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ORIGINAL ARTICLE

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Neurocognitive differences between inpatients and outpatients with symptomatically nonremitted schizophrenia: A cross-sectional study

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Abstract

Purpose: We aimed to examine whether neurocognition in individuals with nonremitted schizophrenia differed between inpatients and outpatients.

Design and methods: We recruited 59 inpatients and 41 patients with nonremitted schizophrenia (assessed with the Andreason criteria), and neurocognitive functions were compared between both, controlling for demographics, psychiatric symptoms.

Findings: Outpatients with nonremitted schizophrenia performed better on tests of processing speed, visual attention, and working memory than did inpatients with nonremitted.

Practice implications: To facilitate discharge for nonremitted inpatients, nursing could focus on processing speed, e.g., arranging the environment such that patients do not need quick responses.

KEYWORDS
early discharge, neurocognition, nonremitted, reaction time, schizophrenia

1 | INTRODUCTION

In several Asian countries, but particularly in Japan, there is a large number of patients with schizophrenia who are long-stay inpatients in psychiatric hospitals, and the average length of hospital stay is approximately 270 days.[1] This has been recognized as a significant problem in the Japanese psychiatric care system. Despite attempts by the government to reduce patient stays in hospital, the problem remains. Therefore, improved psychiatric nursing could allow more effective discharge of patients with schizophrenia into the community.

Generally, the severity of a patient's psychiatric symptoms is an important consideration when psychiatric staff members consider the possibility that a patient should be discharged. However, while some patients who are symptomatically nonremitted should remain hospitalized, it is possible for some such patients to be discharged and effectively supported in the community. Therefore, it can be questioned why some patients with nonremitted schizophrenia can be discharged, while others require continued support as an inpatient.

One potential difference determining whether nonremitted patients are suitable for discharge is cognitive function. In a follow-up of long-stay patients with schizophrenia, Shimono et al.[2] reported that, in addition to symptom severity, the severity of cognitive dysfunction at baseline predicted difficulties in patients' discharge after 2.5 years. The results suggest that psychiatric nursing aiming to facilitate discharge should consider a patient's cognitive function. However, another report of psychiatric nursing practice for patients with schizophrenia suggests that consideration of cognitive function is limited.[3]

Cognitive dysfunction is a well-known feature of patients with schizophrenia alongside their psychiatric symptoms.[4] The Measurement and Treatment Research to Improve Cognition in Schizophrenia consortium propose that cognitive function in patients with schizophrenia consists of seven neurocognitive domains,[5] with the average severity of dysfunction differing for each neurocognitive domain.[6,7] Therefore, to fully understand the cognitive function of a patient, a test battery measuring several neurocognitive domains should be used. However, scores on several tests, such as the Wisconsin Card Sorting Test and the Continuous Performance Test, which are often included in a test battery may be influenced by the participant's education level or duration.[8] This suggests that a test battery that is not influenced by education should be introduced.

It remains unclear whether neurocognitive differences among symptomatically nonremitted patients could determine which patients

are able to live in the community despite not achieving remission. It should be clarified whether using a test battery that is not influenced by education might facilitate discharge. Therefore, in this study we aimed to elucidate neurocognitive differences between symptomatically nonremitted inpatients and nonremitted outpatients with Cog Health (Cogstate, Melbourne, Australia). Cog Health measures several neurocognitive domains while controlling for the effects of education level or duration. Our results will have implications for improving psychiatric nursing care for nonremitted inpatients with schizophrenia.

2 | METHODS

2.1 | Participants

We recruited inpatients with schizophrenia from two psychiatric hospitals in Tokyo, Japan. Inclusion criteria were as follows: diagnosis of schizophrenia; inpatients; symptomatically nonremitted based on the criteria by Andreasen et al.;[9] and consent for participation from both the patient and treating physician. Exclusion criteria were as follows: less than 20 years old; under isolation or physical restraint; or treated with a lobotomy.

Our aim was to clarify differences in neurocognitive function between inpatients and outpatients with symptomatically nonremitted schizophrenia. To provide data for outpatients with nonremitted schizophrenia, we used data from a previously recruited sample, which have been described in a previously published article.[10]

2.2 | Procedures

This article forms part of a series with our previously published article,[10] and the measurements taken were the same for both studies. The relevant measures are outlined below.

We collected data between January 2009 and October 2012. Interviews and measurements of psychiatric symptoms and neurocognitive function were conducted in a private meeting room on the ward. Interviews were conducted before the neurocognitive tests. All psychometric tests were conducted in a single day for each participant.

2.2.1 | Demographics

Using medical records, we obtained demographic and baseline treatment information (age, sex, age of onset, duration of illness, length of hospital stay, education, and type and dose of medication). Antipsychotic doses were calculated as chlorpromazine equivalents, anxiolytic medications as diazepam equivalents, and anti-Parkinsonian medications as biperiden equivalents.

2.2.2 | Psychiatric symptom

We used the Positive and Negative Syndrome Scale (PANSS), comprising positive, negative, and general psychopathology subscales, to assess current psychiatric symptoms. This scale has been previously tested for validity and reliability, both of which have been demonstrated.[11] The PANSS consists of 30 items that are rated from 1 (absent) to 7 (severe) based on symptom severity over the previous week. In the analysis, we used the three subscale scores and the total PANSS score. Participants who did not meet the remission criteria outlined by Andreasen et al.[9] were defined as having nonremitted schizophrenia.

2.2.3 | Neurocognitive function

To assess neurocognitive function, we used the Cog Health software (Cogstate, Melbourne, Australia), which has been extensively evaluated for reliability and validity.[12] Furthermore, neurocognitive scores obtained from Cog Health are not affected by an individual's duration or level of education.[12] Participants performed the following five tasks, which were displayed on a personal computer: speed of processing (reaction time), visual attention (reaction time), working memory (reaction time, accuracy), visual learning (accuracy), and spatial attention (reaction time). Higher scores indicated better neurocognitive function.

We standardized individual scores on each by setting the mean score to 100 and the standard deviation (SD) to 10. Standardized reference scores were calculated based on the reference group of scores from more than 30 000 healthy individuals included in the Cog Health software, and these were used for comparison with the scores from our sample. This enabled us to compare patient scores with scores from healthy individuals without directly investigating age-matched healthy individuals.

2.3 | Statistical analysis

We performed t-tests to investigate differences in demographic and psychopathological symptom parameters between inpatients and outpatients. Initially, we compared neurocognitive function between symptomatically nonremitted inpatients and healthy age-matched people with a t-test, with 100 representing the average score of age-matched healthy individuals. Subsequently, analyses of covariance (ANCOVAs) were performed to compare neurocognitive functions between inpatients and outpatients while controlling for parameters identified as significantly different in the t-test.

Values of $p < 0.05$ were considered significant. All statistical analyses were performed with SPSS for Windows version 23.0 (SPSS, Chicago, IL, USA).

2.4 | Ethical considerations

The research protocol for this study was approved by the ethics committee of the participating university and by the hospitals in which the participants were treated. Moreover, participants and their doctors were informed about the study's aims and methods with a pamphlet, and patients were free to participate or refuse without consequences. All participants and their doctors provided written consent to participate in the study. All investigations performed during the study were completed in a private room to ensure patient

TABLE 1 Demographics and psychopathological symptoms of participants

	Inpatient Group	Outpatient Group	
	n = 59	n = 41	
	Mean	Mean	p value[a]
Demographics			
Age	58.4 ± 14.60	43.8 ± 12.30	<.001
Age of onset	27.1 ± 10.36	23.9 ± 7.56	.089
Duration of illness (year)	31.3 ± 14.07	20.0 ± 11.88	<.001
Length of stay (month)	157.7 ± 156.94	26.9 ± 52.85	<.001
Dosage of FGA (mg)	253.6 ± 527.81	222.1 ± 465.43	.759
Dosage of SGA (mg)	455.4 ± 382.41	472.7 ± 365.43	.821
Sum dosage of antipsychotics (mg)	709.0 ± 549.92	694.8 ± 565.85	.900
Biperiden (mg)	1.7 ± 2.84	2.2 ± 2.34	.401
Diazepam (mg)	12.7 ± 13.16	14.4 ± 12.19	.498
Psychopathological symptoms			
Positive scale	14.9 ± 4.20	13.4 ± 3.77	.063
Negative scale	22.2 ± 7.20	18.8 ± 5.83	.013
General psychopathology scale	34.2 ± 6.39	27.6 ± 5.35	<.001
Sum of PANSS	71.3 ± 12.71	59.7 ± 10.79	<.001

[a]t-test comparing inpatient group with outpatient group in remitted schizophrenia

privacy. Participants were allowed to rest at any point during the investigation.

3 | RESULTS

3.1 | Participant characteristics

We included 59 inpatients in this study (mean age = 58.4±14.60) and compared their scores with the data from our previous study for 41 outpatients (mean age = 43.8±12.30). As shown in Table 1, there were significant differences between inpatients and outpatients in age, duration of illness, length of stay, and negative, general psychopathological, and total PANSS scores. Inpatients were older, had been ill for longer, and had more severe PANSS scores.

3.2 | Neurocognitive function scores

As shown in Table 2, inpatients had worse scores for all neurocognitive domains than in age-matched healthy people ($p < .0001$). Scores for spatial attention in inpatients were particularly low with a mean reaction time of less than 80. We also compared outpatients with healthy controls (Table 3), and observed fewer differences in neurocognition, which patients showing significantly worse performance for working memory (accuracy, $p = 0.008$) and spatial attention ($p < .0001$).

ANCOVAs showed that reaction times for speed of processing, visual attention, and working memory in the outpatient group were faster than were those in the inpatients group after controlling for confounding variables (age, duration of illness, length of stay, and negative and general psychopathology PANSS scores, Table 4). Among these three neurocognitive domains, speed of processing was lowest in inpatients.

TABLE 2 Comparing neurocognitive function in inpatients and healthy controls

	Inpatient Group	
	n = 59	
Neurocognitive Domain	Mean	*p* value[a]
Speed of processing	88.0 ± 11.25	<.001
Visual attention	92.7 ± 10.10	<.001
Working memory		
reaction time	92.2 ± 7.39	<.001
accuracy	81.2 ± 13.78	<.001
Visual learning	90.5 ± 10.25	<.001
Spatial attention	79.9 ± 14.01	<.001

[a]t-test comparing average score of healthy controls with inpatients.

TABLE 3 Comparing neurocognitive function in outpatients and healthy controls

	Outpatient Group	
	n = 41	
Neurocognitive Domain	Mean	*p* value[a]
Speed of processing	99.3 ± 9.87	.672
Visual attention	101.9 ± 7.44	.105
Working memory;		
reaction time	98.9 ± 7.68	.366
accuracy	95.0 ± 11.40	.008
Visual learning	100.8 ± 11.10	.645
Spatial attention	90.6 ± 7.68	<.001

[a]t-test comparing average scores of healthy controls with outpatients reference data by Kurebayashi (2016).

TABLE 4 Comparing neurocognitive function of inpatients with that of outpatients

Neurocognitive Domain	Inpatient Group *n* = 59 Mean	Outpatient Group *n* = 41 Mean	ANCOVA[a] *p* value
Speed of processing	88.0 ± 11.25	99.3 ± 9.87	.037
Visual attention	92.7 ± 10.10	101.9 ± 7.44	.034
Working memory;			
reaction time	92.2 ± 7.39	98.9 ± 7.68	.047
accuracy	81.2 ± 13.78	95.0 ± 11.40	.316
Visual learning	90.5 ± 10.25	100.8 ± 11.10	.271
Spatial attention	79.9 ± 14.01	90.6 ± 7.68	.671

[a]ANCOVA comparing neurocognitive scores for of inpatients with those of outpatients controlling for age, age of onset, length of stay, and negative and general psychopathology PANSS scores.

4 | DISCUSSION

In this study, we investigated neurocognition in inpatients and outpatients with nonremitted schizophrenia. Our results suggest that the patient group living in the community, despite being symptomatically nonremitted, have better neurocognitive function than do nonremitted inpatients, particularly for speed of processing, visual attention, and working memory. These differences remain when controlling for demographics and psychiatric symptoms.

Our results suggest that outpatients outperform inpatients in several neurocognitive domains (Table 4). Comparelli et al.[13] previously conducted a cross-sectional study to examine whether neurocognitive function of inpatients differs from that of outpatients. Consistent with our results, the authors reported several indicators that neurocognition in outpatients was better than that in inpatients. Similarly, Shimono et al.[2] explored predictors of discharge in long-stay hospitalized patients with schizophrenia in a longitudinal study, reporting that worse cognitive function predicted discharge difficulties. Moreover, Trampush et al.[14] clarified predictors of clinical response, reporting that better neurocognitive function predicts a good treatment response. Taking these reports and our results together, we suggest that worse neurocognitive function might cause difficulties for discharge.

Our results suggest that among several neurocognitive domains, outpatients performed better on tasks of speed of processing, visual attention, and working memory than did inpatients. An association between better visual attention and better social function has previously been reported.[15] Furthermore, a longitudinal study by Nuechterlein et al.[16] has shown that visual attention at baseline in first-episode schizophrenia predicted return to work or school 9 months later. These results are consistent with our own, suggesting a relationship between better visual attention and discharge from hospital in patients with schizophrenia.

Differences in working memory performance have also been reported between inpatients and outpatients.[13] Huang and Hsiao[17] reported that better working memory in patients with schizophrenia was associated with better global social functioning. A longitudinal association between working memory at baseline and social function 13 years later has also been observed.[18] Additionally, Czajkowski et al.[19] conducted a 4-year longitudinal study and reported that social function in patients with worse working memory performance at baseline did not improve across the 4 years. In contrast, social function in patients with a median or high level of working memory performance at baseline tended to improve. Again, these reports are consistent with our results.

In the cross-sectional study by Comparelli et al.,[13] outpatients with remitted schizophrenia also showed faster responses for speed of processing measured with the Trail Making Test Part A than did inpatients. In a longitudinal study, Sánchez et al.[20] investigated inpatients with schizophrenia across 6 months and found that speed of processing in inpatients predicts functional outcome at follow-up. Other longitudinal studies examining first-episode schizophrenia have reported that processing speed in first-episode schizophrenia at baseline predicts functional outcome 2 years later[21] and 7 years later.[9] Furthermore, studies suggest that speed of processing at baseline predicted social function 6 months later,[22] 4 years later,[15] and 13 years later.[18] Considering these results, it appears that slower speed of processing is associated with patients having difficulties with discharge. Furthermore, among several neurocognitive domains, speed of processing has been recognized as fundamental in schizophrenia.[23,24]

In this study, we observed that speed of processing in the inpatient group was lowest among the three neurocognitive domains that differed significantly between the groups. Therefore, we suggest that psychiatric nursing should focus on a patient's speed of processing as optimal strategy to facilitate discharge of patients with nonremitting schizophrenia.

4.1 | Limitations

This study's design has several limitations. First, we use a cross-sectional study design, so causal relationships between neurocognitive function and discharge cannot be assessed. Indeed, longitudinal studies are required to elucidate any causal relationships. Second, the number of participants in this study was relatively small. Future studies are required with larger sample sizes to further support our findings.

4.2 | Practice for psychiatric nursing

Psychiatric nursing to facilitate discharge for inpatients with nonremitted schizophrenia should focus on improving a patient's slower reaction times in speed of processing, visual attention, and working memory.

Methods by which psychiatric nursing can compensate for patients' slower reaction time include consideration of a patient's environments to ensure they can think or deal with a range of situations. For example, supportively waiting until a patient answers or initiates an act in both usual care situations and social skills training. Part-time jobs that have a slow pace may also be appropriate the patients and psychiatric nurses seek a patient's first job after discharge.

Moreover, enhancing reaction times requires physical activity. Recently, the association between physical activity and neurocognitive function has attracted attention, especially the relationship between lower physical activity and slower reaction times that is often reported.[25,26] A recent longitudinal study reported that patients with schizophrenia who increased daily activity for 6 months had significant improvements in reaction times at follow-up.[27] Furthermore, an interventional study has suggested that aerobic exercise improves speed of processing.[28] Therefore, some mildly intensive exercise might improve reaction times.

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AUTHORSHIP STATEMENT

All authors meet the authorship criteria according to the latest guidelines of the International Committee of Medical Journal Editors, and all authors are in agreement with the manuscript.

DISCLOSURE STATEMENT

The authors declare that there is no conflict of interest.

AUTHOR CONTRIBUTIONS

Y.K.: Study design, data collection, and drafting and revising the manuscript. J.O.: Study design and revising the manuscript. All authors meet the authorship criteria according to the latest guidelines of the International Committee of Medical Journal Editors, and all authors have approved the manuscript.

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REFERENCES

1. Ministry of Health, Labour and Welfare. (2015). The overall condition of survey of medical institutions and hospital report. Available at: http://www.mhlw.go.jp/toukei/saikin/hw/iryosd/15/dl/gaikyo.pdf#search=%27%E7%B2%BE%E7%A5%9E%E7%A7%91±%E5%B9%B3%E5%9D%87%E5%9C%A8%E9%99%A2%E6%97%A5%E6%95%B0%27 [Article in Japanese].
2. Shimono M, Fujikawa N, Yoshimasu K, et al. Analysis of factors relating to the discharge of long stay psychiatric patients. *Clinical Psychiatry*. 2004;46(4):403–414. (in Japanese)
3. Kurebayashi Y. A literature review on study's methodology of nursing care for patients with schizophrenia considering their neurocognitive functions. *J. Human Sci.* 2016;13(1):2019–2031.
4. Mesholam-Gately RI, Guiliano AJ, Goff KP, Faraone SV, Seidman LJ. Neurocognition in first-episode schizophrenia: a meta-analytic review. *Neuropsychology* 23(3):315–336.
5. Green MF, Neuchterlein KH, Gold JM, et al. Approaching a consensus cognitive battery for clinical trials in schizophrenia: the NIMH-MATRICS conference to select cognitive domains and test criteria. *Biol. Psychiatr*. 2004;56(5):301–307.
6. McCleery A, Ventura J, Kern RS, et al. Cognitive functioning in first-episode schizophrenia: MATRICS Consensus Cognitive Battery (MCCB) profile of impairment. *Schizophrenia Research*. 2014;157(1-3):33–39.
7. Wu JQ, Chen DC, Tan YL, et al. Cognitive impairments in first-episode drug-naïve and chronic medicated schizophrenia: MATRICS consensus cognitive battery in a Chinese Han population. *Psychiatric Research*. 2016;238, 196–202.
8. Ekerholm M, Firus Waltersson S, Fagerberg T, et al. Neurocognitive function in long-term treated schizophrenia: a five-year follow-up study. *Psychiatr. Res.* 2012;200(2-3):144–152.
9. Andreasen NC, Carpenter WT Jr., Kane JM, Lasser RA, Marder SR, Weinberger DR. Remission in schizophrenia: proposed criteria and rationale for consensus. *Am. J. Psychiatr.* 2005;162(3):441–449.
10. Kurebayashi Y, Otaki J. Neurocognitive functions in patients with remitted and nonremitted schizophrenia: a cross-sectional study. *Perspectives in Psychiatric Care*. 2016;[Epub ahead of print].
11. Kay SR, Opler LA, Lindenmayer JP. Reliability and validity of the positive and negative syndrome scale for schizophrenia. *Psychiatr. Res.* 1988;23(1):99–110.
12. Ogata S, Yamada T, Motohashi N, et al. Investigation of the reliability, validity and extrapolability of the CogHealth software. *Japanese Journal of Cognitive Neuroscience*. 2008;10, 119–129.(in japanese)
13. Comparelli A, De Carolis A, Corigliano V, et al. Neurocognition, psychopathology, and subjective disturbances in schizophrenia: a comparison between short-term and remitted patients. *Comprehensive Psychiatr*. 2012;53(7):931–939.
14. Trampush JW, Lencz T, DeRosse P, et al. Relationship of cognition to clinical response in first-episode schizophrenia spectrum disorders. *Schizophrenia Bulletin*. 2015;41(6):1237–1247.
15. Kurtz MM, Moberg PJ, Ragland JD, Gur RC, Gur RE. Symptoms versus neurocognitive test performance as predictors of psychosocial status in schizophrenia: a 1- and 4-year prospective study. *Schizophrenia Bulletin*. 2005;31(1):167–174.
16. Nuechterlein KH, Subotnik KL, Green MF, et al. Neurocognitive predictors of work outcome in recent-onset schizophrenia. *Schizophrenia Bulletin*. 2011;37(Suppl 2):S33-S40.
17. Huang CLC, Hsiao S. The functional significant of affect recognition, neurocognition, and clinical symptoms in schizophrenia. *PLoS ONE* 2017;12(1):e0170114.
18. Øie M, Sundet K, Ueland T. Neurocognition and functional outcome in early-onset schizophrenia and attention-deficit/hyperactivity disorder: a 13-year follow-up. *Neuropsychology*. 2011;25(1):25–35.

19. Fu S, Czajkowski N, Rund BR, Torgalsbøen AK. The relationship between level of cognitive impairments and functional outcome trajectories in first-episode schizophrenia. *Schizophrenia Res*. 2017;[Epub ahead of print].

20. Sánchez P, Ojeda N, Peña J, et al. Predictors of longitudinal changes in schizophrenia: the role of processing speed. *Journal of Clinical Psychiatry*. 2009;70(6):888–896.

21. Peña J, Segarra R, Ojeda N, Garcia J, Equiluz JI, Gutiérrez M. Do the same factors predict outcome in schizophrenia and non-schizophrenia syndromes after first-episode psychosis? A two-year follow-up study. *Journal of Psychiatric Research*. 2012;46(6):774–781.

22. Lewandowski KE, Cohen BM, Keshavan MS, Sperry SH, Öngür D. Neuropsychological functioning predicts community outcomes in affective and non-affective psychosis: a 6-month follow-up. *Schizophrenia Research*. 2013;148(0):34–37.

23. Ojeda N, Peña J, Sánchez P, Elizagárate E, Ezcurra J. Processing speed mediates the relationship between verbal memory, verbal fluency, and functional outcome in chronic schizophrenia. *Schizophrenia Research*. 2008;101(1-3):225–233.

24. Ojeda N, Peña J, Schretlen DJ, et al. Hierarchical structure of the cognitive processes in schizophrenia: the fundamental role of processing speed. *Schizophrenia Research*. 2012;135(1-3):72–78.

25. Leutwyler H, Hubbard EM, Jeste DV, Miller B, Vinogradov S. Associations of schizophrenia symptoms and neurocognition with physical activity in older adults with schizophrenia. *Biological Research for Nursing*. 2014;16(1):23–30.

26. Stubbs B, Ku PW, Chung MS, Chen LJ. Relationship between objectively measured sedentary behavior and cognitive performance in patients with schizophrenia vs controls. *Schizophrenia Bulletin*. 2017;43(3):566–574.

27. Kurebayashi Y, Otaki J. Association between altered physical activity and neurocognitive function among people with schizophrenia: a minimum 6-months' follow-up study. *Journal of Comprehensive Psychiatry*. 2017;77, 45–52.

28. Su CY, Wang PW, Lin YJ, Tang TC, Liu MF, Chen MD. The effects of aerobic exercise on cognition in schizophrenia: a 3-month follow-up study. *Psychiatry Research*. 2016;244, 394–402.

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