



Original Article

Factors predicting discharge after two years for inpatients in the psychiatric long-term care wards who can walk independently

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Abstract. [Purpose] The purpose of this study was to investigate the factors that affected the discharge of walkable patients admitted to psychiatric long-term care wards. [Participants and Methods] The participants were walkable patients admitted to psychiatric long-term care wards at three different hospitals in Japan. The baseline assessments of all 73 patients were conducted between September and December 2018. During the 2 year follow-up period, five patients died, while 68 were included in the analysis. The baseline assessment includes the basic information of the participants and the risk of locomotive syndrome. [Results] In the comparisons between the discharged (n=12) and hospitalizing groups (n=56), the age, length of stay, and two-step and stand-up test scores at the baseline assessment were significantly different. The multiple logistic regression analysis, which discriminates between the two groups, adopted age as a significant variable in the baseline assessment as a predictor of dischargeability (odds ratio: 1.08; 95% confidence interval: 1.01, 1.16). [Conclusion] Age was considered to be a discharge likelihood predictor, as it affects the decline in motor function, such as locomotive syndrome, as well as the social resources that would be needed after discharge, such as family support.

Key words: Psychiatric long-term care wards, Discharge, Locomotive syndrome

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INTRODUCTION

Deinstitutionalization is an ongoing process worldwide for patients with psychiatric disease¹⁾. In Japan, the number of psychiatric beds per 100,000 people in 1998 was 287, the highest in the world²⁾, with an average length of stay (LOS) of 277.1 days for psychiatric and behavioral impairment treatment³⁾. Moreover, long hospitalization in psychiatric long-term care wards is common, with 51.1% and 82.2% of inpatients having an LOS exceeding 5 years and exceeding 1 year, respectively⁴⁾.

Various studies have examined the factors affecting prolonged LOS among psychiatric disease inpatients. Longer LOS has been associated with older age, male gender, ethnicity, accommodation and family environment, multiple psychiatric diagnoses, medical-psychiatric comorbidity, and restraints during current admission⁵⁻⁸⁾. In Japanese studies, older age, no ambulance use, involuntary admission, and lower Global Assessment of Functioning scores were factors identified leading to a longer LOS for inpatients with psychiatric disease^{9, 10)}. However, few studies have analyzed the relationship between

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physical functioning and LOS.

There were some reports on the physical functioning of people with psychiatric disease, especially schizophrenia, where premature aging, weight gain, reduced daily functioning, and increased metabolic and cardiovascular were the reported risks¹¹). Low physical fitness in people with schizophrenia was associated with illness duration; smoking; the presence of metabolic syndrome; and more severe negative, depressive, and cognitive symptoms¹²).

In this study, we focused on the locomotive syndrome¹³), occurring in the elderly who have come to need nursing care services due to locomotor appendage problems or risk conditions that may require such services in the future¹⁴), as a low physical function factor that may prevent patients with psychiatric disease from being discharged. Some inpatients with psychiatric disease reports related age to prolonged LOS^{5,9}). The association between locomotive syndrome and prolonged LOS may be due to the close relationship between the age and locomotive syndrome. However, to best of our knowledge, no studies on this relationship have been performed.

In order to elucidate the factors that prevent patients admitted to psychiatric long-term care wards from discharge even though they are able to walk independently, the purpose of this study was to investigate the factors affecting the discharge of patients.

PARTICIPANTS AND METHODS

This was a longitudinal, multi-institutional study, with 203 patients admitted to psychiatric long-term care wards at three different hospitals in Japan, excluding individuals for inability to walk without a cane, failure to provide consent, and missing data. The two-step test, which was a locomotive syndrome evaluation index, requires a degree of physical function, allowing walking without a cane. Therefore, the participants who could walk independently without a cane or any walking aid were selected, with baseline assessments conducted between September and December 2018 for 73 patients. During the 2 year follow-up period, five people died, while 68 patients were included for analysis (Fig. 1).

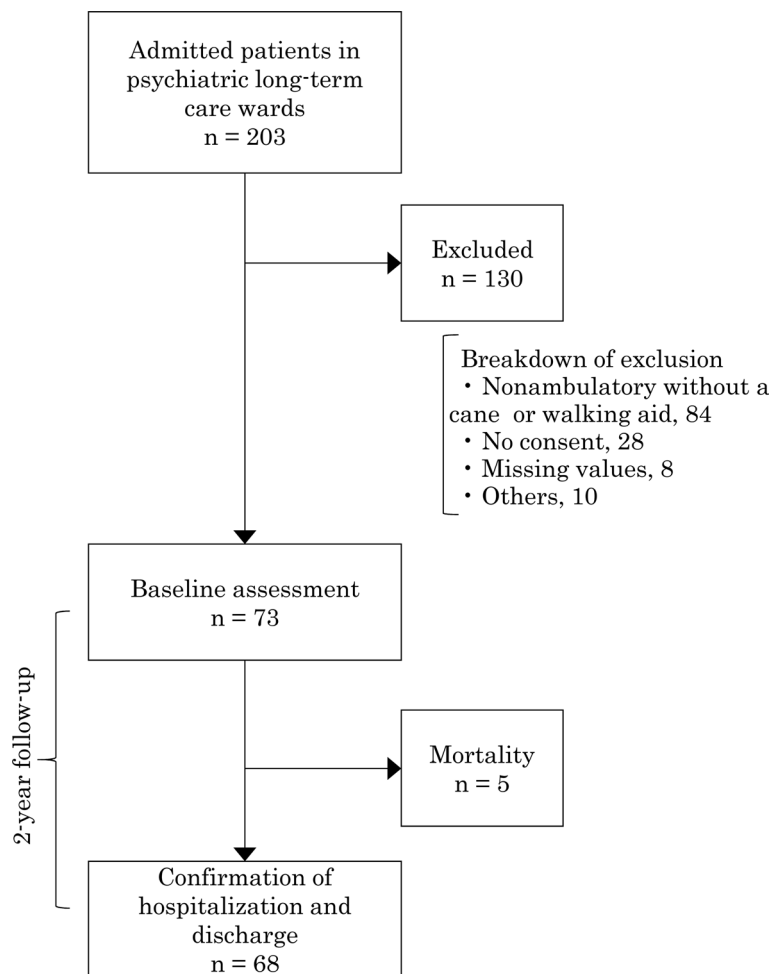


Fig. 1. Flowchart of participant selection.

The study was conducted in accordance with the tenets of the Declaration of Helsinki and was approved by the Ethics Committee of Hirakawa Hospital (approval number: H30-1).

The baseline assessment included the participants' basic information and the locomotive syndrome risk. The basic information obtained from medical records was age, gender, F code (F0 to F9) in the ICD-10 Classification of Mental and Behavioral Disorders, LOS, and chlorpromazine equivalent dose of antipsychotics (CP dose).

To assess the locomotive syndrome risk, the 25-question Geriatric Locomotive Function Scale (GLFS), a two-step test, and stand-up test were administered¹⁵⁾. The 25-question GLFS was a self-administered, comprehensive measure consisting of 25 items assessing pain, daily living activities, social functioning, and mental health¹⁶⁾. The 25 items were scored on a five-point scale ranging from 0 (no impairment) to 4 (severe impairment), which were then added to calculate the total score (minimum=0, maximum=100 points). The higher the score obtained on the 25-question GLFS, the worse the locomotive function. The scale's validity and relationship with disability from locomotive syndrome had been assessed¹⁷⁾ using the two-step test, which measured stride length assessing walking ability, muscle strength, balance, and lower limb flexibility. The participants started from a standing position and moved two steps forward with the widest stride they could possibly manage without losing balance. If they succeeded in holding the final standing position longer than 3 seconds without any additional steps, the trial was judged as completed. The distance was then standardized by dividing it by the participant's height. The test was performed twice, recording the best result¹⁸⁾. The stand-up test assessed leg strength by having the participant stood up on one or both legs from the seats of specified heights, 40 cm, 30 cm, 20 cm, and 10 cm. The participant stood up from each seat, first with both legs and then with one leg. If the participant could stand up without leaning back to gain momentum and maintain the posture for 3 seconds, then the participant was considered to have passed that height level. In this study, if the participant could stand up with one leg, he or she was given 8 to 5 points, while 4 to 1 point was given if they are able to stand up with both legs. Additionally, with each seat height increment, 1 point was deducted.

The independence level in the activities of daily living (ADL) was evaluated with the Barthel Index, which is an ordinal scale for the functional assessment of disability, with verified validity and reliability¹⁹⁾, and widely used in neurological and orthopedic disorder outcome research.

During the 2 year follow-up period, patients who had been discharged to home or group home were defined as the discharged group, while patients who were hospitalizing were defined as the hospitalizing group. Information about hospitalizing or discharged group was examined from the medical records.

For statistical analysis, the participants' age, gender, F code, LOS, CP dose, 25-question GLFS score, two-step test score, stand-up test score, and Barthel Index were compared between the two groups, where the effect size was calculated with the Welch two-sample t-test (Hedges' g), Fisher's exact test (ϕ or Cramer's V), and Wilcoxon rank-sum test (Cliff's Δ). Correlation and partial correlation coefficients of the items that differed significantly between the two groups were analyzed using the Pearson product-moment and Spearman's rank correlation coefficient tests. Multiple logistic regression analysis was performed to identify the factors that predicted discharge, in which items with significant differences between the groups were treated as independent variables. The variance inflation factor (VIF) of independent variables was calculated. To assess how well the model could discriminate between the discharged and the hospitalizing groups, receiver operating characteristic (ROC) analysis, the area under the curve (AUC), sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were used. We conducted all analyses using R version 3.5.1, with a threshold significance of $p < 0.05$.

RESULTS

In the comparisons between the discharged ($n=12$) and hospitalizing groups ($n=56$), the age, LOS, and two-step and stand-up test scores at the baseline assessment were significantly different (Table 1). The correlation matrix of variables was significantly different between the two groups at the baseline assessments (Table 2).

Multiple logistic regression analysis adopted age as a significant dischargeability predictor variable in the baseline assessment (odds ratio: 1.08; 95% CI: 1.01, 1.16) (Table 3). Figure 2 showed the ROC curve for discriminating whether or not a patient would be discharged using a logistic regression model with age as an independent variable. The AUC of the ROC curve and cutoff value for predicting discharge were 0.85 and 55 years, respectively, with 73% sensitivity, 91% specificity, 97.6% PPV, and 42.3% NPV.

DISCUSSION

In this study, the factors, including locomotive syndrome, which affected the discharge of patients admitted to psychiatric long-term care wards were analyzed.

The comparison between the discharged and hospitalizing groups revealed older patients with a longer LOS, worse two-step test scores, and worse stand-up test scores for the hospitalizing group (Table 1). The age results were consistent with previous studies^{5, 9)}, which was likely because the number of comorbid diseases other than psychiatric disorders increases with age. Previous Japanese research reported that the most common discharge destination for patients hospitalized in a psychiatric ward for one year or longer was a psychiatric ward in another hospital (47.4%)²⁰⁾, making it clear how difficult it is to discharge patients with long-term hospitalization experience to the community.

Table 1. Comparison of the characteristics between the discharged and hospitalizing groups

	Overall n=68	Discharged n=12	Hospitalizing n=56	p (effect size)
Age (years)	57.2 ± 13.9	41.5 ± 15.8	60.6 ± 10.9	0.001 (1.08) a
Female, % (n)	44.1 (30)	41.7 (5)	44.6 (25)	1.00 (0.02) b
F code, % (n)	F0: 0 (0)	F0: 0 (0)	F0: 0 (0)	1.00 (0.16) c
	F1: 1.5 (1)	F1: 0 (0)	F1: 1.8 (1)	
	F2: 86.8 (59)	F2: 83.3 (10)	F2: 87.5 (49)	
	F3: 8.8 (6)	F3: 8.3 (1)	F3: 10.6 (5)	
	F4: 0 (0)	F4: 0 (0)	F4: 0 (0)	
	F5: 0 (0)	F5: 0 (0)	F5: 0 (0)	
	F6: 0 (0)	F6: 0 (0)	F6: 0 (0)	
	F7: 2.9 (2)	F7: 8.3 (1)	F7: 2.1 (1)	
	F8: 0 (0)	F8: 0 (0)	F8: 0 (0)	
	F9: 0 (0)	F9: 0 (0)	F9: 0 (0)	
LOS (days)	3,423.8 ± 3,979.5	1,167.2 ± 1,020	3,907.3 ± 4,211.2	<0.001 (0.70) a
CP dose (mg/day)	491.7 ± 501.84	486.5 ± 629.6	492.9 ± 477.0	0.97 (0.01) a
25-question GLFS	14.5 (8.5, 48)	13.5 (8.25, 40)	15 (8.5, 48)	0.61 (0.10) d
Two-step test	1.06 ± 0.33	1.35 ± 0.35	1.00 ± 0.29	0.006 (1.12) a
Stand-up test	4 (3, 6)	5 (4.75, 6)	4 (3, 6)	0.003 (0.53) d
Barthel Index	100 (100, 100)	100 (100, 100)	100 (95, 100)	0.19 (0.10) d

F code: F code (F0 to F9) in the ICD-10 Classification of Mental and Behavioral Disorders.

F0: Mental disorders due to known physiological conditions.

F1: Mental and behavioral disorders due to psychoactive substance use.

F2: Schizophrenia, schizotypal, delusional, and other non-mood psychotic disorders.

F3: Mood [affective] disorders.

F4: Anxiety, dissociative, stress-related, somatoform, and other nonpsychotic mental disorders.

F5: Behavioral syndromes associated with physiological disturbances and physical factors.

F6: Disorders of adult personality and behavior.

F7: Intellectual disabilities.

F8: Pervasive and specific developmental disorders.

F9: Behavioral and emotional disorders with onset usually occurring in childhood and adolescence.

LOS: Length of stay; CP dose: Chlorpromazine equivalent dose of antipsychotics; 25-question GLFS: 25-question Geriatric Locomotive Function Scale.

p*<0.01, *p*<0.001, NS: Not significant.

a: Welch two-sample *t*-test, Hedges' *g*.

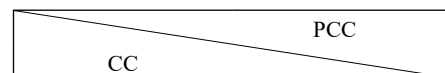
b: Fisher's exact test, ϕ .

c: Fisher's exact test, Cramer's *V*.

d: Wilcoxon rank-sum test, Cliff's Δ .

Table 2. Correlation matrix of the variables which was significantly different between the two groups at baseline assessments

	Age	LOS	Two-step	Stand-up
Age	1.00	0.02	-0.42***	-0.35**
LOS	0.25*	1.00	-0.27*	-0.12
Two-step	-0.57***	-0.37*	1.00	0.25*
Stand-up	-0.52***	-0.28*	0.49***	1.00

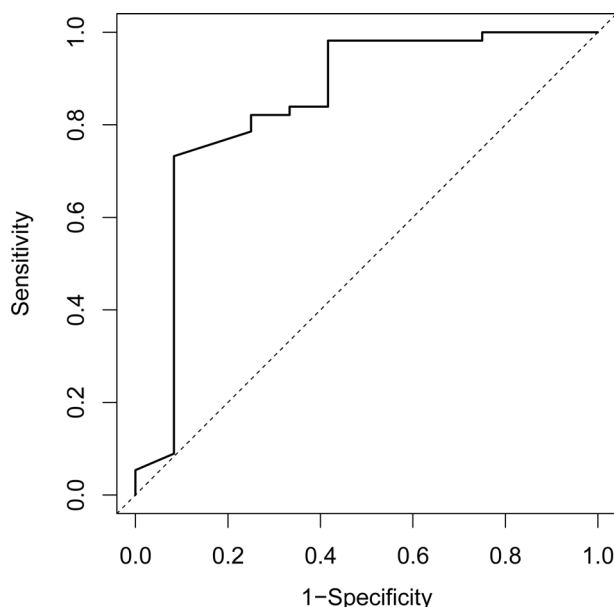


LOS: Length of stay; Two-step: Two-step test score; Stand-up: Stand-up test score; PCC: Partial correlation coefficient; CC: Correlation coefficient.

p*<0.05, *p*<0.01, ****p*<0.001.

Table 3. Multivariate logistic regression analysis of factors predictive of discharge outcomes

	Crude OR (95% CI)	Adjusted OR (95% CI)	p	VIF
Age	1.12 (1.05, 1.19)	1.08 (1.01, 1.16)	0.023	1.61
Length of stay	1.00 (1.00, 1.00)	1.00 (1.00,1.00)	0.096	1
Two-step test	0.02 (0.00, 0.23)	0.16 (0.01, 3.46)	0.232	1.1
Stand-up test	0.40 (0.19, 0.82)	0.81 (0.39, 1.67)	0.546	1.15



AUC (95% CI): 0.85 (0.69, 1.00)
Cutoff value: 55 years
Sensitivity: 0.73
Specificity: 0.91
PPV: 97.6%
NPV: 42.3%

Fig. 2. ROC curve for logistic regression model.

There were significant differences between the two groups with respect to the two-step test and stand-up test scores, suggesting that a slight physical functioning decline, even if the ADL can still be performed without assistance, might have a negative effect on the discharge. Activity limitations associated with locomotive syndrome has been reported to appear in the following order: sports activity, walking, transferring, and self-care²¹). Therefore, patients in this study may have experienced decreased physical functioning, affecting their social life, such as their ability to do housework and socialize. There was no significant difference in the 25-question GLFS score between the two groups, although there were significant differences in the two-step test and stand-up test scores, inferring that some patients with psychiatric disease overestimated or underestimated their own health status and did not present corresponding results on both tests. Regarding the F code, F2 (schizophrenia, schizotypal, delusional and other non-mood psychotic disorders) was the most common in both groups, showing no difference between the groups. In this study, CP dose was not related to the discharge, although tardive dyskinesia associated with antipsychotic treatment is known to affect the lower-body physical functioning in patients with schizophrenia²²). The Barthel Index was perfect for many patients, showing the ceiling effect of the evaluation, although revealing no difference between the two groups.

The correlation coefficient test for the variables that differed significantly between the discharged and hospitalizing groups showed significant correlations between all variables. Furthermore, partial correlation coefficient test showed weaker associations between LOS and other variables and moderate correlations between age and the two-step test and stand-up test scores, which were locomotive syndrome indicators (Table 2). This was the same result as in a previous study²³). The locomotive syndrome has been associated with syndromes that increase with age, such as the metabolic syndrome²⁴), cognitive impair-

ment²⁵), and sarcopenia²⁶). The study results also revealed a strong influence of age in the association between variables.

The multivariate logistic regression analysis showed age as an adopted discharge predictor, while other variables were not. The results could be attributed to be relatively strong relationship of age as an influence on discharge, as described in the above partial correlation coefficient analysis. In a comparison between the two groups, a significant difference was found between the two-step test and stand-up test scores, with a large effect size^{27, 28}) of 1.12 and for the Hedges' *g* in the two-step test score and Cliff's Δ in the stand-up test score, respectively. However, it was not adapted as a significant independent variable in the logistic regression analysis, due to its small sample size of 12 in the discharge group. In the logistic regression equation with age as the independent variable, the cutoff value to determine whether the patient would be discharged after two years was 55 years, inferring that age could influence the support level, such as family members, that could be taken into account in discharge plan developing. If the patient is older than 55 years old, the family members who would assist the patients after discharge, such as the parents, would be even older, suggesting impracticality of discharging to home.

One of the study's limitations is the small sample size. In the medical literature, an event per variable of 10 is widely used as the lower limit for developing logistic regression model for risk prediction²⁹). In the present study, the number of discharges during the 2 year study was as few as 12 people. However, a comparison between the discharged and the hospitalizing groups showed a significant difference between the two-step test and stand-up test scores and a large effect size, suggesting that future studies should be conducted with increased sample size. In this study, the patients discharged to home, and those discharged to group homes and other facilities were defined as the discharged group and analyzed. Although discharge to home and discharge to a group home or other facilities may have different social resources available after discharge, this study limitation was that we were unable to investigate the social resources that can be expected. These limitations need to be resolved for further research to be done in the future. In addition, since this study focused on the effect of locomotive syndrome on discharge, it included patients who could walk independently without a cane or any walking aid. However, with the use of social resources, patients can be discharged from the hospital even if they cannot walk independently. Therefore, in the future, it is necessary to analyze the effect of motor functions on discharge for patients who cannot walk.

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None.

Conflict of interest

The authors declare no conflicts of interest associated with this manuscript.

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