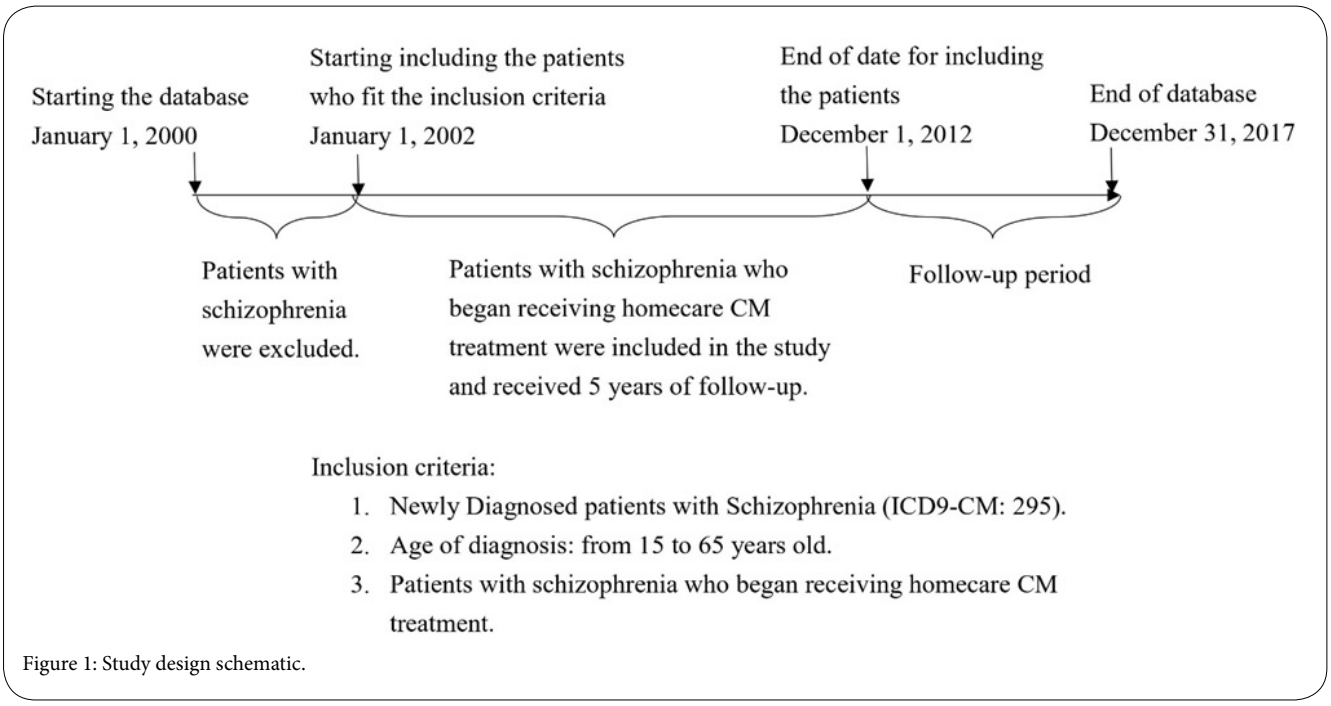

Figure 1: Study design schematic.

Patients were excluded from the study if they were under 16 or over 65 years of age at the time of initial schizophrenia diagnosis or if they had missing data on sex or age. After applying these exclusion criteria, the final study cohort comprised 4,578 patients with newly diagnosed schizophrenia who received home care CM treatment. The index date was defined as each participant's initial date of home care CM treatment implementation. All patients were subsequently followed for a period of 5 years from their respective index dates.

In the home care CM treatment covered by Taiwan's NHI program, a responsible hospital assembled a multidisciplinary outreach team that included psychiatrists, psychiatric nurses, and sometimes also social workers to provide direct services delivery and linkage to other resources for patients living in the community. The home care CM treatment is indicated for patients with severe mental illness who exhibit limited insight and poor treatment compliance; disturbing behavior; high risk of violence, self-harm or suicide; and considerable function deterioration. The treatment provides a maximum of two face-to-face outreach visits per month to evaluate the symptoms, possible adverse drug reactions and social functions for patients in the community. Besides direct provision and evaluation of medications, the program also delivered psychotherapy, psychoeducation and counseling to both patients and their families [19].

Based on first-year home care CM treatment intensity among 4,578 participants, patients were classified into high (>12 treatments/year), intermediate (7-12 treatments/year), and low (<7 treatments/year) groups, corresponding to above 50th, 25th-50th, and below 25th percentiles of treatment frequency distribution, respectively. This study was reviewed and approved by the institutional review board of Bali Psychiatric Center, Taiwan. A waiver of informed consent was granted because the data from the NHIRD was de-identified before analysis.

Outcomes of interest

The primary outcomes of this study were psychiatric hospitalization and suicide attempts during the 5-year follow-up period after the index date. Psychiatric hospitalization was defined as a patient's admission to a psychiatric hospital or psychiatric ward in a general hospital. A suicide attempt was defined as an emergency department visit or hospitalization with a relevant suicide diagnosis (ICD-9-CM codes E950-E959; ICD-10 codes X60-X84).

Study covariates

The following demographic variables were assessed: sex, age at first diagnosis, age at index date, phase of first use of home care CM treatment within 3 years of a schizophrenia diagnosis, while the late initiation phase refers to starting it after 3 years. Policy effects due to the amendment of Taiwan's MHA were also considered. Accordingly, the included patients were divided into before-2008 and after-2008 groups by the calendar year of the index date and adjusted in the analysis.

Clinical variables, including psychiatric and medical comorbidities, were retrieved from NHIRD claims of at least two ambulatory or one inpatient record within one year prior to the index date to assess the comorbidities. Psychiatric comorbidities included depressive disorders (ICD-9-CM: 296.2x, 296.3x, 296.82, 300.4, and 311; ICD-10 codes: F32.x, F33.x, and F34.1), anxiety disorders (ICD-9-CM: 300.x excluding 300.4; ICD-10 codes: F40.x-F42.x, F44.x, F45.x, F48.x, F68.11, F68.8, F99, and R45.2), bipolar disorders (ICD-9-CM: 296 excluding 296.2, 296.3, and 296.82; ICD-10 codes: F30.x, F31.x, F39, F33.8, F34.8, and F34.9) and substance use disorder (ICD-9-CM: 291.x, 292.x, 303.x, 304.x, 305.x, 357.5, 425.5, 535.3, 571.0, 571.1, 571.2, and 571.3; ICD-10 codes: F11.1x ~ F19.1x). Comorbid medical conditions were defined on the basis of Charlson Comorbidity Index scores that reflected the severity of medical comorbidities [31].

Statistical analysis

We compared the aforementioned three groups (high, intermediate, and low groups) in terms of their demographic characteristics and clinical variables. Continuous variables were analyzed through an ANOVA, whereas categorical variables were analyzed using the chi-squared test. The Cochran-Armitage test for trend was used to analyze changes in the annual incidence of psychiatric hospitalization and suicide attempts in the three groups within 1 year before the index date and every year thereafter.

The generalized estimating equation (GEE) model was used to analyze the effect of home care CM treatments on psychiatric hospitalization and suicide attempts among the home care CM groups at different time points within the 5-year follow-up period after the index date. When using GEE, a working correlation matrix was set at exchangeable and followed the Poisson distribution.

The Cox proportional hazards regression model was used to estimate hazard ratios (HRs) for comparing psychiatric hospitalization incidence among the three groups. The Kaplan–Meier method was employed to compare the three groups regarding the time to hospitalization after the end of home care CM treatment. All the patients were followed from their end of home care CM treatments until psychiatric hospitalization, death, or the end of the fifth year, whichever occurred first. The Cox proportional hazards regression model and the GEE model were adjusted for age at first schizophrenia diagnosis, sex, policy effect of MHA amendment, psychiatric comorbidities, phase of first use of home care CM treatments (early vs. late initiation phase), and CCI scores. All statistical analyses were performed using SAS statistical software version 9.4 (SAS Institute). A two-tailed P value of <0.05 was considered statistically significant.

Results

We identified 4,578 newly diagnosed schizophrenia patients who began receiving home care CM treatments between January 1, 2002, and December 31, 2012. These patients' mean age at the index date was 40.23 ± 11.62 years. Of the cohort, 53.04% were men. The high, intermediate, and low groups comprised 2,027 (44.28%), 1,383(30.2%), and 1,168 (25.51%) patients, respectively. The mean duration from the initial diagnosis of schizophrenia to the first utilization of home care CM treatment was 2.49 ± 2.85 years.

No significant differences were observed among the three groups for sex, phase of the first use of home care CM treatments, psychiatric comorbidities, or Charlson Comorbidity Index scores (Table 1). However, the high group patients were older at schizophrenia diagnosis and home care CM treatment compared to the intermediate and low groups. The proportions of patients after the MHA amendment in the three groups were also different. Furthermore, the mean interval between the end of initial home care treatment and subsequent psychiatric hospitalization was significantly ($P < 0.01$) longer in the high group (3.33 ± 1.95 years) than in the intermediate (2.81 ± 2.09 years) and low (2.11 ± 2.16 years) groups.

Table 1: Baseline characteristics of newly diagnosed schizophrenia patients in different intensities of home care case management (CM) treatment groups.

	Overall (N=4578)	High group group (N=1383)	Intermediate group (N=2027)	Low group (N=1168)	*P*
Age at first schizophrenia diagnosis (years), mean (SD)a	36.82 (11.79)	37.78 (11.73)	36.38 (11.89)	35.68 (11.65)	<0.01[§]
Sex, n (%)					0.77
Male	2428 (53.04)	1079 (53.23)	740 (53.51)	609 (52.14)	
Female	2150 (46.96)	948 (46.77)	643 (46.49)	559 (47.86)	
Age at index date (years), mean (SD)[a]	40.23 (11.62)	41.34 (11.5)	39.71 (11.72)	38.9 (11.55)	<0.01[§]
Policy effect					<0.01
Before the MHA amendment (2002–2007)	1890 (41.28)	767 (37.84)	580 (41.94)	543 (46.49)	
After the MHA amendment (2008–2012)	2688 (58.72)	1260 (62.16)	803 (58.06)	625 (53.51)	
Phase of the first use of a home care CM treatments					0.06
Early initiation phase[b]	3160 (69.03)	1363 (67.24)	969 (70.07)	828 (70.89)	
Late initiation phase[c]	1418 (30.97)	664 (32.76)	414 (29.93)	340 (29.11)	
Psychiatric comorbidities, n (%)					
Depressive disorder	154 (3.36)	63 (3.11)	43 (3.11)	48 (4.11)	0.26
Anxiety disorder	179 (3.91)	71 (3.5)	59 (4.27)	49 (4.2)	0.45
Bipolar disorder	179 (3.91)	80 (3.95)	45 (3.25)	54 (4.62)	0.21
Substance use disorder	56 (1.22)	22 (1.09)	25 (1.81)	9 (0.77)	0.05
Charlson Comorbidity Index score, n (%)					0.88
0	4459 (97.4)	1973 (97.34)	1344 (97.18)	1142 (97.77)	
1	98 (2.14)	44 (2.17)	33 (2.39)	21 (1.8)	
2	21 (0.46)	10 (0.49)	6 (0.43)	5 (0.43)	
The interval between the completion of initial home care treatment and subsequent psychiatric hospitalization, mean (SD)[a]	2.86 (2.11)	3.33 (1.95)	2.81 (2.09)	2.11 (2.16)	<0.01[§]

The high group comprised newly diagnosed schizophrenia patients who received home care CM treatments >12 times within the first year after the index date.
The intermediate group comprised patients with schizophrenia who received home care CM treatments 7–12 times within the first year after the index date.
The low group comprised patients with schizophrenia who received home care CM treatments <7 times within the first year after the index date.
The index date was each participant's initial date of the home care CM treatments implementation.
[a]One-way ANOVA with Tukey's post hoc test.
[§]High group > intermediate group; high group > low group; intermediate group = low group.
[b]Early initiation phase: Home care CM treatments were initiated ≤3 years after the first diagnosis of schizophrenia.
[c]Late initiation phase: Home care CM treatments were initiated >3 years after the first diagnosis of schizophrenia.
Abbreviations: SD, standard deviation; MHA, Mental Health Act.

Figure 2 presents trends in the annual incidences of psychiatric hospitalization and suicide attempts in all three groups. During the 5-year follow-up period, the annual incidence of psychiatric hospitalization decreased significantly in each group (high group, from 57.23% to 18.60%; intermediate group, from 61.82% to 20.17%; low group, from 68.24% to 25.34%; P for trend < 0.01. However, no group exhibited any significant change in the annual incidence of suicide attempts during the follow-up period. Notably, in the low group, the incidence of suicide attempt in the second year of follow-up was similar to that within 1 year before the index date.

Table 2 presents the results of the GEE analysis. Compared to the risk of psychiatric hospitalization one year before the index date in the low group, the high group maintained a significantly lower risk of psychiatric hospitalization from the first year through the fourth year after the index date (exp (*B*): −0.768 to −0.358; $P < 0.01$). However, the intermediate group had a significantly low risk of psychiatric hospitalization only in the first year after the index date (exp (*B*): −0.321; $P < 0.01$). Regarding the risk of suicide attempts, no significant difference was observed in each year after the index date among these groups.

Table 3 presents the high and intermediate groups had a lower risk of psychiatric hospitalization after adjusting for potential confounders compared to the low group, the adjusted HR [aHR]: 0.51 [95% confidence interval (CI): 0.46–0.56] in regular group, and aHR: 0.67 [95% CI: 0.60–0.74] in intermediate group. The Kaplan–Meier survival curves also confirmed that the high and intermediate groups had a lower risk of psychiatric hospitalization than the low group (log-rank P < 0.01; Figure 3).

Discussion

In this 5-year follow-up study, three main findings were revealed: 1) high-intensity home care CM (>12 treatments in the first year) demonstrated a lower risk of psychiatric hospitalization for up to four years post-treatment initiation and a longer average time to

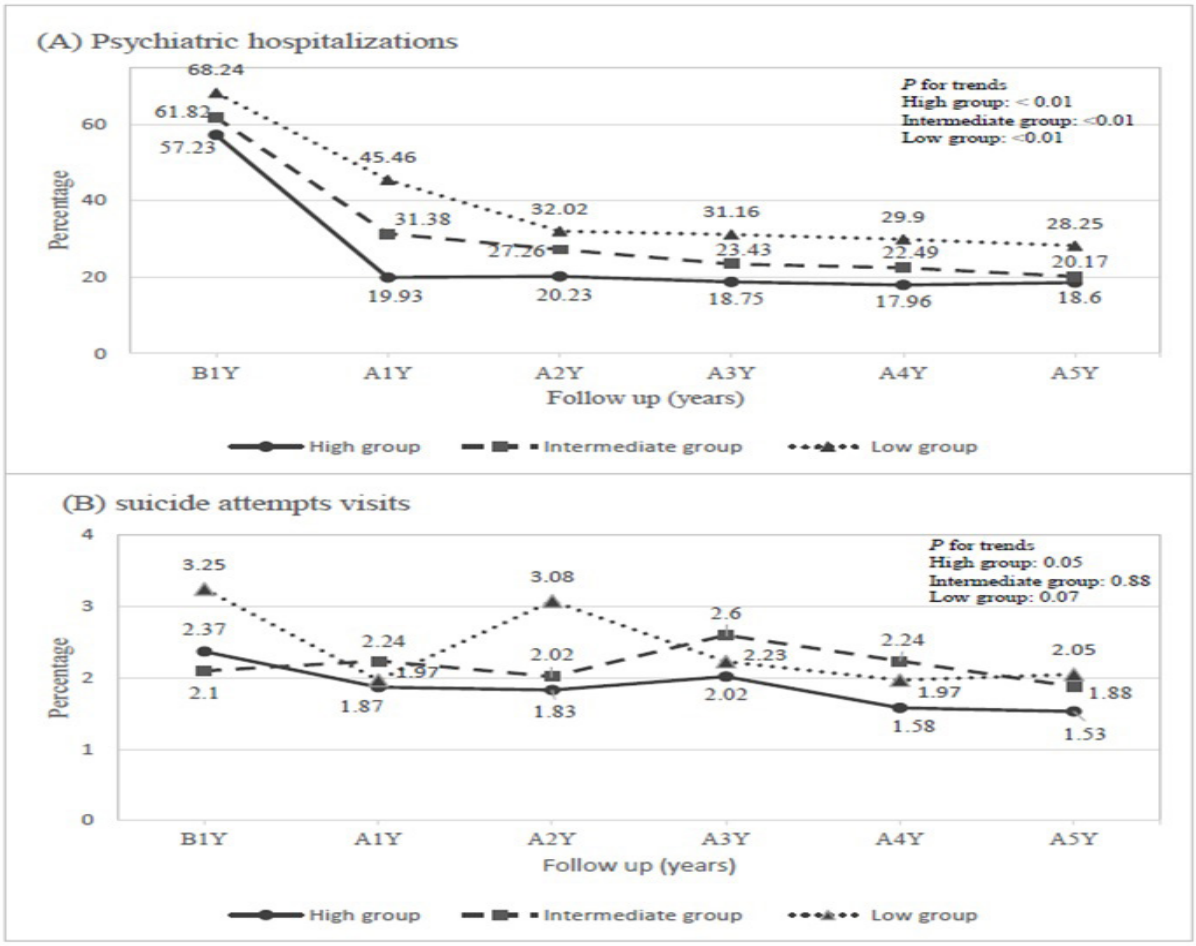

Figure 2: Trends of annual (A) psychiatric hospitalizations and (B) suicide attempts in the high, intermediate, and low groups.
These trends were analyzed using the Cochran–Armitage test.
B1Y: within 1 year before the index date; AnY: nth year after the index date.

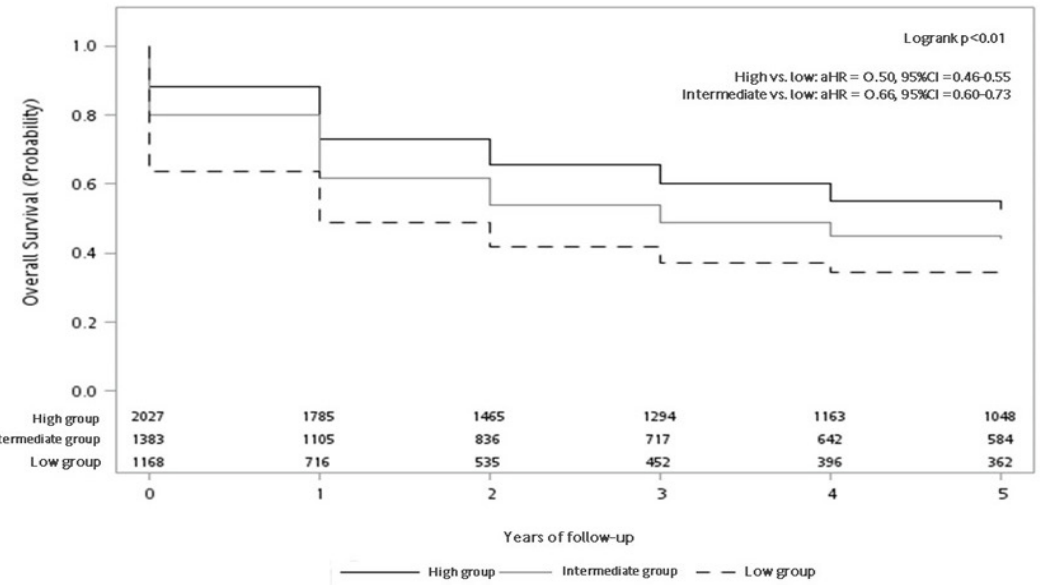

Figure 3: Survival curves and adjusted hazard ratios for psychiatric hospitalization in the high, intermediate, and low (reference) groups.
The aHRs were calculated using Kaplan–Meier analysis; the models were adjusted for variables including age at first schizophrenia diagnosis, sex, policy effect, psychiatric comorbidities, phase of the first use of a home care treatment (early vs. late initiation phase), and Charlson Comorbidity Index scores.
Abbreviations: aHR, adjusted hazard ratio.

Table 2: Risks of psychiatric hospitalization, ED visits, and suicide attempts in different intensities of home care case management (CM) treatment groups.

	Estimate (SE)	95% CI	*P*
Psychiatric hospitalization			
Group (ref= Low group)			
High group	-0.801 (0.063)	-0.92 ~ -0.68	**<0.01**
Intermediate group	-0.497 (0.067)	-0.63 ~ -0.37	**<0.01**
Time (ref= B1Y)			
A1Y	-0.292 (0.043)	-0.38 ~ -0.21	**<0.01**
A2Y	-0.708 (0.06)	-0.83 ~ -0.59	**<0.01**
A3Y	-0.725 (0.061)	-0.84 ~ -0.61	**<0.01**
A4Y	-0.781 (0.07)	-0.92 ~ -0.64	**<0.01**
A5Y	-0.941 (0.078)	-1.09 ~ -0.79	**<0.01**
Interaction effect (ref=Low group*B1Y)			
High group*A1Y	-0.768 (0.073)	-0.91 ~ -0.62	**<0.01**
High group*A2Y	-0.311 (0.084)	-0.48 ~ -0.15	**<0.01**
High group*A3Y	-0.359 (0.087)	-0.53 ~ -0.19	**<0.01**
High group*A4Y	-0.358 (0.094)	-0.54 ~ -0.17	**<0.01**
High group*A5Y	-0.177 (0.102)	-0.38 ~ 0.02	0.08
Intermediate group*A1Y	-0.321 (0.071)	-0.46 ~ -0.18	**<0.01**
Intermediate group*A2Y	-0.013 (0.087)	-0.18 ~ 0.16	0.88
Intermediate group*A3Y	-0.159 (0.089)	-0.33 ~ 0.02	0.08
Intermediate group*A4Y	-0.138 (0.095)	-0.32 ~ 0.05	0.15
Intermediate group*A5Y	-0.119 (0.106)	-0.33 ~ 0.09	0.26
Suicide attempt			
Group (ref= Low group)			
High group	-0.779 (0.356)	-1.48 ~ -0.08	**0.03**
Intermediate group	-0.885 (0.398)	-1.67 ~ -0.1	**0.03**
Time (ref= B1Y)			
A1Y	-0.35 (0.395)	-1.12 ~ 0.42	0.38
A2Y	0.249 (0.407)	-0.55 ~ 1.05	0.54
A3Y	0.042 (0.34)	-0.62 ~ 0.71	0.90
A4Y	-0.414 (0.305)	-1.01 ~ 0.18	0.18
A5Y	-0.519 (0.375)	-1.25 ~ 0.22	0.17
Interaction effect (ref=Low group*B1Y)			
High group*A1Y	0.353 (0.513)	-0.65 ~ 1.36	0.49
High group*A2Y	-0.852 (0.552)	-1.93 ~ 0.23	0.12
High group*A3Y	-0.378 (0.488)	-1.33 ~ 0.58	0.44
High group*A4Y	-0.363 (0.471)	-1.29 ~ 0.56	0.44
High group*A5Y	-0.027 (0.545)	-1.09 ~ 1.04	0.96
Intermediate group*A1Y	1.226 (0.786)	-0.31 ~ 2.77	0.12
Intermediate group*A2Y	0.024 (0.632)	-1.22 ~ 1.26	0.97
Intermediate group*A3Y	0.344 (0.561)	-0.76 ~ 1.44	0.54
Intermediate group*A4Y	0.333 (0.522)	-0.69 ~ 1.36	0.52
Intermediate group*A5Y	-0.114 (0.541)	-1.17 ~ 0.95	0.83

The risks were analyzed through Poisson regression with a GEE model adjusted for variables including age at first schizophrenia diagnosis, sex, policy effect, psychiatric comorbidities, phase of the first use of a home care interventions (early vs. late initiation phase), and Charlson Comorbidity Index scores.

B1Y: within 1 year before the index date; AnY: n^{th} year after the index date.

Abbreviations: GEE: generalized estimating equation.

Table 3: Associations between the baseline characteristics of patients and their risk of psychiatric hospitalization.

	Crude HR (95% CI)	*P*	Adjusted HR (95% CI)*	*P*
Home care case management group (ref = Low group)				
High group	0.50 (0.45~0.55)	**<0.01**	0.51 (0.46~0.56)	**<0.01**
Intermediate group	0.67 (0.61~0.74)	**<0.01**	0.67 (0.6~0.74)	**<0.01**
Age at first schizophrenia diagnosis (year)	0.97 (0.97~0.98)	**<0.01**	0.98 (0.97~0.98)	**<0.01**
Male (ref = female)	1.21 (1.21~1.31)	**<0.01**	1.12 (1.04~1.22)	**0.01**
Early initiation phasea (ref = late initiation phaseb)	0.88 (0.81~0.96)	0.02	0.99 (0.9~1.09)	0.78
Policy effect				
After the MHA amendment (ref = before the amendment)	1.05 (0.97~1.14)	0.26	1.08 (0.98~1.18)	0.11
Psychiatric comorbidities				
Depressive disorder (ref = no)	1.62 (1.33~1.96)	<0.01	1.22 (0.93~1.62)	0.15
Anxiety disorder (ref = no)	1.46 (1.22~1.76)	<0.01	0.97 (0.76~1.22)	0.77
Bipolar disorder (ref = no)	1.62 (1.35~1.95)	<0.01	1.3 (1.03~1.63)	**0.03**
Substance use disorder (ref = no)	2.34 (1.74~3.15)	<0.01	1.77 (1.3~2.4)	**<0.01**
Charlson Comorbidity Index score (ref = 0)				
1	1.27 (0.98~1.65)	0.07	1.33 (1.02~1.73)	**0.04**
2	1.15 (0.64~2.08)	0.64	1.38 (0.76~2.51)	0.29

The associations were analyzed using Cox proportional hazards models.
aEarly initiation phase: Home care case management treatments were initiated ≤3 years after the first diagnosis of schizophrenia.
bLate initiation phase: Home care case management treatments were initiated >3 years after the first diagnosis of schizophrenia.
*Adjusted models: Adjusted for all the other variables listed in this table except for the independent variables.
Abbreviations: CI, confidence interval; MHA, Mental Health Act; ref, reference.

hospitalization compared to other groups; 2) the annual incidence of psychiatric hospitalization decreased significantly after the initiation of home care CM treatments. However, we observed no beneficial effect of these treatments on suicide attempts; 3) young age, substance use disorder, bipolar disorder, and male sex were identified as risk factors associated with increased likelihood of psychiatric hospitalization during the follow-up period.

Our study demonstrated that home care CM treatment significantly decreased the annual incidence of psychiatric hospitalization, like previous reports [20,21,32,33]. Additionally, the findings indicate that the high intensity of home care CM treatment within the first year after diagnosis is significantly associated with both the likelihood of subsequent psychiatric hospitalization and its long-term effectiveness in patients newly diagnosed with schizophrenia. In Taiwan, the outreach home care CM treatment is a non-intensive CM model with a high caseload and lower visit frequency that is derived from the intensive case management model. This program provides the direct provision of medications and the evaluation of possible drug adverse effects to patients with severe mental illness. The program also delivers direct psychosocial interventions like psychotherapy, psychoeducation, and counseling, as well as linkage to other resources for both patients and their families in the community [19]. Hypothetically, these services would help manage the risk factors of relapse such as lack of insight, non-adherence with antipsychotics, poor premorbid adjustment and care givers' criticism [12-14]. Maintaining patients' medication adherence and enhancing their insight are the major objectives of home care CM treatment in Taiwan. This may explain why patients with schizophrenia experienced significantly decreased hospitalization rates after receiving home care services.

The effect of community mental health teams on suicide in severe mental illness is scarce and inconclusive [20,25,32]. In our study, the annual attempted suicide rates range from 1.5% to 3% in 3 home care groups during the study period, which is lower than in recent large cohort studies [34]. However, the effect of home care CM treatment on suicide attempt did not reach statistical significance. Although we observed a decreasing trend in the annual incidence of suicide attempts in the high group, the difference was not significant.

In our study, 70% of participants who received the home care CM treatment were in their early course of schizophrenia. This stage is characterized by a high risk of suicide [35,36] and high rate of relapse [10,11]. Previous studies have shown that early-course schizophrenia patients with a history of suicide attempts require more intensive treatment. Taiwan's home care CM program is designed to offer several key services, including symptom stabilization through direct provision of medications, coping skill enhancement, and employment and welfare assistance. Theoretically, these services might help prevent suicide [37]. However, due to limited insurance policy coverage, each patient receives a maximum of two home care CM treatments per month which may be insufficient for suicide crisis interventions in this vulnerable population. Therefore, to enhance suicide prevention, the monthly limits on home care CM treatments should be reconsidered for this high-risk group. There is a need for a specialized, assertive early intervention program that incorporates systematic risk assessment and a structured aftercare program for this population.

Patients with co-occurring substance use disorder and bipolar disorder and male sex were risk factors associated with psychiatric hospitalization during the 5-year follow-up period. A systematic

review [14] of longitudinal studies reported that persistent substance use disorder significantly increase the risk of relapse in the early course of psychosis. Some of the risk factors for relapse are traditional treatment targets of home care CM model, whereas other risk factors (e.g., substance use disorder) pose a challenge for the multidisciplinary team. To optimize the home care CM model, clinicians and home care CM team should encourage patients to regularly receive monthly interventions. In addition to managing with vigilance on these risk factors, particularly for patients with irregular visits, active collaboration with addiction specialist to overcome the challenge of substance use disorder is recommended.

The worldwide prevalence rate of home care visit services in patients with schizophrenia is rare. Our study showed that approximately 7% of patients received home care visiting services in patients with schizophrenia; although the prevalence rate increased after 2007 due to policy support; however, it is still lower than 10%. Several factors would influence patients receiving home visit services, such as patients' or psychiatrist' perception, the severity of the illness, the patient's support system and insurance coverage [38]. Future comprehensive research to explore the factors for patients, family, and clinician attitudes towards for receive home care services is needed.

Limitations and implications for future research

Several limitations should be addressed. First, the use of health insurance administrative data limited our ability for fidelity measurement, which is essential for interpreting the findings of case management studies [39]. Nevertheless, each hospital offering home care CM treatments in Taiwan is subject to periodic review and accreditation by the Taiwan Joint Commission on Hospital Accreditation, an independent nongovernmental organization. Furthermore, the treatments delivered under the home care CM program are periodically audited by the Taiwan NHI administration. Second, because of the nature of the claims database, the possibility of bias due to unmeasured confounders such as symptom severity, cognitive function, social support, patient satisfaction with the treatments, and clinicians' personal preferences cannot be fully ignored. Third, we analyzed suicide attempts on the basis of emergency department visits or hospitalizations; this method might have led to a sample biased toward high disease severity, possibly resulting in the overestimation of suicide risk. In Taiwan, a National Suicide Surveillance System for reporting suicide deaths and suicide attempts that captures highly precise incidence of suicidal behavior was established in 2006 to facilitate the early detection [40]. However, we were unable to link the NHIRD to the database of the surveillance system because of law enforcement related to privacy protection. Fourth, data regarding several known risk factors for suicide including marital status, employment status, and recent loss were not available for analysis. Finally, we analyzed only individuals with newly diagnosed schizophrenia who had received home care CM treatments in Taiwan; this might have limited the generalizability of our findings.

Implications for policy and practice

Our study demonstrates that the home care CM model significantly reduced the annual incidence and risk of psychiatric hospitalization during a 5-year follow-up period. Patients who received more than 12 times home care case management interventions within the first year had a 49% decrease in risk of psychiatric hospitalization compared to those who received interventions less than 7 times within the first year. In this model, nurses play a crucial role in providing medical services such as delivering antipsychotic drugs, monitoring drug compliance, checking physical and mental status, giving information, and supporting caregivers for patients with schizophrenia in a community setting. By establishing a trusting nurse-patient relationship and discovering patient needs, nurses can help patients early in receiving home care CM services and support patients to receive home care services at least 12 times a year to stabilize their illness. Nurses should develop tailored treatment strategies for patients with co-occurring substance use disorders and bipolar disorders to decrease relapse.

Conclusions

Patients with newly diagnosed schizophrenia are at high risk of relapse and suicide during their early course of the illness. The home care CM treatment not only decreased annual incidence of psychiatric hospitalization, with high treatments within the first year, the beneficial effect maintained for a long period. Thus, more active consideration of home care CM treatment as a strategy to prevent further functional deterioration and brain damage related to relapse should be encouraged. Regarding to suicide preventions, there is a need of implementation efforts to incorporate systematic suicide risk assessment and crisis interventions into the home care program for this high-risk population. Tailored treatment strategies are needed for patients with co-occurring substance use and bipolar disorders to prevent relapse.

Ethical Approval

This study was reviewed and approved by the institutional review board of Bali Psychiatric Center, Taiwan. (approval number: 1110314-06). All procedures performed in this study were in accordance with the ethical standards of the institutional or national research committee.

Funding

This study was supported by grants from the National Science and Technology Council, Taiwan (111-2341-B-715-006), MacKay Medical College (MMC-RD-111-2B-P002), and Bali Psychiatric Center, Taiwan (MOHW-11102). The funders had no role in the design and conduct of the study; the interpretation of the data or approval of the manuscript; or decision to submit the manuscript for publication. The funder had no role in the study design, study conduct, data interpretation, manuscript approval, or decision to submit the manuscript for publication.

Conflicts of Interest

All authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Author Contributions

Su-Chen Fang: Conceptualization, Methodology, Software, Supervision, Writing- Original draft preparation. Cheng-Yi Huang: interpreted the data, rigorously revised the manuscript and Funding acquisition. Yu-Hsuan Joni Shao: Resources. Jin-Biau Li, Chi-Ling Chou and Jui-Chen Liao: Validation. Wan-Hsiang Tai and Sheng-Miauh Huang: Reviewing and Editing.

Acknowledgments

We are grateful to the Health Data Science Center, Ministry of Health and Welfare, Taiwan for providing insurance claims data, administrative and technical support.

Data Availability

Data are available, although not publicly, on Taiwan's National Health Insurance Research Database. Requests for data can be sent as a formal proposal to the Health and Welfare Data Science Center, Ministry of Health and Welfare, Taiwan.

References

1. World Health Organization. Schizophrenia. Internet. World Health Organization. Sep 16, 2022.
2. Silberstein J, Harvey PD (2019) Cognition, social cognition, and Self-assessment in schizophrenia: prediction of different elements of everyday functional outcomes. CNS Spectr 24: 88-93.
3. GBD 2019 Mental Disorders Collaborators (2022) Global, regional, and national burden of 12 mental disorders in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. The Lancet Psychiatry 9: 137-150.
4. Lafeuille M-H, Laliberté-Auger F, Lefebvre P, Frois C, Fastenau J, et al. (2013) Impact of atypical long-acting injectable versus oral antipsychotics on rehospitalization rates and emergency room visits among relapsed schizophrenia patients: a retrospective database analysis. BMC Psychiatry. 13: 221.
5. Messias EL, Chen CY, Eaton WW (2007) Epidemiology of schizophrenia: review of findings and myths. Psychiatr Clin North Am 30: 323-338.
6. Akinsulore A, Mapayi BM, Aloba OO, Oloniniyi I, Fatoye FO, et al. (2015) Disability assessment as an outcome measure: a comparative study of Nigerian outpatients with schizophrenia and healthy control. Ann Gen Psychiatry14: 40.
7. Jablensky A (2000) Epidemiology of schizophrenia: the global burden of disease and disability. Eur Arch Psychiatry Clin Neurosci 250: 274-285.
8. Fakorede OO, Ogunwale A, Akinhanmi AO (2020) Disability among patients with schizophrenia: A hospital-based study. Int J Soc Psychiatry 66: 179-187.
9. Zaheer J, Olfson M, Mallia E, Lam JSH, de Oliveira C, et al. (2020) Predictors of suicide at time of diagnosis in schizophrenia spectrum disorder: A 20-year total population study in Ontario, Canada. Schizophr Res 222: 382-388.
10. Kazadi N, Moosa M, Jeenah F (2008) Factors associated with relapse in schizophrenia. S Afr J Psychiatr 14: 52-62.
11. Eaton WW, Mortensen PB, Herrman H, Freeman H, Bilker W, et al. (1992) Long-term Course of Hospitalization for Schizophrenia: Part I. Risk for Rehospitalization. Schizophr Bull 18: 217-228.
12. Law MR, Soumerai SB, Ross-Degnan D, Adams AS (2008) Ross-Degnan D, Adams AS. A longitudinal study of medication nonadherence and hospitalization risk in schizophrenia. J Clin Psychiatry 69: 47-53.
13. Perkins DO (2002) Predictors of noncompliance in patients with schizophrenia. J Clin Psychiatry 63: 1121-1128.
14. Alvarez-Jimenez M, Priede A, Hetrick SE, Bendall S, Killackey E, et al. (2012) Risk factors for relapse following treatment for first episode psychosis: a systematic review and meta-analysis of longitudinal studies. Schizophr Res 139: 116-128.
15. World Health Organization. Comprehensive mental health action plan 2013–2030.
16. National Institute for Health and Care Excellence (NICE). Psychosis and schizophrenia in adults: prevention and management (Clinical guideline no. 178). National Institute for Health and Care Excellence.
17. Hsu W-T, Wu H-C, Chou F (2017) A history of mental health laws in Taiwan. Taiwan J Psychiatry 31: 195-203.
18. Mueser KT, Bond GR, Drake RE, Resnick SG (1998) Models of community care for severe mental illness: a review of research on case management. Schizophrenia bulletin 24: 37-74.
19. Chen WY, Hung YN, Huang SJ, Pan CH, Su SS, et al. (2019) Nationwide analysis of medical utilization in people with severe mental illness receiving home care case management. Schizophrenia Research 208: 60-66.
20. Malone D, Newron-Howes G, Simmonds S, Marriot S, Tyrer P (2007) Community mental health teams (CMHTs) for people with severe mental illnesses and disordered personality. Cochrane Database Syst Rev 2007: Cd000270.
21. Chang YC, Chou FHC (2015) Effects of home visit intervention on re-hospitalization rates in psychiatric patients. Community Ment Health J. 51: 598-605.
22. Kurt A, Ersan EE (2021) Comparison of Hospitalization Rate and Social Functioning of Patients Receiving Community Mental Health Service and Outpatient Psychiatry Policlinic. Psychiatr Danub 33: 532-540.
23. Creed F, Tyrer P (1995) Evaluation of community treatments for acute psychiatric illness. Community psychiatry in action: Analysis and prospects. 1995:11-27.
24. Merson S, Tyrer P, Onyett S, Lack S, Birkett P, et al. (1992) Early intervention in psychiatric emergencies: a controlled clinical trial. Lancet 339: 1311-1314.
25. Pirkola S, Sund R, Sailas E, Wahlbeck K (2009) Community mental-health services and suicide rate in Finland: a nationwide small-area analysis. Lancet. 373: 147-153.
26. Hsiao WC, Cheng SH, Yip W (2019) What can be achieved with a single-payer NHI system: The case of Taiwan. Soc Sci Med 233: 265-271.
27. Lin LY, Warren-Gash C, Smeeth L, Chen PC (2018) Data resource profile: the National Health Insurance Research Database (NHIRD). Epidemiol Health 40: e2018062.
28. Hsing AW, Ioannidis JP (2015) Nationwide Population Science: Lessons From the Taiwan National Health Insurance Research Database. JAMA Intern Med 175: 1527-1529.
29. World Health Organization. International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10)-2014-WHO Version for ;2014. Accessed Sep. 18, 2022.
30. National Health Insurance Administration MoHaW, Taiwan,. Copayments.
31. Sundararajan V, Henderson T, Perry C, Muggivan A, Quan H, et al. (2004) New ICD-10 version of the Charlson comorbidity index predicted in-hospital mortality. J Clin Epidemiol 57: 1288-1294.
32. Simmonds S, Coid J, Joseph P, Marriott S, Tyrer P (2001) Community mental health team management in severe mental illness: a systematic review. Br J Psychiatry 78: 497-502; discussion 503-505.
33. Chang L-R, Lin Y-H, Chang H-CW, et al. (2013) Psychopathology, rehospitalization and quality of life among patients with schizophrenia under home care case management in Taiwan. J Formos Med Assoc 112: 208-215.
34. Schmutte T, Costa M, Hammer P, Davidson L (2021) Comparisons between suicide in persons with serious mental illness, other mental disorders, or no known mental illness: Results from 37 US states, 2003–2017. Schizophr Res 228: 74-82.
35. Wiersma D, Nienhuis FJ, Slooff CJ, Giel R (1998) Natural course of schizophrenic disorders: a 15-year followup of a Dutch incidence cohort. Schizophr Bull 24: 75-85.
36. Nordentoft M, Madsen T, Fedyszyn I (2015) Suicidal behavior and mortality in first-episode psychosis. J Nerv Ment Dis 203: 387-392.
37. Huang XY, Lin MJ, Yang TC, Hsu YS (2010) The functions of hospital-based home care for people with severe mental illness in Taiwan. J Clin Nurs 19: 368-379.
38. Burr C, Richter D (2021) Predictors of community mental health nursing services use in Switzerland: Results from a representative national survey. Int J Ment Health Nurs 30:1640-1648.
39. Dixon LB, Schwarz EC (2014) Fifty years of progress in community mental health in US: the growth of evidence-based practices. Epidemiol Psychiatr Sci 23: 5-9.
40. Siu WHS, Juang YY, Huang TM, et al. Effectiveness of aftercare program for suicide ideators: Real-world evidence from National Suicide Surveillance System in Taiwan. Medicine (Baltimore) 101: e31192.