

Cognitive Rehabilitation for Improving the Executive Functions of Outpatients with Chronic Schizophrenia in Psychiatric Day Hospital: A Pre-Post-Intervention Study

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ABSTRACT

Objective: This study aimed to examine the effects of an intervention program to improve the executive functions of patients with chronic schizophrenia.

Design: A pre- and post-intervention study

Materials and Methods: This study included 10 outpatients with chronic schizophrenia in a psychiatric hospital. The program consisted of six sessions with 30-45 min each twice per week for over 2 weeks. Patients selected a task related to their everyday activities during the program. The Behavioral Assessment of Dysexecutive Syndrome (BADS) was used to assess the executive functions pre- and post-intervention.

Results: Post-intervention total BADS score and its three subtests were significantly higher than pre-intervention scores ($p < 0.05$).

Discussions: This program improves planning ability, cognitive flexibility, and self-confidence, focusing on assessing the problems interfering with daily activities in the community of patients with chronic schizophrenia. Mental health healthcare professionals should consider the program in terms of improving executive dysfunction, the process of promoting insight, and mental health recovery.

Conclusions: Study results revealed that this program is useful and effective in improving the executive functions of patients with chronic schizophrenia.

KEY WORDS

executive function, mental health recovery, cognitive rehabilitation, schizophrenia

INTRODUCTION

Schizophrenia has a worldwide prevalence of 1 in 100 individuals. Approximately 80% of individuals diagnosed with schizophrenia struggle with various neurocognitive deficits¹⁾. Many patients with schizophrenia have general cognitive dysfunction, such as attention, executive functions, and social cognition. Moreover, 70% of patients with schizophrenia have executive dysfunctions²⁾. Executive dysfunction due to prefrontal damage causes disorders affecting planning ability, cognitive flexibility, self-regulation, inhibition, goal-directed behavior, and complex problem-solving ability. Executive functions are conceptualized as having four components: volition, planning, purposive action, and effective performance³⁾.

Executive dysfunction was associated with declines in complex instrumental activities of daily living (ADLs)⁴⁾. Instrumental ADL difficulties, which are required for independent living, are experienced by individuals with schizophrenia. Executive dysfunction encompasses various cognitive processes that influence an individual's ability to adapt and function in society⁵⁾. Most patients with schizophrenia require formal or informal daily living support and many remain chronically ill, with active symptom exacerbations and remissions⁶⁾. A patient's overall degree of disability mainly depends on cognitive impairment severity.

Symptoms may impair the abilities to hold a job, remain in school, maintain relationships, and even perform self-care⁷⁾. Therefore, patients with schizophrenia require greater effort, compensatory strategies, or accommodation in terms of instrumental ADL performances.

A previous study on chronic schizophrenia revealed that loss of planning ability in specific aspects of executive dysfunction affected independence in ADLs, as assessed using the Behavioral Assessment of Dysexecutive Syndrome (BADS)⁸⁾. Healthcare mental health professionals have a growing need for intervention strategies to improve the executive functions associated with declined instrumental ADLs in patients with chronic schizophrenia⁴⁾. However, very few attempts were made at developing an intervention program focused on improving the components of executive functions relevant to ADLs for patients with chronic schizophrenia. Moreover, more research is needed to determine the effectiveness of educational and psychosocial interventions on the quality of life of patients with schizophrenia⁹⁾.

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Table 1: Structure of the intervention program.

Session	Subject	Contents	Time
1	Clarification of the task	-Assessment of problems interfering with ADLs in the community -Selection of the task related to instrumental ADLs that the patient wants to improve -Conduct a pretest (BADS, instrumental ADL scale, and VAS)	45 min
2	Goal setting	-Specify the goal of the task that the patient will address in the intervention program -Determine the goal that is achievable in 2 weeks	30 min
3	Planning	-Dissolution and simplification of complex actions into a single step -Write down the steps into three behaviors-preparation, practice, and confirmation, with a place to check off the step when it is completed	30 min
4	Features of executive functions	-Understanding the components of executive functions -Errorless learning by checking the following order of executive functions: (1) volition, (2) planning, (3) purposive action, and (4) effective performance	30 min
5	Planning practice	-Implemented the planned steps twice -Procedures of the practice are as follows: (1) read aloud the steps written out in Session 3 from the beginning, and (2) Prepare necessary items and practice	30 min each
6	Reflection	-Assessment of confidence in performing tasks in daily life ahead -Conduct a post-test (BADS, instrumental ADL scale, and VAS)	45 min

Note. The intervention program comprised six sessions, each lasting 30-45 min, twice per week, for 2 weeks.

BADS, Behavioral Assessment of Dysexecutive Syndrome; ADL, activity of daily living; VAS, Visual Analog Scale.

Literature review

Cognitive Rehabilitation for the Executive Functions of Patients With Chronic Schizophrenia

Recent studies revealed cognitive remediation therapy¹⁰ as a useful intervention for improving executive dysfunction in schizophrenia. However, a systematic review of the efficacy of executive functions in schizophrenia¹¹ revealed that most research methods were case studies and the output of related scientific studies has not significantly increased. Moreover, executive dysfunction has no approved treatments, whether pharmacological or psychological. Exploring the characteristics and possibilities of the most effective treatments and their clinical and social impact remained necessary although advances are made in the cognitive rehabilitation study in the form of consensus-based assessment and treatment models for schizophrenia¹¹.

Therefore, this study aimed to examine the effects of an intervention program to improve the executive functions of patients with chronic schizophrenia.

MATERIALS AND METHODS

Participants

This study included 10 outpatients with chronic schizophrenia from a psychiatric day hospital in Japan. Schizophrenia was diagnosed based on the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders⁶.

The inclusion criteria included (1) a Mini-Mental State Examination (MMSE) score of ≥ 20 ; (2) an outpatient who has had the diagnostic symptoms for > 1 year; (3) the absence of another psychiatric disease that could cause cognitive impairment.

Developing an intervention program for patients with chronic schizophrenia

This original intervention program was created with reference to a previous study of interventions for executive function in mild cognitive impairment¹². The program consists of six sessions of 30-45 min for over 2 weeks, twice per week (Table 1).

The first session, clarification of the task, assesses the patient's current problems interfering with ADLs in the community and selects a task related to instrumental ADLs that the patient wants to improve. Examples of the tasks include the ability to take responsibility for own

medications, shopping, adopting infection prevention methods (hand-washing practice), and developing the habit of light exercises. The second session, goal setting, specifies the goal of the task that the patient will address in the intervention program in 2 weeks. The third session, planning, focused on dissolving and simplifying complex actions into single steps based on the teaching task-specific routines¹³. Additionally, each step is simplified into three behaviors, including preparation, practice, and confirmation, with a place to check off the step as it is completed. The fourth session, features of executive functions, understands the executive function components and checks the following order of executive functions by errorless learning. Hurford, Kalkstein and Hurford¹⁴ reported that errorless learning yielded successful outcomes and enhances learning in patients with schizophrenia. The fifth session, planning practice, implements the planned steps twice. In the first stage, patients read aloud the steps from the beginning that were developed in the third session based on self-instruction training. In the second stage, patients prepare the necessary items and practices. This approach breaks down each new task to be learned into small components that are then overlearned through imitative learning and repetitive practice of perfect task execution. This session was performed twice. The sixth session, reflection, assesses the confidence in performing ahead ADLs at home.

Measurement Assessment of the executive functions

The BADS

The BADS is a valid tool that assesses problems in the everyday behavior of patients with dysexecutive syndromes¹⁵. Additionally, the BADS includes six subtests. A profile score, ranging from 0 (severely deficient) to 4 (normal performance), is determined for each subtest, and the sum of each subtest is calculated as the total profile score (BADS-TP). The maximum total score is 24. The six BADS subtests and their executive abilities were as follows: Rule Shift Cards Test (RSCT), cognitive flexibility; Action Program Test (APT), practical problem-solving; Key Search Test (KST), planning and searching strategies; Temporal Judgment Test (TJT), time judgments; Zoo Map Test (ZMT), planning; and Modified Six Elements Test (MSET), ability to plan, organize, and monitor behavior.

Assessment of instrumental ADLs

The Instrumental ADL Scale

This scale consists of eight domains: using the telephone, shopping, food preparation, housekeeping, laundry, mode of transportation,

Table 2: Description of the participants (n = 10).

Subject	Age	Gender	BPRS	CPZE	Selected task ^a
1	53	M	41	730	Taking responsibility for own medications
2	58	M	41	1000	Taking responsibility for own medications
3	64	M	42	200	Taking responsibility for own medications
4	70	F	40	400	Taking responsibility for own medications
5	48	M	38	200	Shopping
6	79	M	39	600	Shopping
7	61	M	39	753	Adopting infection prevention methods (handwashing practice)
8	62	M	39	1400	Adopting infection prevention methods (handwashing practice)
9	51	M	38	950	Developing the habit of light exercises
10	56	M	39	400	Developing the habit of light exercises

^aPatients selected a task related to their everyday activities.

Note. BPRS, Brief Psychiatric Rating Scale; CPZE (mg/day), chlorpromazine equivalents.

responsibility for own medications, and ability to handle finances¹⁶). The total score ranges from 0 (low function, dependent) to 8 (high function, independent).

Assessment of self-confidence

The Visual Analog Scale (VAS)

This study used a Likert scale, ranging from 0 (not confident) to 10 (very confident), to evaluate the patients self-confidence in everyday life in the community.

The BADS, instrumental ADL scale, and VAS were evaluated by our researchers in sessions 1 and 6.

Clinical assessment

The Brief Psychiatric Rating Scale (BPRS)

The BPRS¹⁷ assesses the level of 18 symptom constructs, including hostility, suspiciousness, hallucination, and grandiosity (18-item version, in which 1 indicates absent and 7 indicates severe).

Chlorpromazine Equivalents (CPZEs)

CPZEs (mg/day) are often used as a relative measure of the antipsychotic potency of neuroleptics. The drug equivalent of 200-300 mg of chlorpromazine is considered the minimum effective dose and > 1,000 mg is considered high¹⁸.

Data collection and analysis

Data were collected from November 2021 to September 2022. The researcher explained the aims and procedures of the study to the patients before obtaining consent for the investigation.

The pre- and post-intervention BADS, instrumental ADL scale, and VAS results were compared using the Wilcoxon signed-rank test. Statistical Package for the Social Sciences (version 28; IBM Corp., Armonk, NY, USA) was used at a 95% confidence level.

Table 3: Evaluations in pre-intervention and post-intervention scores (n = 10).

	Pre-intervention			Post-intervention			<i>p</i>
	M	SD	(Range)	M	SD	(Range)	
BADS							
RSCT	1.70	1.16	(1-4)	2.60	1.35	(1-4)	*
APT	2.70	0.48	(2-3)	2.70	0.48	(2-3)	NS
KST	0.90	0.32	(0-1)	1.10	0.32	(1-2)	NS
TJT	2.20	0.92	(1-3)	2.50	0.71	(1-3)	NS
ZMT	1.10	0.74	(0-2)	2.30	0.48	(2-3)	*
MSET	1.10	0.32	(1-2)	1.80	0.42	(1-2)	**
BADS-TP	9.70	1.57	(8-12)	13.00	1.94	(10-16)	**
Instrumental							
ADL	6.00	1.25	(4-7)	6.20	1.03	(4-7)	NS
VAS	4.10	3.11	(0-9)	6.70	1.77	(4-9)	*

Wilcoxon signed-rank test

Note. BADS, Behavioral Assessment of Dysexecutive Syndrome; RSCT, Rule Shift Cards Test; APT, Action Program Test; KST, Key Search Test; TJT, Temporal Judgment Test; ZMT, Zoo Map Test; MSET, Modified Six Elements Test; BADS-TP, BADS Total Profile; instrumental ADL, instrumental activities of daily living scale; VAS, Visual Analog Scale; M, mean; SD, standard deviation; NS, not significant.

**p* < 0.05

***p* < 0.01

NS = *p* > 0.05

RESULTS

Description of the sample

The mean age, mean BPRS, and mean CPZE score of patients were 60.2 ± 9.2 years, 39.6 ± 1.3 , and 663.3 ± 383.3 mg/day, respectively (Table 2). The pre- and post-intervention BPRS scores and CPZE showed no significant difference. No difference was found in the patients pre- and post-intervention degrees of psychiatric symptoms of schizophrenia.

Evaluation of the intervention program

The BADS-TP score was significantly higher (mean = 13.0 ± 1.9) than the pre-intervention score (mean = 9.7 ± 1.6) (*p* < 0.01) (Table 3). The post-intervention scores of the three subtests of the BADS, including RSCT, ZMT, and MSET, significantly improved (*p* < 0.05).

The pre- and post-intervention instrumental ADL scores were not significantly different. The post-intervention VAS scores (mean = 6.7 ± 1.8) were higher than the pre-intervention scores (mean = 4.1 ± 3.1) (*p* < 0.05) (Table 3).

No significant differences were found between the tasks in the post-intervention BADS scores. Additionally, no significant correlation was found between patients ages and BADS scores.

DISCUSSION

This study evaluated the effectiveness of an intervention program in improving the executive functions of patients with chronic schizophrenia. The pre-intervention BADS scores suggested impaired executive functions compared with those in healthy controls of the same age (mean = 18.5 ± 3.0)¹⁹. The post-intervention BADS-TP results revealed a significantly improved executive dysfunction in patients with chronic schizophrenia. Additionally, the three BADS subtest scores (i.e., RSCT, ZMT, and MSET) were improved. These results suggest that this intervention program enhanced the abilities of cognitive flexibility (RSCT) and planning (ZMT and MSET). A previous study used the BADS to investigate the improvement of executive dysfunction in schizophrenia using a computer/virtual reality tool²⁰. This study, for the first time, confirmed the effectiveness of improving executive dysfunction as an evi-

dence-based cognitive rehabilitation focused on the daily activities of patients with chronic schizophrenia.

More important is that patients dissolved and simplified complex actions into single steps based on the teaching task-specific routines in session 3. For instance, the responsibility for managing their medications was simplified as follows: *Preparation* (prepare one dose of oral medication and check the time of administration), *Practice*, (calmly and surely take the medicine), and *Confirmation* (check any leftover medicines and the next time of administration). Hence, enhancements were confirmed in the post-intervention RSCT, ZMT, and MSET scores. Our findings suggest that this session helps improve the abilities of planning and cognitive flexibility. The "planning" and "cognitive flexibility" abilities of specific aspects of executive functions affected independence in everyday behavior in patients with chronic schizophrenia⁸). We indicate that mental health healthcare professionals should focus on developing interventions that target task routines for everyday activities and executive dysfunction characteristics in patients with chronic schizophrenia. Enough practice was performed repeatedly in session 5, considering that patients independently live at home. Moreover, patients were able to increase their awareness of training procedures and problem-solving using verbal self-instruction. Instrumental ADL dysfunction in individuals with schizophrenia demands detailed assessment and tailored training to ensure optimum functioning²¹).

Moreover, most patients with schizophrenia possess poor awareness or insight, which is significantly associated with executive dysfunction. Patients defined the goal of the intervention program and promoted awareness of motivation to succeed at the task in sessions 1 and 2. Al-HadiHasan, Callaghan and Lynn²²) revealed that insight into schizophrenia, positive impact on health and wellbeing, empowerment, and enhanced confidence were necessary for patients to accept the intervention. Thus, the improved self-confidence in session 6 suggests that the intervention program empowered and promoted awareness of the problems interfering with daily activities in the community. Healthcare professionals should focus on each patient's problems related to independent ADLs and each patient's goal setting that is achievable in the short term. Incorporating a perspective that enhances the patient's insight is important to promote recovery as an evidence-based practice for schizophrenia. Specific cognitive interventions that address the cognitive decline in schizophrenia have strongly been endorsed to target recovery and reduce disability due to mental illness²³). Mental health recovery programs have a positive effect on illness management and social functionality in patients with schizophrenia²⁴). Enhancing patients insight is important to promote recovery using our intervention program. Continuing cognitive rehabilitation for patients with schizophrenia can effectively improve insight, health knowledge of schizophrenia, and the quality of life of patients.

Lastly, patients confirmed the order of executive functions by errorless learning in session 4. Hence, the patient could effectively practice the training of the task. We emphasize the significance of each task selected by the patients and their training. Many patients with schizophrenia have decreased ability to plan for taking their medications in the correct dosages at the correct time. A relationship between insight, medication adherence, and executive dysfunction has been revealed in patients with schizophrenia²⁵). Therefore, improving the patients insight is expected to increase their medication adherence, and professionals should promote adherence to antipsychotic medication regimens and support patients to regularly take their medications. Patients planned and shopped within the provided budget. In this task, patients must have calculation abilities and attention. The program to improve grocery shopping skills might be clinically beneficial to enhancing executive function and complex instrumental ADLs in patients with schizophrenia²⁶). Regarding the task of adopting infection prevention methods (handwashing practice), patients reflected on whether they had planned and properly performed handwashing to prevent infection. Adopting and adhering to the protective measures recommended to prevent infection, such as handwashing, may be difficult for patients because schizophrenia is characterized by impaired insight and decision-making capacity²⁷). Individuals with schizophrenia may be more susceptible to coronavirus disease 2019 transmission due to several factors, such as cognitive impairment, lower awareness of risk, and barriers to adequate infection control, including congregate living²⁸). Patients with schizophrenia are at a higher risk of infection and worse outcomes, particularly when they are affected by clinical comorbidities. Therefore, healthcare professionals should focus on developing interventions for improving handwashing practice, targeting both cognitive and psychosocial components to enhance self-management in individuals with schizophrenia. Patients planned to walk for approximately 60 min/day, regarding the task of developing the habit of light exercises. Individuals with mental illness-

es, such as schizophrenia, encounter physical health-related problems; therefore, we must help them adhere to ADL changes. Lifestyle-changing interventions also motivate individuals to eat a healthy diet and exercise regularly to prevent premature mortality²⁹). Exercise may be effective in increasing awareness of chronic schizophrenia.

Our interventions used a combination of behavioral and educational approaches that are easy to implement in daily practice in patients with schizophrenia. Healthcare professionals should help them participate with peace of mind when performing cognitive rehabilitation. Additionally, this program will be useful in improving a variety of instrumental ADLs for patients with chronic schizophrenia because no significant difference was found in the BADS scores for each task. Creating models that provide direct support in real life and improve necessary functions and planning comprehensive interventions that improve social functioning in real life are important³⁰). Our intervention was designed to improve abilities in establishing goal-directed plans and performing them effectively.

Some study limitations should be considered when interpreting the results, and several suggestions were provided for future research. First, the findings of this study should be interpreted for only one clinical setting because of the small size and short intervention time. Second, further studies with more rigorous methodology are needed to examine the potential practicality of the intervention program in the future.

SUMMARY

Our findings suggest that this original intervention program improved the executive functions of patients with chronic schizophrenia. Additionally, this program will be useful and effective in improving the executive functions of patients with chronic schizophrenia. Moreover, sufficient training in executive functions improves planning ability, cognitive flexibility, and self-confidence, and assessing the problems interfering with ADLs in the community needs to focus. Healthcare professionals should consider developing interventions that target task routines for everyday activities and the characteristics of executive dysfunction in patients with chronic schizophrenia. Furthermore, we should create the program in terms of executive dysfunction improvement, insight promotion, and mental health recovery.

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ETHICAL STATEMENT

This study was approved by the Institutional Review Board of Tokiwa University, Japan (no. 100130). The instruments used in this study are generally permitted to be used; therefore, we referenced the sources considering copyright.

INFORMED CONSENT

All participants provided written informed consent before the initiation of any research procedure. To ensure that the patients had adequate knowledge before making this decision, they were informed about the possibility of opting out of the study and that their anonymity would be guaranteed during the data analysis and reporting.

CONFLICTS OF INTEREST

Fukuta D, Ikeuchi S, and Mori C declare no conflicts of interest with the research or writing of this paper.

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