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Research paper

Relationship between disability self-awareness and cognitive and daily living function in schizophrenia

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ABSTRACT

We investigated the relationship between disability self-awareness and cognitive and daily living functions in 49 patients with schizophrenia. The World Health Organization Disability Assessment Schedule 2.0 (WHODAS) self-report was used to identify patient-rated global function. A clinician-rated measure of global function was obtained using the Personal and Social Performance Scale (PSP); disability self-awareness was calculated using two global function scores. The Positive and Negative Syndrome Scale (PANSS) and the Calgary Depression Scale for Schizophrenia (CDSS) were used to evaluate clinical symptoms, while the MATRICS consensus cognitive battery (MCCB) and the UCSD Performance-based Skills Assessment (UPSA) were applied to assess cognitive and daily living functionality, respectively. The WHODAS scores correlated significantly with the MCCB verbal learning, visual learning, and social cognition domains, and with the UPSA communication domain. The PSP correlated significantly with all MCCB and UPSA domains. Disability self-awareness demonstrated positive correlation with most domains of MCCB and UPSA. The findings of this study indicate that the lower the cognitive and daily living function in patients with schizophrenia, the more positively they perceive their own disability.

1. Introduction

Patients with schizophrenia may have diverse functional disabilities, including those related to social and occupational capacities (Mohamed et al., 2008), which are known to involve psychopathological symptoms and basic and social cognition (Switaj et al., 2012). An overall assessment of patient function generally comprises the clinician's evaluation and the patient's self-report. Self-reported function in schizophrenia is related to the patient's perceived stigma and quality of life (Dan et al., 2011; Ertugrul and Ulug, 2004). Owing to problems associated with insight or psychotic symptoms, some patients with schizophrenia understand and report their symptoms and functional abilities differently from objective observers (Bowie et al., 2007). Therefore, a self-report of function may reflect self-awareness of disability, which is of clinical significance because it may affect participation in drug therapy, rehabilitation, and social and occupational activities (Gould et al., 2013).

Various methods have been applied to evaluate the function of patients with schizophrenia. The Global Assessment of Functioning Scale (GAF) and Social and Occupational Function Assessment Scale (SOFAS) have been the most widely used assessment tools. The GAF has been fixed to axis V in order to evaluate a patient's overall function with the multi-axis diagnostic system of the Diagnostic and Statistical Manual of Mental Disorders 4th Edition (DSM-IV) (American Psychiatric Association, 1994). Not only does the GAF allow assessment of the level of function with relative ease and speed, it also has a significant correlation with clinical symptoms and social functions in patients with schizophrenia (Startup et al., 2002). However, the GAF has disadvantages when it comes to evaluation of dysfunctions caused by physical conditions or psychosocial stress, and problems related to psychiatric symptoms (Piersma and Boes, 1997). The SOFAS was alternatively developed to focus on social and occupational skills; it is therefore limited to certain factors, while others cannot be classified (Kennedy and Foti, 2003). The Personal and Social Performance Scale (PSP) was created based on the SOFAS to overcome the aforementioned problems. The PSP provides a score based on classification of the subject's functions in four areas: (1) socially useful activities, (2) personal and social relationships,

(3) self-care, and (4) disturbing aggressive behaviors. The PSP has demonstrated high validity and reliability for patients with schizophrenia (Nasrallah et al., 2008).

The DSM-5 (American Psychiatric Association, 2013) has been revised recently, and now recommends that patient function be evaluated using the World Health Organization Disability Assessment Schedule (WHODAS) 2.0, which is based on the International Classification of Functioning, Disability, and Health (ICF) approved by the World Health Organization (WHO). This includes the concepts of "functioning", which refers to the positive characteristics of an individual at the physical, personal, and social levels, and "disability", which encompasses the individual's negative aspects (World Health Organization, 2000). The WHODAS offers the advantages of self-reporting, easy inspection, and easy adaptation over existing alternative functional evaluations. Several studies have been conducted using the WHODAS in patients with schizophrenia. Akinsulore et al. (2015) reported higher WHODAS scores in patients with schizophrenia compared to a healthy control group, and a significant correlation between WHODAS and positive and negative syndrome scale (PANSS) scores. Another study in elderly patients with schizophrenia reported that WHODAS scores correlated with depressive symptoms and quality of well-being, but not with cognitive performance and everyday functioning (McKibbin et al., 2004).

Several previous studies confirmed that scores of self-reports and others may differ when evaluating patients with schizophrenia. Harvey et al. (2019) calculated the rating accuracy by comparing self- and informant-reported scores of everyday functioning in patients with schizophrenia; it was found that depression, autistic traits, and social avoidance were involved. When the WHODAS is used for self-reporting by patients with schizophrenia, the results are more reflective of subjective perspectives related to disability than actual function (Gold, 2014). In terms of the patient's disability, checking the direction and degree of difference between self-reported scores and the actual degree of disability assessed by others reflects the disability self-awareness; this may play a unique role in the treatment and prognosis of patients with schizophrenia. For example, if a patient's function has improved but the patient is unaware, treatment compliance and patient satisfaction may be poor. In contrast, from the clinician's perspective, effects may be insufficient; however, if they are substantial for the patient, they may have a positive effect on their quality of life. Therefore, the patient's perception of their function may differ from that of the clinician, in that both see certain factors as more and others as less important.

Self-awareness of disability in patients with schizophrenia is therefore an independent factor that may have important clinical significance; some studies have been conducted in this regard. Gould et al. (2015) confirmed that misestimating one's own ability and functioning level is one of the most important factors affecting real-world functioning in patients with schizophrenia. Silberstein et al. (2018) mentioned that the difference between self-reported and informant-rated social cognition is involved in the impairment of everyday functioning, and that it is necessary to understand the meaning of self-assessment in disability evaluation and reduction. Therefore, this work aimed to evaluate disability self-awareness in patients with schizophrenia using the WHODAS (self-report) and PSP (clinician-report), and compare it with other clinical assessments of cognitive and daily living function.

2. Methods

2.1. Subjects

The subjects were patients diagnosed with schizophrenia according to the DSM-5 (American Psychiatric Association, 2013) criteria. They also met the following conditions: 1) aged 18 to 60 years, 2) receiving the same dose of antipsychotics for the last 3 months, 3) had stable symptoms, and 4) were undergoing day hospitalization or occupational

rehabilitation. Patients with coexisting psychiatric or neurological disorders and those with a level of intelligence that would make it difficult to perform the tests properly were excluded. All subjects provided written informed consent. The study was approved by the institutional review board of Busan Paik Hospital, Inje University College of Medicine.

2.2. Demographic and clinical characteristics

Patient sex, age, education level, duration of illness, and type and dose of current medications were recorded through interviews and reviews of medical records. The dose of antipsychotics was converted into the chlorpromazine equivalent dose (CPZE) (Gardner et al., 2010).

2.3. World Health Organization Disability Assessment Schedule (WHODAS)

The WHODAS 2.0 is a disability assessment tool based on the international functional disability health classification. It comprises 36 questions, and evaluates the function of the subject in six domains: understanding and communicating, getting around, self-care, getting along with people, life activities, and participation in society (Konecky et al., 2014). In this study, the participant's activities during day hospitalization or rehabilitation performance were assessed to replace the evaluation of work/school involvement as part of the participation in society domain. Based on the patient's status over the past 30 days, responses to each question were scored from 0 to 4. The overall score was based on the complex scoring method, and was in the range of 0–100%. In this study, a self-report method was implemented to evaluate patient-rated global function.

2.4. Personal and social performance scale (PSP)

The PSP was developed by Morosini et al. (2000) at the Italian National Institutes of Health. It takes an average of 5 min and evaluates a total of four items: socially useful activities, personal and social relationships, self-care, and disturbing as well as aggressive behaviors. In this study, the PSP was used for the purpose of evaluating clinician-rated global function. The Korean version of the PSP scale was used (Rhee and Kim, 2006).

2.5. Disability self-awareness

In this study, disability self-awareness was calculated using the WHODAS and PSP scores. For WHODAS, the higher the score, the more severe the degree of disability assessed by the patient, and the higher the PSP score, the less the degree of disability evaluated by the clinician. Since different types of tests had to be compared, the WHODAS and PSP scores were standardized to the Z-score. If the sum of the two scores is 0, the degree of disability evaluated by the patient and the clinician is similar, and if the number is positive, the patient may perceive their function to be worse than it actually is.

2.6. Positive and negative syndrome scale (PANSS)

The PANSS is a widely used tool for evaluating a patient's psychopathology. It comprises 30 items: 7 to evaluate positive symptoms, 7 to evaluate negative symptoms, and 16 to evaluate general psychopathology. Each item is scored according to the evaluation criteria, from 1 to 7 points; the higher the score, the more severe the psychopathology. The Korean version of the PANSS was used (Yi et al., 2001).

2.7. Calgary Depression Scale for Schizophrenia (CDSS)

The CDSS was designed to assess depression in patients with schizophrenia. It is a structured interview tool comprising 9 questions,

and is graded according to the evaluation criteria from 0 to 3 for depression, hopelessness, self-deprecation, guilty ideas of references, pathological guilt, morning depression, early morning waking, suicide, and observed depression. It allows for better discrimination between depression and negative symptoms of patients with schizophrenia than other existing depression scales (Kontaxakis et al., 2000). In this study, the Korean version of the CDSS was used (Kim et al., 2005).

2.8. MATRICS consensus cognitive battery (MCCB)

The MCCB is a standardized tool, that was developed by the National Institute of Mental Health to assess basic cognition in patients with schizophrenia (Nuechterlein et al., 2008). It evaluates 7 cognitive domains and comprises 10 subtests: (1) speed of processing (Brief Assessment of Cognition in Schizophrenia (BACS): symbol coding, category fluency: animal naming, trail making test); (2) attention/vigilance (continuous performance test-identical pairs); (3) working memory (Wechsler Memory Scale-III: spatial span, letter-number span); (4) verbal learning (Hopkins verbal learning test-revised); (5) visual learning (brief visuospatial memory test-revised); (6) reasoning and problem solving (neuropsychological assessment battery: mazes); and (7) social cognition (Mayer-Salovey-Caruso emotional intelligence test: managing emotion). We used the Korean version of the MCCB.

2.9. University of California San Diego performance-based skills assessment (UPSA)

The UPSA is a tool developed to evaluate patients' daily living functions, and evaluates the five major living skills through role-play activities. These include the financial domain (ability to count money, make changes, and pay bills), the communication domain (ability to understand specific situations, using telephones and letters, and to properly express oneself), the comprehension/planning domain (ability to understand newspaper article content and to know what one needs), the transportation domain (ability to use public transportation and consider transfers and calculate time, among others), and the household skills domain (ability to select food in preparation for cooking). In this study, the Korean version of the UPSA was used (Kim et al., 2017).

2.10. Statistical analysis

Data are presented as means and standard deviations for continuous variables; discrete variables are presented as frequencies and percentages. Correlation analysis was performed to examine the correlations between disability self-awareness and other clinical factors. SPSS version 25.0 (IBM Corp, Armonk, NY, USA) was used for all analyses; the significance level for all tests was set at $p < 0.05$.

3. Results

3.1. Demographic and clinical characteristics

A total of 49 subjects participated in the study. Data on sex, age, education level, duration of illness, and CPZE of antipsychotic drugs of the subjects are summarized in Table 1. The total PANSS score was 74.98 ± 13.00, and the scores for the three subscales of positive symptoms, negative symptoms, and overall psychopathology were 16.63 ± 3.81, 19.67 ± 4.71, and 38.67 ± 7.54, respectively. The overall CDSS score was 4.49 ± 3.82 points.

3.2. Cognitive function, everyday function, and global function

The MCCB composite score was 23.51 ± 10.24 points, the UPSA total score was 68.10 ± 17.60 points, the PSP was 65.69 ± 13.79 points, and the WHODAS overall score was $27.61 \pm 16.73\%$. The Z score standardized on PSP ranged from -1.32 to 1.98 points, and the Z score

Table 1
Demographic and clinical characteristics of patients (N = 49).

	Mean	SD	Range
Sex			
Male, *n* (%)	34 (69.39)		
Female, *n* (%)	15 (30.61)		
Age (years)	38.73	9.56	22.00–62.00
Education (years)	13.29	1.62	9.00–16.00
Duration of illness (months)	89.63	96.88	7.00–432.00
Average daily neuroleptic dose (mg, CPZE)	612.52	319.26	150.00–2100.00
PANSS			
Positive subscale	16.63	3.81	8.00–27.00
Negative subscale	19.67	4.71	10.00–29.00
General psychopathology subscale	38.67	7.54	18.00–57.00
Total score	74.98	13.00	36.00–102.00
CDSS	4.49	3.82	0.00–19.00

CDSS, Calgary Depression Scale for Schizophrenia; CPZE, Chlorpromazine Equivalent; PANSS, Positive and Negative Syndrome Scale; SD, Standard Deviation.

standardized on the WHODAS overall score ranged from -1.72 to 2.13 points. The disability self-awareness score was 0.00 ± 1.11 points (range: -2.75 to 2.23 points). The detailed scores for each domain are summarized in Table 2.

3.3. Relationship between disability self-awareness and clinical factors

Patient-rated global function evaluated with the WHODAS correlated with the PANSS total score and the PANSS subscales. In particular, the PANSS general psychopathology subscale score showed significant correlation with all domains, except for the getting around and getting along with people domains of the WHODAS. The PANSS total score also correlated with all domains except for the getting along with people and participation in society domains of the WHODAS. The CDSS did not

Table 2
Cognitive function, everyday function, and global function of patients (N = 49).

	Mean	SD	Range
MCCB			
Speed of processing	32.80	10.99	10.00–55.00
Attention/Vigilance	37.20	10.13	19.00–62.00
Working memory	31.53	10.18	7.00–55.00
Verbal learning	31.14	7.57	20.00–51.00
Visual learning	35.63	11.66	12.00–60.00
Reasoning/Problem solving	41.86	10.29	28.00–64.00
Social cognition	24.51	9.97	8.00–48.00
Composite score	23.51	10.24	7.00–48.00
UPSA			
Financial	17.05	2.84	9.00–20.00
Communication	12.28	4.87	1.60–20.00
Comprehension/Planning	10.33	5.51	0.00–20.00
Transportation	15.03	4.15	6.60–20.00
Household skills	13.37	8.50	0.00–20.00
Total score	68.10	17.60	33.20–100.00
PSP	65.69	13.79	42.00–95.00
WHODAS			
Understanding/Communicating	1.32	0.83	0.00–2.83
Getting around	0.82	0.86	0.00–2.80
Self-care	0.78	0.92	0.00–3.25
Getting along with people	1.35	0.72	0.00–2.60
Life activities	1.02	0.85	0.00–3.75
Participation in society	1.36	0.75	0.00–2.63
Overall score (%)	27.61	16.73	5.49–60.66

MCCB, Measurement and Treatment Research to Improve Cognition in Schizophrenia (MATRICS) Consensus Cognitive Battery; PSP, Personal and Social Performance Scale; SD, Standard Deviation; UPSA, University of California San Diego (UCSD) Performance-based Skills Assessment; WHODAS, World Health Organization Disability Assessment Schedule.

show a significant correlation with the WHODAS or the PSP. Cognitive function evaluated with the MCCB was found to have significant correlation with the WHODAS, primarily in the verbal learning, visual learning, and social cognition domains. The UPSA showed a significant correlation with the WHODAS, mainly in the communication domain. The PSP correlated significantly with all items of the PANSS, MCCB, and UPSA.

Disability self-awareness demonstrated significant negative correlation with the PANSS negative symptoms subscale ($r = -0.428$, $p = 0.002$). The disability self-awareness and MCCB composite score ($r = 0.415$, $p = 0.003$), speed of processing ($r = 0.410$, p = 0.003), attention/vigilance ($r = 0.349$, $p = 0.014$), working memory ($r = 0.291$, $p = 0.043$), and reasoning/problem-solving domains ($r = 0.452$, $p = 0.001$) were also significantly positively correlated. There was significant positive correlation between disability self-awareness and UPSA total score ($r = 0.445$, p = 0.001), communication ($r = 0.295$, $p = 0.040$), transportation ($r = 0.319$, $p = 0.025$), and household skills domains ($r = 0.422$, p = 0.003) (Table 3).

4. Discussion

In this study, disability self-awareness was evaluated in patients with schizophrenia using the WHODAS self-report and PSP. The PSP, a measure of clinician-rated global function, showed significant correlations with all items of cognitive and daily living function, whereas the WHODAS, as a measure of patient-rated global function, only correlated with certain items of cognitive function; most daily living functions had no significant relationship. Disability self-awareness has significant positive correlation with cognitive function and daily living function, and it is believed that low cognitive and daily living function are associated with a tendency to perceive one's disability more positively.

It is known that psychopathology evaluated through PANSS in patients with schizophrenia, has a significant relationship with global function evaluated through PSP and WHODAS. According to previous

studies, the worse the clinical symptoms in all PANSS items, the lower the global function; this was mostly consistent with the results of this study (Guilera et al., 2012; Jelastopulu et al., 2014). In this study, disability self-awareness and the negative subscale scores of PANSS showed significant negative correlation, indicating that patients with schizophrenia perceived their disability more seriously, as they had fewer negative symptoms. Among several clinical symptoms, negative symptoms are known to reflect the patient's insight and cognitive function (Bozikas et al., 2004; Kemp and Lambert, 1995). Although there may be limitations in the interpretation of the exact causal relationship, patients with high insight and cognitive function in relation to low negative symptoms can realistically perceive their function more clearly; if excessive, it appears that there is a possibility of accepting it to be worse than it actually is. Unlike preceding studies (Bowie et al., 2007; Schwartz, 2001), we did not find significant correlation between depression and disability self-awareness in patients with schizophrenia. We assume that this is due to the fact that the subjects who participated in the current study had stable symptoms and participated in day hospitalization and/or occupational rehabilitation. The depression scores determined with the CDSS were therefore very low (CDSS mean score = 4.49, CDSS cut-off score (Kim et al., 2005) = 8).

Cognitive function, evaluated with the MCCB, showed significant correlations with the WHODAS, mainly for learning abilities and social cognition. Although various cognitive domains are linked to patients' lives, verbal and visual learning have a direct effect on the patient's community functioning and also play a major role in predicting future functional capacity (Fisher et al., 2009; Vesterager et al., 2012). Further, of all cognitive functions, verbal and visual learning are known as the domains with the strongest associations with social behavior (Fett et al., 2011). Among the domains of the MCCB, social cognition is different from the pure neurocognition reflected in other domains, and is often interpreted separately (Sabbag et al., 2012). Maat et al. (2012) found that general cognitive function is a significant predictor of quality of life in normal controls, but only social cognition was associated with quality

Table 3
Correlation between disability self-awareness and clinical factors in patients (N = 49).

	WHODAS							PSP	Disability self-awareness
	Understanding/communicating	Getting around	Self-care	Getting along	Life activities	Participation	Overall score		
PANSS									
Positive	0.386[†]	0.222	0.254	0.081	0.168	0.256	0.283*	−0.286*	−0.003
Negative	0.173	0.258	0.345*	0.018	0.266	0.039	0.237	−0.710[†]	−0.428[†]
General	0.493[†]	0.256	0.374[†]	0.135	0.404[†]	0.300*	0.408[†]	−0.553[†]	−0.131
Total	0.461[†]	0.307*	0.416[†]	0.109	0.380[†]	0.263	0.405[†]	−0.661[†]	−0.231
CDSS	−0.015	−0.039	−0.030	−0.184	0.001	0.110	−0.031	−0.100	−0.119
MCCB									
Speed of processing	0.029	−0.125	−0.133	0.140	0.017	−0.073	−0.036	0.490[†]	0.410[†]
Attention/Vigilance	0.076	−0.069	0.044	0.209	0.106	0.089	0.088	0.299*	0.349*
Working memory	−0.077	−0.073	−0.162	0.173	0.004	−0.148	−0.064	0.386[†]	0.291*
Verbal learning	−0.162	−0.116	−0.485[†]	−0.202	−0.272	−0.276	−0.315*	0.407[†]	0.083
Visual learning	−0.150	−0.343*	−0.378[†]	−0.064	−0.167	−0.315*	−0.296*	0.361*	0.058
Reasoning/Problem-solving	0.049	0.039	−0.055	0.266	−0.091	0.098	0.053	0.447[†]	0.452[†]
Social cognition	−0.311*	−0.337*	−0.348*	−0.064	−0.284*	−0.272	−0.338*	0.506[†]	0.151
Composite score	−0.114	−0.236	−0.322*	0.117	−0.140	−0.200	−0.194	0.653[†]	0.415[†]
UPSA									
Financial	−0.337*	−0.275	−0.323*	−0.030	−0.231	−0.052	−0.267	0.367[†]	0.091
Communication	−0.446[†]	−0.457[†]	−0.334*	−0.104	−0.366[†]	−0.117	−0.384[†]	0.710[†]	0.295*
Comprehension/Planning	−0.223	−0.252	−0.114	−0.067	−0.187	−0.162	−0.208	0.450[†]	0.218
Transportation	−0.013	−0.109	−0.149	0.167	0.007	−0.111	−0.049	0.403[†]	0.319*
Household skills	−0.041	−0.033	−0.241	0.098	−0.139	0.083	−0.067	0.534[†]	0.422[†]
Total score	−0.267	−0.289*	−0.327*	0.036	−0.259	−0.076	−0.254	0.747[†]	0.445[†]

CDSS, Calgary Depression Scale for Schizophrenia; MCCB, Measurement and Treatment Research to Improve Cognition in Schizophrenia (MATRICS) Consensus Cognitive Battery; PANSS, Positive and Negative Syndrome Scale; PSP, Personal and Social Performance Scale; UPSA, University of California San Diego (UCSD) Performance-based Skills Assessment; WHODAS, World Health Organization Disability Assessment Schedule.
* p-value < 0.05.
† p-value < 0.01.

of life in their sample of patients with schizophrenia. Green et al. (2005) also reported that social cognition plays a critical role in community functioning in patients with schizophrenia. The results of this study suggest that social cognition is an important factor in evaluating global rather than general cognitive function in patients with schizophrenia. On the contrary, in the case of disability self-awareness, a significant correlation was found with all general cognitive functions except for the MCCB domains mentioned previously. Overall, patients with schizophrenia are primarily interested in social cognition when evaluating their global function; relatively general cognitive function may be overlooked. Therefore, compared to the decrease in clinician-rated global function, the lower the general cognitive function, the less is the change in self-rated global function; disability self-awareness may also be considered to decrease.

The UPSA reflects functional capacity related to daily living functions in patients with schizophrenia through role play (Heinrichs et al., 2006). According to a study by Sabbag et al. (2012), self-assessment accuracy of everyday function is low in patients with schizophrenia, and approximately 60% of patients report their ability differently from their actual performance. In this study, objective functional capacity evaluated with the UPSA and self-awareness of function evaluated with the WHODAS showed significant correlation only in the communication domain. In healthy subjects, communication has an important relationship with social cognition; this has been revealed in several previous studies (Roskos-Ewoldsen and Monahan, 2009). Studies in patients with schizophrenia have also found that communication difficulties are a key factor in social cognitive decline (Couture et al., 2006). MCCB and UPSA evaluation in the current study suggested that social cognition plays an important role in self-assessment of global function in patients with schizophrenia. Considering disability self-awareness, in this study, the lower was the daily living function evaluated by UPSA, the better was the patients perception of global function. Similar to the previous interpretation of the MCCB results, this is believed to have occurred because it was highly likely that patients with schizophrenia did not consider most of the UPSA domains in evaluating their global function. In addition, in case of the communication domain, from the patient's perspective, the lower the score, the lower is the global function; however, it was relatively less than the decrease in the global function evaluated by the clinician. It was therefore believed that there was positive correlation with disability self-awareness.

The appropriate level of disability self-awareness can only be achieved through appropriate understanding of one's current state. Due to limited insight, a significant number of patients with schizophrenia underestimate their symptoms (Amador et al., 1991; Gonzalez-Suarez et al., 2011). Importantly, acceptance of one's symptoms and understanding of one's functional ability can differ. For example, even if patients have some understanding of their psychotic symptoms, such as their hallucinations or delusions, it may be difficult for them to grasp how these symptoms affect their functioning, and which specific functional domains are effected. Smith et al. (2000) reported that low insight correlated with core symptoms in patients with schizophrenia, whereas severe depression was associated with high insight. Bowie et al. (2007) used a specific level of functioning scale (SLOF) in patients with schizophrenia to assess daily living function through self-reports, and compared the patients' reports to the case managers' rating. Subjects were classified as accurate raters, underestimators, and overestimators. While underestimators had more severe depressive symptoms and higher cognitive function than the overestimators, the latter had the most severe cognitive and functional disabilities. This suggests that various clinical factors need to be considered in addition to social cognition when patients with schizophrenia self-evaluate their function.

There are several limitations to this study. First, it is difficult to generalize the results, as the subjects were either in day hospitals or occupational rehabilitation; this have limited the range of symptoms or functions observed. Second, for calculating the degree of disability self-awareness, the scope of comparing the different tools, namely, WHODAS

and PSP were limited. Although the scores of the two tools were compared after standardization, it will be necessary to use the same tools for patients and clinicians in future studies. Third, the interpretation of the results is somewhat difficult, as they provide no further insights into the factors that may be involved in evaluating self-awareness of disability. Fourth, as we did not include a healthy control group, we cannot be certain that the results of this study are characteristic of patients with schizophrenia. Fifth, this study identified the correlation between cognitive and daily living function and disability self-awareness, but the causal relationship was not confirmed. Future research is needed in this regard.

To summarize, this study evaluated the degree of self-awareness of disability in patients with schizophrenia by comparing patient-rated and clinician-rated global function. Patient-rated global function evaluated by WHODAS self-reported scores was found to be primarily related to social cognition, including learning and communication abilities. Regarding disability self-awareness, patients with schizophrenia were found to perceive their global function better than their cognitive function; daily life function was perceived lower. When evaluating the patient's disability to establish a treatment plan or to determine prognosis, it will be necessary to consider both, the difference according to the reporter, and cognitive and daily living functions.

Declaration of competing interest

The authors declare no conflict of interest with any commercial or other associations in connection with the submitted article.

Contributors

Jung-Joon Moon conducted the study protocol as primary principal investigator. Sung-Jin Kim wrote the first draft of the manuscript. Sung-Jin Kim and Dong-Wook Jeon designed the study, analyzed the data, drafted the manuscript, and participated the study protocol as the coinvestigator.

Young-Soo Seo, Sung-Soo Jung, Yoo-Chul Lee, Jeong-Eun Kim, and Yeon-Sue Kim conducted the study protocol as the co-investigator. Sung-Jin Kim and Do-Un Jung managed the literature searches and revised the manuscript critically for important intellectual content. All authors contributed to and have approved the final manuscript.

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