





Perceptions of and subjective difficulties with social cognition in schizophrenia from an internet survey: Knowledge, clinical experiences, and awareness of association with social functioning

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Aim: Social cognition impacts social functioning in schizophrenia; however, little is known about how patients with schizophrenia themselves perceive social cognition. This study, using an internet survey, aimed to investigate their knowledge of social cognition, clinical experiences related to social cognition, awareness of social cognition's role in one's social life, and the relationships between subjective difficulties with social cognition and social functioning.

Methods: Data from 232 outpatients with schizophrenia (SZ) and 494 healthy controls (HC) were obtained through an internet survey and were weighted according to the demographics of the national population. A newly developed survey questionnaire on knowledge, experience, and awareness of social cognition was administered. Subjective difficulties were evaluated using the Self-Assessment of Social Cognition Impairments and the Observable Social Cognition Rating Scale.

Results: Less than a quarter of both groups were familiar with the term or concept of social cognition. Less than 5%

of both groups had experienced being assessed or treated for social cognition. More than half of both groups were aware of the relationship between social cognition and social functioning. The SZ group had higher levels of subjective difficulties than the HC group across all social cognitive domains. The attributional bias domain of subjective difficulties was negatively associated with social functioning.

Conclusion: Patients with schizophrenia had substantial subjective difficulties in social cognition, which they perceived as being related to social functioning. However, their knowledge of social cognition was limited, and the assessment and treatment might not be widespread in regular clinical practice.

Keywords: cognitive function, psychosis, real-world functioning, schizophrenia, social cognition, social functioning.

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Patients with schizophrenia exhibit a substantial decline in social functioning.¹ This decline has broad adverse effects on a variety of social situations including work, school, relationships with family and friends, and independent living.^{2,3} To date, various factors have been examined that directly or indirectly affect social functioning. Examples of the major potential factors include neurocognition, negative symptoms, mood symptoms, and motivation.^{4–7} In addition, a growing focus has been placed on social cognition, which refers to “the mental operations that underlie social interactions, including perceiving, interpreting, and generating responses to the intentions, dispositions, and behaviors of others”.^{8,9} Social cognitive impairments have a significant impact on social functioning, and social cognition acts as a mediator between neurocognition and social functioning.^{9–11} This knowledge has led to studies examining the domains of social cognition and the development of measures. In 2006, the National Institute of Mental Health Workshop suggested five representative domains of social cognition in schizophrenia research: theory of mind, social

perception, social knowledge, attributional style/bias, and emotion processing.⁸ Thereafter, the Social Cognition and Psychometric Evaluation study examined the psychometric properties of measures for each domain selected by an expert panel and proposed the current recommendations for their use.^{12–14} Validation of these measures with consideration given to language and cultural differences has also begun.^{15–18} Social cognitive impairments are also attracting attention as a promising therapeutic target; to date, mainly psychological interventions have been developed (e.g. Social Cognition and Interaction Training), as current pharmacological treatments have little effect on cognitive impairment.^{19,20} Positive evidence of the effects of such interventions has been accumulating.²¹

Although a clinical strategy targeting social cognition is expected to be a key to improving social functioning and achieving clinical recovery, little is known about how social cognition itself is perceived by patients with schizophrenia. According to a few measures developed to assess subjective difficulties in social cognition,

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patients with schizophrenia were conscious of many difficulties when given detailed examples of social situations or behaviors that require social cognition.^{22,23} However, to begin with, it may be very uncommon for patients with schizophrenia to know about social cognition and to have a clear sense of the need to receive treatment. Specifically, it is unclear what proportion of patients know about the term and concept of social cognition, its relation to mental illness, and the existence of its assessment and treatment methods. It is also unclear what proportion of patients is aware of its relationship to social functioning or what proportion of patients has ever been assessed and treated. Furthermore, how subjective difficulties themselves impact social functioning is poorly understood, although such information is important for elucidating the mechanisms of social functioning in the real world. More information on patients' perceptions and subjective difficulties regarding social cognition is urgently needed to enlighten and disseminate information regarding social cognition in actual clinical practice and to translate maturing research findings into actual, real-world benefits to patients. For patients with schizophrenia, increased knowledge of social cognition may provide a psychoeducational role in itself, allowing insight into their own social cognitive difficulties in the context of interpersonal situations. This psychoeducational role may facilitate participation in rehabilitation for social cognition, improve adherence to treatment, and even be associated with prognosis.²⁴ In the general population, knowledge of social cognition is associated with stigma toward mental illness. Stigma consists of three components: knowledge, attitudes, and behaviors, and the general population has various misunderstandings about mental illness.²⁵ For example, they often assume that mental illness derives from psychological factors, such as a weakness of personality, rather than biological factors.²⁶ Therefore, improving knowledge of social cognition could be a first step toward reducing stigma.

In the present study, we aimed to investigate knowledge of social cognition, clinical experiences of being assessed or treated for social cognition, and awareness of social cognition's role in one's social life among patients with schizophrenia living in the community, as well as the relationships between subjective difficulties in social cognition and social functioning. The present study also included healthy controls to enable a comparison of the perceptions and subjective difficulties of social cognition experienced by patients with schizophrenia relative to those experienced by healthy controls.

Methods

Study design and participants

This study had a cross-sectional design, in which data from outpatients with schizophrenia or schizoaffective disorder (SZ group) and healthy controls (HC group) were collected through a web-based, self-administered questionnaire survey. This survey was conducted from March 5 to March 15, 2021, by a professional agency with a large internet survey panel (Rakuten Insight, Inc., Tokyo, Japan; <https://member.insight.rakuten.co.in/>); a link to the online question form was distributed *via* email. Participants in both groups were between the ages of 20 and 59 years. Individuals in the SZ group had been diagnosed as having schizophrenia or schizoaffective disorder, had received continuous outpatient treatment for at least 1 year, and had no history of psychiatric hospitalization within 3 months of the study assessment. The HC group had no history of a psychiatric visit. To calculate the propensity scores based on the national population and to weight the SZ group according to these scores (for detailed statistical methods, please see Section "Data Analysis" below), the age distribution and sex ratio of the HC group was selected so as to reflect those of the latest Population Census of Japan (<https://www.stat.go.jp/english/data/kokusei/2020/summary.html>). The exclusion criteria for both groups were a history of alcohol or substance abuse and a history of brain injury, convulsive seizure, or severe physical illness.

To increase the reliability and validity of the survey, participants who had been previously enrolled in a large internet survey panel as subjects with self-reported schizophrenia or schizoaffective disorder

(SZ group) or with no self-reported history of mental illness (HC group) were included in the present study. The registration information for this panel was regularly checked and updated by the agency. For the SZ group, we included additional self-reported questions to confirm their diagnoses. We asked whether the participants had been informed by a clinician that he or she had schizophrenia or schizoaffective disorder; if they had not, they were excluded. To increase the reliability of the responses, self-reported questions concerning each of the inclusion/exclusion criteria were included (i.e. whether the patient had been receiving outpatient treatment, including medication, for at least 1 year continuously; whether the patient has been hospitalized within 3 months; and whether the patient had no episodes of substance abuse, convulsions, or serious physical illness). Only subjects who met all the criteria were included in the study. For the HC group, we included an additional self-reported question asking whether the participant had ever visited a psychiatrist; if they had, they were excluded. The other exclusion criteria mentioned above were also confirmed using appropriate questions. In addition, we excluded respondents who provided the same answer to all the questions (i.e. straight-lining). Furthermore, we included a question designed to detect fraudulent responses. Specifically, we set up a five-choice question and asked, "Please choose the second from the bottom of the following options." The choices were, in order from top to bottom, A, B, C, D, and E. If the participant chose the wrong answer to this question (i.e. any answer other than D), they were excluded from the analysis. This method is similar to methodologies used in previously reported internet survey research.²⁷

Responses were obtained from 252 patients with schizophrenia and 551 healthy controls. After applying the exclusion criteria, such as subjects with inappropriate responses, 232 patients with schizophrenia and 494 healthy controls were included in the analysis (20 patients with schizophrenia and 57 healthy controls were excluded).

Informed consent was obtained before the participants responded to the questionnaire, and the participants were provided the option to stop the survey at any point. The participants were paid points equivalent to about 50 yen. The study protocol was approved by the Ethics Committee of the Faculty of Medicine, Toho University (A20074). The internet survey agency respected the Act on the Protection of Personal Information in Japan. This study was performed in accordance with the latest version of the Declaration of Helsinki.

Table 1. Questionnaire on knowledge, experience, and awareness of social cognition (KEA-SC)

- Social cognition is generally defined as the mental operations underlying interpersonal relationships, including the human ability to understand the intentions and emotions of others. For example, it refers to the brain functions associated with recognizing emotions from a person's face or voice tone or inferring a person's intentions.
- The following questions are about your perceptions of social cognition. Please answer "yes" or "no" to each question.
1. Do you know or have you ever heard of the term or concept of social cognition?
 2. Have you ever heard of the association of mental illness with social cognition?
 3. Do you think that social cognition is associated with social life?
 4. Do you know that there are ways to measure social cognition?
 5. Have you ever had a test to measure your social cognition?
 6. Do you know that there are programs that aim to enhance social cognition?
 7. Have you ever undergone a program aimed to enhance your social cognition?

Table 2. Characteristics of patients with schizophrenia and healthy controls (after propensity score weighting)

| | SZ (<i>n</i> = 230) | HC (<i>n</i> = 498) | Standardized differences |
|-------------------------|----------------------|----------------------|--------------------------|
| Age (years), mean | 42.9 | 42.7 | 0.016 |
| Female, % | 48.3 | 45.8 | 0.050 |
| Education (years), mean | 14.1 | 14.2 | 0.014 |
| Living alone, % | 17.4 | 18.7 | 0.039 |
| Living with parent, % | 30.3 | 31.3 | 0.022 |
| Living with partner, % | 52.6 | 50.0 | 0.034 |

HC, healthy controls; SZ, schizophrenia.

Table 3. Characteristics of patients with schizophrenia and healthy controls (before propensity score weighting)

| | SZ (<i>n</i> = 232) | HC (<i>n</i> = 494) | Standardized differences |
|-------------------------|----------------------|----------------------|--------------------------|
| Age (years), mean | 44.6 | 41.4 | 0.346 |
| Male, % | 38.8 | 49.6 | 0.219 |
| Education (years), mean | 13.5 | 14.5 | 0.475 |
| Living alone, % | 22.0 | 17.6 | 0.111 |
| Living with parent, % | 50.0 | 21.7 | 0.618 |
| Living with partner, % | 28.0 | 60.7 | 0.697 |

HC, healthy controls; SZ, schizophrenia.

Table 4. Results of the questionnaire on knowledge, experience, and awareness of social cognition (KEA-SC) in patients with schizophrenia and healthy controls

| | SZ (<i>n</i> = 230) % (yes) | HC (<i>n</i> = 498) % (yes) | <i>P</i> |
|--|------------------------------|------------------------------|----------|
| <i>Knowledges</i> | | | |
| Term or concept (item 1) | 23.0 | 24.5 | 0.669 |
| Association with mental illness (item 2) | 21.3 | 17.7 | 0.244 |
| Measures (item 4) | 8.3 | 6.6 | 0.422 |
| Treatments (item 6) | 5.2 | 5.4 | 0.909 |
| <i>Experiences</i> | | | |
| Measures (item 5) | 4.8 | 1.2 | 0.003* |
| Treatments (item 7) | 3.9 | 0.8 | 0.003* |
| <i>Awareness</i> | | | |
| Association with social functioning (item 3) | 64.8 | 51.2 | 0.001* |

*, statistically significant after Bonferroni correction (*P* < 0.007).

HC, healthy controls; SZ, schizophrenia.

Measures

A survey questionnaire on knowledge, experience, and awareness of social cognition (KEA-SC) was developed by the members of a research project (which included the authors of the present report) for the “Development of the first Japanese social cognition test battery”; this research project was supported by a grant from the Japan Agency for Medical Research and Development (AMED) (grant number JP20dk0307092). As shown in Table 1, this self-administered questionnaire begins with a brief definition of social cognition, followed by a yes/no response to seven items: four items regarding the respondent’s knowledge of social cognition (items 1, 2, 4, and 6), two items

regarding the respondent’s experience with the assessment and treatment of social cognition (items 5 and 7), and one item regarding the respondent’s awareness of the association between social cognition and social functioning (item 3). This questionnaire was designed to make it easy to understand the meaning of the questions by using simple Japanese. Prior to the start of the internet survey, several patients with schizophrenia and healthy controls completed the KEA-SC in person to confirm that the questions were well understood.

Subjective difficulties in social cognition were evaluated using the Self-Assessment of Social Cognition Impairments (ACSo) and the Observable Social Cognition Rating Scale (OSCARS). The ACSo is a 12-item self-administered questionnaire that examines subjective

Table 5. Results of the questionnaire on knowledge, experience, and awareness of social cognition (KEA-SC) in patients with recent-onset and chronic schizophrenia

| | Recent-onset SZ (<i>n</i> = 59) % (yes) | Chronic SZ (<i>n</i> = 173) % (yes) | <i>P</i> |
|--|--|--------------------------------------|----------|
| <i>Knowledge</i> | | | |
| Term or concept (item 1) | 23.7 | 23.7 | 0.996 |
| Association with mental illness (item 2) | 23.7 | 23.7 | 0.996 |
| Measures (item 4) | 8.5 | 6.4 | 0.580 |
| Treatments (item 6) | 6.8 | 3.5 | 0.279 |
| <i>Experiences</i> | | | |
| Measures (item 5) | 5.1 | 4.0 | 0.734 |
| Treatments (item 7) | 5.1 | 1.7 | 0.161 |
| <i>Awareness</i> | | | |
| Association with social functioning (item 3) | 39.0 | 70.5 | <0.001* |

*, statistically significant after Bonferroni correction ($P < 0.007$).
SZ, schizophrenia.

Table 6. Comparisons of subjective difficulties in social cognition between patients with schizophrenia and healthy controls

| | SZ (<i>n</i> = 230) | HC (<i>n</i> = 498) | <i>P</i> | Cohen's <i>d</i> |
|---------------------------------|----------------------|----------------------|----------|------------------|
| | Mean (SD) | Mean (SD) | | |
| <i>ACSo</i> | | | | |
| Total score | 17.03 (11.89) | 6.55 (8.70) | <0.001 | 1.01 |
| Emotional processes | 3.90 (3.14) | 1.58 (2.15) | <0.001 | 0.93 |
| Theory of mind | 4.66 (3.22) | 1.85 (2.46) | <0.001 | 1.03 |
| Attributional bias | 4.34 (3.32) | 1.61 (2.28) | <0.001 | 1.03 |
| Social perception and knowledge | 4.14 (3.15) | 1.50 (2.20) | <0.001 | 1.04 |
| <i>OSCARS</i> | | | | |
| Total score | 21.51 (11.26) | 11.85 (6.00) | <0.001 | 1.19 |
| Social cognitive ability | 10.45 (5.82) | 5.76 (3.07) | <0.001 | 1.13 |
| Social cognitive bias | 11.06 (6.12) | 6.09 (3.23) | <0.001 | 1.14 |

ACSo, the Self-Assessment of Social Cognition Impairments; HC, healthy controls; OSCARS, the Observable Social Cognition Rating Scale; SD, standard deviation; SZ, schizophrenia.

complaints regarding four different domains of social cognitive impairment: emotional processes, social perception and knowledge, theory of mind, and attributional bias.²² The OSCARS is an 8-item self-administered questionnaire that comprehensively examines subjective complaints regarding social cognitive impairment.²³ The OSCARS consists of two factors: social cognitive bias and social cognitive ability. For both scales, all text was translated from the original language (French for the ACSo, English for the OSCARS) into Japanese and then back-translated into the original languages. The back-translations were reviewed by the original authors, and modifications were made to the Japanese translations as necessary.

Social functioning was evaluated using the Social Functioning Scale (SFS), which is a self-administered measure of a wide range of community functioning, including withdrawal, interpersonal behavior, pro-social activities, recreation, independence-performance, independence-competence, and employment.³ The validity, reliability, and factor structure of the Japanese version of the SFS have been confirmed in previous studies.^{28,29} We used the total SFS score in this study.

To conduct this online survey, a unique form was created. First, a page describing the purpose of the study and obtaining the participant's agreement was presented. Next, questions regarding the

inclusion/exclusion criteria were presented. Participants who met all the criteria then moved to the main question pages; those who did not meet all the criteria exited the study. To reduce the influence of other questionnaires on the results of the KEA-SC, the questions were set so that the respondents needed to answer the KEA-SC, ACSo, OSCARS, and SFS, in that order. The entire survey took approximately 30 min. It was assumed that the respondents would answer the questions independently without any assistance.

Data analysis

To adjust for demographic differences between the SZ group and the HC group, which was sampled according to the national population, we used an inverse probability weighting (IPW) method.³⁰ Data from both of the groups were combined, and a logistic regression model with demographic covariates (sex, age, education, and living status) was used to estimate the probability of "being in the SZ or HC group" (i.e. propensity score).^{31,32} A standardized propensity score was used to weight the data to keep the total number of subjects included constant. When the standardized differences of weighted data between two groups are <0.1, the data are considered to be appropriately balanced

Table 7. Correlation coefficient between the SFS total score and subjective difficulties in social cognition in patients with schizophrenia and healthy controls

| | <i>r</i> | |
|---------------------------------|----------------------|----------------------|
| | SZ (<i>N</i> = 230) | HC (<i>N</i> = 498) |
| <i>ACSo</i> | | |
| Total score | -0.392*** | -0.071 |
| Emotional processes | -0.363*** | -0.071 |
| Theory of mind | -0.353*** | -0.079 |
| Attributional bias | -0.389*** | -0.077 |
| Social perception and knowledge | -0.349*** | -0.045 |
| <i>OSCARS</i> | | |
| Total score | -0.380*** | -0.056 |
| Social cognitive ability | -0.333*** | -0.050 |
| Social cognitive bias | -0.383*** | -0.057 |

P* < 0.05; *P* < 0.01; ****P* < 0.001.

ACSo, the Self-Assessment of Social Cognition Impairments; HC, healthy controls; OSCARS, the Observable Social Cognition Rating Scale; SFS, Social Functioning Scale; SZ, schizophrenia.

14.2 years, respectively. In the SZ group, the mean duration of illness was 12.3 years (SD, 9.8).

First, the results of the KEA-SC were compared between groups using the chi-squared test. Since all the KEA-SC items were yes/no responses, a chi-square test was selected to compare independent categorical data. Then, subjective difficulties in social cognition as assessed by the ACSO and the OSCARS were compared between the groups using the *t*-test. To examine heterogeneity within the SZ group, the SZ group, which had a mean illness duration of 12.3 years, was divided into a recent-onset group (*N* = 59) and a chronic group (*N* = 173) using an illness duration of 2 years as a cutoff; the KEA-SC, ACSO, and OSCARS results were then compared between these two groups. Finally, the associations of the SFS total score with subjective difficulties in social cognition were separately examined for the SZ and HC groups using regression analyses with robust standard error estimation after checking for simple correlations. The regression analyses were performed using two procedures: (i) six simple regression analyses, with SFS as the dependent variable and each of ACSO and OSCARS sub-scales as the independent variable, and (ii) two multiple regression analyses with SFS as the dependent variable and all the ACSO or OSCARS sub-scales (i.e. four ACSO subscales or two OSCARS subscales), respectively, as the independent variables. All the regression analyses were also controlled for age and sex.

Statistical differences were determined using two-tailed tests and a significance level of *P* < 0.05. The results of the KEA-SC were corrected for multiple comparisons using the Bonferroni method (*P* < 0.007). Data were analyzed using SPSS, version 26.0 (IBM, Armonk, NY, USA).

by the propensity score.^{33,34} All subsequent analyses were performed using the weighted data produced using this IPW method. The demographic data after weighting is shown in Table 2 (before weighting is shown in Table 3). The mean ages of the SZ and HC groups were 42.9 and 42.7 years, and 48.3% and 45.8% were female, respectively. The mean duration of education of the SZ and HC groups were 14.1 and

Table 8. Results of regression analyses examining associations of social functioning with subjective difficulties in social cognition in patients with schizophrenia (*N* = 232) and healthy controls (*N* = 494)

| Independent variables | Simple regression | | | Multiple regression | | |
|------------------------------------|-------------------|------------------|--------------------------------|---------------------|------------------|--------------------------------|
| | β | 95% CI | Adjusted <i>R</i> ² | β | 95% CI | Adjusted <i>R</i> ² |
| <i>Patients with schizophrenia</i> | | | | | | |
| <i>ACSo</i> | | | | | | |
| Emotional processes | -0.373*** | (-0.552, -0.193) | 0.150 | -0.082 | (-0.347, 0.183) | 0.178 |
| Theory of mind | -0.390*** | (-0.566, -0.215) | 0.159 | -0.105 | (-0.421, 0.211) | — |
| Attributional bias | -0.415*** | (-0.585, -0.244) | 0.174 | -0.257* | (-0.463, -0.051) | — |
| Social perception and knowledge | -0.379*** | (-0.560, -0.198) | 0.153 | -0.022 | (-0.318, 0.275) | — |
| <i>OSCARS</i> | | | | | | |
| Social cognitive ability | -0.358*** | (-0.555, -0.160) | 0.133 | -0.110 | (-0.350, 0.131) | 0.165 |
| Social cognitive bias | -0.405*** | (-0.598, -0.213) | 0.165 | -0.320** | (-0.566, -0.075) | — |
| <i>Healthy controls</i> | | | | | | |
| <i>ACSo</i> | | | | | | |
| Emotional processes | -0.057 | (-0.156, 0.042) | 0.027 | -0.007 | (-0.229, 0.215) | 0.028 |
| Theory of mind | -0.067 | (-0.169, 0.034) | 0.028 | -0.104 | (-0.360, 0.151) | — |
| Attributional biases | -0.075 | (-0.171, 0.021) | 0.029 | -0.139 | (-0.328, 0.050) | — |
| Social perception and knowledge | -0.040 | (-0.138, 0.057) | 0.025 | 0.187 | (-0.037, 0.411) | — |
| <i>OSCARS</i> | | | | | | |
| Social cognitive ability | -0.040 | (-0.158, 0.078) | 0.025 | -0.004 | (-0.164, 0.157) | 0.024 |
| Social cognitive bias | -0.047 | (-0.164, 0.069) | 0.026 | -0.044 | (-0.204, 0.115) | — |

P* < 0.05; *P* < 0.01; ****P* < 0.001.

Dependent variable was the social functioning scale total score. All analyses were controlled for age and gender and were weighted by propensity scores.

β , standardized partial regression coefficient; ACSO, Self-Assessment of Social Cognition Impairments; CI, confidence interval; OSCARS, Observable Social Cognition Rating Scale; *R*², coefficient of determination.

Results

Knowledge, experience, and awareness of social cognition

Less than a quarter of both groups knew about the term or concept of social cognition (item 1) and its relation to mental illness (item 2), and <10% of both groups knew about the existence of its measure (item 4) or treatment (item 6), with no significant differences between the groups. Less than 5% of both groups had experience with being assessed (item 5) or treated (item 7) for social cognition, with the results for the SZ group being significantly higher than those for the HC group. On the other hand, more than half of both groups were aware of the relationship between social cognition and social functioning (item 3), with the results for the SZ group being significantly higher than those for the HC group. The details are shown in Table 4. Regarding the within-group differences, the chronic group had a significantly higher awareness of the relationship between social cognition and social functioning (item 3) than the recent-onset group, while the other items were not significantly different (Table 5).

Subjective difficulties in social cognition

As shown in Table 6, in all domains of social cognition, the SZ group had significantly higher subjective difficulties than the HC group, and all their effect sizes were large. These results were consistent between the ACSO and the OSCARS. Regarding the within-group differences, no significant differences in any of the items were seen between the recent-onset and chronic groups.

Associations of subjective difficulties in social cognition on social functioning

In the correlation analysis, there were significant but weak negative correlations ($r < 0.4$) between the SFS total score and all items of the ACSO and OSCARS in the SZ group, but no correlations were found in the HC group (Table 7). In the SZ group, all sub-scales of subjective difficulties in social cognition were negatively and significantly associated with social functioning in each of the single regression analyses. In the multiple regression analyses for each scale, only the attributional bias of the ACSO and the social cognitive bias of the OSCARS were negatively and significantly associated with social functioning. The adjusted R^2 values of these multiple regression models were 0.178 and 0.165, respectively (Table 8). In the HC group, no significant associations were seen for any of the simple or multiple regression analyses.

Discussion

The present study investigated perceptions and subjective difficulties with social cognition among patients with schizophrenia living in the community. In the present study, many of the patients with schizophrenia and the healthy controls had limited knowledge of social cognition. Furthermore, only a few of them had received any assessment or treatment for social cognition. Therefore, the concept of social cognition might not appear to have penetrated into current clinical practice or society. There was no difference in knowledge of social cognition between the two groups. This result may be due to the fact that both patients with schizophrenia and healthy controls are unaware that not only is social cognition a symptom of schizophrenia, but that social cognition itself can be defined or exist as a human brain function in a scientific context. To the best of our knowledge, no data from other countries have been reported, making it impossible to compare and suggesting that this situation might be common worldwide. Since antipsychotic treatment alone is woefully inadequate to achieve a clinical recovery from schizophrenia,³⁵ the establishment of novel treatment strategies is urgently needed. Social cognitive interventions could be one of the strategies,^{21,36} and further attention with regard to social cognition is needed not only in the field of research, but also in real-world clinical practice. This necessity is supported by the present results indicating a discrepancy between a low proportion of knowledge and experience among the study population but a high

proportion of awareness of a relationship with social functioning, representing a potential unmet need in patients with schizophrenia.

The results of the self-administered ACSO and OSCARS questionnaires showed that the patients with schizophrenia were conscious of stronger difficulties when given detailed examples of social situations or behaviors that require social cognition, compared with the healthy controls. An example of a question was: “*You see others as intending you harm, especially in ambiguous (unclear) situations. For example, you walk past a few people who are laughing and think that they are laughing at you (social cognitive bias in OSCARS).*”²³ These results were consistent across all sub-scales (i.e. emotional processes, social perception and knowledge, theory of mind, attributional bias in ACSO, and social cognitive bias and social cognitive ability in OSCARS). These were consistent with previous studies.^{22,23} Patients with schizophrenia are usually assumed to have a limited perception of their psychological symptoms, especially of psychotic symptoms.³⁷ A similar assumption with regard to cognitive symptoms would seem reasonable, since the results of subjective and objective assessments are often inconsistent.³⁸ In fact, previous studies examining the psychometric properties of the ACSO and the OSCARS showed relatively low correlations between the results for subjective difficulties and those for objective impairments of social cognition. However, the present results cannot be neglected because these subjective difficulties in social cognition were much stronger than those in the healthy controls, and the regression analyses showed that all domains of subjective difficulties were negatively associated with social functioning. This subjective association between social cognition and social functioning is consistent with previous studies that have examined objective associations.^{10,39}

Among the domains of subjective difficulties, only the attributional bias in the ACSO and the social cognitive bias in the OSCARS were associated with social functioning in the multiple regression analyses, respectively. These two subscales could assess a conceptually consistent parameter (i.e. subjective difficulty in attributional bias). Attributional bias refers to “the way in which individuals explain the causes and make sense of social events or interactions”.^{8,12} This includes an increased tendency to attribute hostile intentions to others in ambiguous social situations and is associated with persecutory delusional symptoms.⁴⁰ Furthermore, it is also associated with other psychiatric symptoms, such as social anxiety, in patients with schizophrenia.^{41,42} Because fewer social anxiety symptoms and a lesser personality tendency to behave pessimistically have been shown to facilitate social functioning in patients with schizophrenia,^{43,44} the present negative relationship, i.e. fewer subjective difficulties in attributional bias were associated with better social functioning, could be consistent with these previous findings. Unlike other domains of social cognition, previous research on measurable attributional bias in schizophrenia has not been plentiful,^{45,46} and some authors have reported that attributional bias is less associated with global functioning.^{41,47,48} In light of the present results, subjective difficulties in social cognition (especially attributional bias) may be more related to impaired social functioning than the decline in social cognition itself. Alternatively, subjective difficulties in social cognition may be mediated between social cognition and social functioning, and it would be useful to examine both objective and subjective scales simultaneously in the future. Furthermore, awareness of social cognition could be regarded as a component of meta-cognition, which is described as a spectrum of processes enabling persons to notice and reflect upon their own thoughts, feelings, and wishes.⁴⁹ Examining the difference between objective and subjective evaluations from the perspective of meta-cognition is also important.⁵⁰ These findings would be important for elucidating the highly complex mechanisms of social functioning that patients with schizophrenia require to live in the community. Moreover, for actual clinical settings, understanding the patient’s subjective difficulties can help the patient and medical professionals establish a good empathic and cooperative relationship to support their recovery process.⁵¹ This is often a crucial factor in ensuring that patients with schizophrenia, whose motivation is often impaired,

will not withdraw from psychological interventions or rehabilitation programs.^{52,53}

Although the present study had the limitation of being conducted as an internet survey, we took advantage of this methodology to collect data widely from various residential areas across Japan and to reduce bias by sampling the healthy control according to the national population and weighting the data. Because of limitations in the accuracy of the diagnoses, treatment status, and the conditions of the healthy controls, which were only confirmed through self-reporting, we took all possible precautions that can be taken when conducting an internet survey. In addition, the heterogeneity within the patient group needs to be carefully examined. In the present results, no differences in knowledge and experiences of social cognition were seen between the recent-onset and chronic groups, but the chronic group was more aware of the relationship between social cognition and social functioning. This finding suggests that patients with schizophrenia have very few opportunities to gain knowledge and clinical experience, and that the longer they live within a community, the more aware they become of the relationship between social cognition and social functioning. The results showing a lack of difference between the duration of illness and subjective difficulties were consistent with the fact that cognitive decline, including social cognition, is observed even before disease onset, with relatively the same level of decline observed during the early disease stage as that observed during the chronic stage.^{54,55} However, other factors related to the heterogeneity of patients with schizophrenia, such as psychiatric symptoms and medication, were not fully assessed in this study; thus, the results should be interpreted with caution, and further study is needed. Regarding the causal relationship between subjective difficulties in social cognition and social functioning, previous longitudinal studies have shown that cognitive function, including social cognition, predicts long-term social functioning in schizophrenia.^{56,57} Based on these results, regression analyses were conducted under the hypothesis that subjective social cognition predicts social functioning. However, the influence of social functioning on the participants' subjective evaluations cannot be denied,⁵⁸ which could indicate a contrary causal relationship, and the results of this cross-sectional study should be interpreted with caution. The KEA-SC is a convenient scale for the recognition on social cognition that was newly developed for this study and requires further investigation of its reliability and validity, although it may have contributed to the issues raised in this research area. To reinforce the present findings and to overcome these important limitations, we plan to conduct a face-to-face survey in the future study, the protocol for which has already been published.¹⁵

In conclusion, patients with schizophrenia had substantial subjective difficulties in social cognition, which they perceived to be associated with social functioning. However, their knowledge of social cognition was limited, and its assessment and treatment might not be widespread in regular clinical practice. Together with the establishment of assessments and treatment methods for social cognition, knowledge of social cognition needs to be disseminated and made available in actual clinical practices in a manner such that the patients themselves will accept and be interested in this concept. To this end, understanding the patients' perceptions and subjective difficulties with social cognition would be an important first step.

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Author contributions

T.U. R.O., and T.N. designed the study and wrote the protocol. Y.T., A.A., I.W., N.H., and S.I. were involved in the conceptualization of the study. T.U. collected the data, undertook the statistical analysis, and wrote the first draft of the manuscript. All the authors contributed to and approved the final manuscript.

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