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ORIGINAL PAPER

Mentalizing Errors in Patients with Schizophrenia Who Received Psychosocial Rehabilitation: a Case-Control Study

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Abstract
The main objective of this study was to evaluate the mentalizing performance of patients with schizophrenia who received daily psychosocial rehabilitation treatment compared with healthy controls. Differences in mentalizing performance between men and women, and the relationship between mentalizing deficits, cognitive impairment, symptoms, and global functioning of patients were also examined. A case-control study design was utilized *(N* = 95). Adults with schizophrenia were recruited from psychosocial rehabilitation clinics ($n = 53$) and healthy controls were recruited from the community ($n = 42$). Mentalizing was evaluated with the Movie for the Assessment of Social Cognition, an audiovisual measure with good ecological validity. Measures of cognitive functioning, symptoms, and global functioning were also administered. Patients exhibited significant mentalizing deficits. Specifically, patients made more undermentalizing errors and more no mentalizing errors compared with healthy controls. In patients and healthy controls, no differences were found between men and women in mentalizing abilities. In patients with schizophrenia, lower cognitive functioning (i.e., immediate and delayed verbal learning, verbal fluency, and processing speed) were associated with poorer mentalizing. In patients, processing speed explained 31% of the variance in total mentalizing errors and mentalizing deterioration was associated with poorer overall functioning. Psychosocial rehabilitation interventions in people with schizophrenia should consider mentalizing deficits (especially undermentalizing and no mentalizing difficulties) and their relationship with reduced processing speed in treatment delivery (e.g., direct and organized communication). Integration of treatments targeting mentalizing deficits in a psychosocial rehabilitation setting is recommended to improve functioning in schizophrenia.

Keywords Schizophrenia · Social cognition · Mentalizing · MASC

Introduction

Mentalizing is the ability of a person to represent the mental states of others and infer their intentions and beliefs [1]. Frith [2] first proposed that an anomaly in mentalizing may underlie the development of psychotic symptoms which generated a large volume of research about this topic (see reviews of Brüne [3] and Harrington, Siegert, & McClure [4]). In recent decades, a

large body of literature has accumulated on mentalizing in people with schizophrenia (e.g., Penn, Sanna, & Roberts [5]). While deficits in overall mentalizing are widely established in individuals with schizophrenia, there remains a gap in understanding of specific types of mentalizing deficits such as hypermentalizing errors (excessive attribution of intentions to others) and undermentalizing errors (lack of ability to represent own and others mental states; Frith [2, 6]).

Several meta-analyses establish mentalizing deficits in schizophrenia. Sprong, Schothorst, Vos, Hox, & Van Engeland [7] demonstrated a stable and significant deterioration of mentalizing in patients (*Cohen's d* = −1.255; *k* = 29 studies) and showed, on average, the performance of patients with schizophrenia was more than one standard deviation below that of healthy controls. The results of two subsequent meta-analytical studies are consistent with this finding (i.e., Bora, Yucel, & Pantelis [8]: *Cohen's d* = 1.10, *k* = 36 studies; Savla, Vella, Armstrong, Penn, & Twamley [9]: *Hedges' g* = .96, *k* = 50 studies). Mentalizing deficits affect the social, work and school functioning since individuals may struggle to correctly interpret social signals and it can also be difficult to infer the intentions of others; that is, on the one hand, individuals with mentalizing deficits do not detect double meanings and ironies and on the other, they may also "detect" imaginary intentions [10].

Sex differences in mentalizing have been studied in both healthy controls and in individuals with schizophrenia. In studies made up of healthy controls, women tend to outperform men on mentalizing tasks. Giovagnoli [11] conducted a study on mentalizing in 170 healthy subjects (68 men and 102 women) and revealed a significant advantage for women to correctly infer the intentions of others. However, in patients with schizophrenia, Fretland et al. [12] have not found significant differences in mentalizing deficits between men and women.

Cognitive deficits of patients with schizophrenia are also important in the functional evolution and prognosis of the disease [13]. In line with the results of previous meta-analyses, Schaefer, Giangrande, Weinberger, & Dickinson [14] found that patients with schizophrenia obtained significantly lower scores than healthy controls across different domains of cognitive functioning (mean effect size, *g* = −1.03). Preceding research has differentiated between the constructs of neurocognition (e.g., verbal learning, working memory, verbal fluency, and processing speed) and social cognition [15]. That is, in schizophrenia, neurocognition and social cognition (the latter includes mentalizing) represent two different [16] but related [17] areas of vulnerability. Regarding symptoms of schizophrenia, previous research demonstrates an association between mentalizing deficits, negative symptoms [18–20] and disorganization [21, 22]. Additionally, Montag et al. [23] found moderate correlations between no mentalizing and negative symptoms of schizophrenia as well as between overmentalizing and positive symptoms. Fretland et al. [12] also found that overmentalizing was moderately associated with positive symptoms and that undermentalizing tended to be associated with disorganization symptoms. However, Fretland et al. [12] did not find evidence for significant associations between no mentalizing and symptoms. Thus, mentalizing deficits in schizophrenia are important to understand when considering the strong relationship between this domain of social cognition and other areas affected by schizophrenia including cognitive ability, symptoms, and overall functioning. Perhaps most importantly for psychosocial treatment contexts, mentalizing deficits are related to impaired functioning. For example, Brüne, Abdel–Hamid, Lehmkämper, & Sonntag [24] found that mentalizing deficits are the best predictor of low social competence. Thus, psychosocial interventions developed to date aim to reduce these mentalizing deficits and, consequently, to reduce their impact on overall functioning (e.g., Moritz & Woodward [25]; Penn, Roberts, Combs, & Sterne [26]).

To our knowledge, this is the first study that will examine mentalizing in patients with schizophrenia enrolled in daily psychosocial rehabilitation treatment, a subtype of patients who usually present with more impaired functioning than those engaged exclusively in standard outpatient care (e.g., medication management and psychotherapy). Considering the previously established relationships between mentalizing deficits with cognitive functioning, symptoms, and overall functioning, the main objective of this work is to evaluate the mentalizing performance of patients in a psychosocial rehabilitation context compared with that of healthy controls, inspecting the number and percentage of mentalizing errors (i.e., overmentalizing, undermentalizing, and no mentalizing). Specific aims of the study are to 1) analyze differences between men and women on mentalizing performances (both in patients and healthy controls); and 2) examine the relationship of mentalizing deficits with cognitive functioning, symptoms, and overall functioning in patients.

Material and Methods

Participants

Fifty-three patients were recruited (36 men and 17 women) who met the diagnostic criteria for schizophrenia according to the DSM–5 [27]. Patients with a diagnosis of psychosis due to a medical condition or substance use, a history of traumatic brain injury (TBI), neurological disease, visual impairment, or any medical condition known to affect cognitive performance were excluded. All were chronically stable patients and ages ranged from 18 to 65-years-old. All patients received psychopharmacological treatment, and attended distinct psychosocial rehabilitation centers for daily rehabilitation treatment. These centers serve patients with severe mental disorders to strengthen physical, emotional, social, and intellectual capacities to reach a level of autonomy that allows for community reintegration.

A case-control design was achieved through intentional non-random sampling of individuals without psychopathology which included 42 participants from the community (27 men and 15 women) between the ages of 18 and 65-years-old. Healthy participants were matched for age, sex, and education level with the patient sample. Healthy participants were excluded for the following: meeting criteria for a DSM-5 diagnosis [27], taking psychotropic medication, receiving outpatient mental health treatment, a history of TBI, a visual defect or any medical condition known to affect cognitive performance, and consuming illicit substances in the last 12 months.

Measures

Movie for Assessment of Social Cognition (MASC; Dziobek et al. 2006 [28]; Spanish version of Lahera et al. [29]). The MASC is a 45-min audiovisual measure that evaluates mentalizing from a film in which the interaction between different characters is shown. The film is stopped 46 times, and participants are asked about the emotions, thoughts, and intentions of protagonists. The MASC provides a global score of mentalizing as well as subscales assessing different types of mentalizing errors (i.e., overmentalizing, undermentalizing, and no mentalizing).

Positive and Negative Syndrome Scale (PANSS; Kay, Opler, & Lindenmayer [30]; Spanish version of Peralta & Cuesta [31]). The PANSS assesses the severity of schizophrenia

symptoms using three subscales: Positive Scale of PANSS (PANSS–P), Negative Scale of PANSS (PANSS–N), and General Psychopathology Scale of PANSS (PANSS–PG). The PANSS–P evaluates delusions, conceptual disorganization, hallucinatory behavior, excitement, grandiosity, suspiciousness/persecution, and hostility; the PANSS–N assesses blunted affect, emotional withdrawal, poor rapport, passive/apathetic social withdrawal, difficulty in abstract thinking, lack of spontaneity and flow of conversation, and stereotyped thinking; the PANSS–PG evaluates anxiety, depression, mannerisms and posturing, and other general symptoms.

Screen for Cognitive Impairment in Psychiatry (SCIP; Purdon [32]; Spanish version of Pino et al. [33]). The SCIP assesses cognitive functioning using five subscales: Verbal Learning Test-Immediate (VLT–I), Verbal Learning Test-Delayed (VLT–D), Working Memory Test (WMT), Verbal Fluency Test (VFT), and Processing Speed Test (PST). The SCIP scores yield four categories of cognitive impairment: normal performance, mild impairment, moderate impairment, and severe impairment.

Global Assessment of Functioning Scale (GAF; Endicott, Spitzer, Fleiss, & Cohen [34]; American Psychiatric Association [35]). This measure assesses the level of psychological, social, and occupational functioning during the last twelve months, not including changes in activity due to physical limitations. The GAF ranges from 1 to 100 with higher scores indicating better functioning.

Procedure

A brief telephone interview was conducted with patients attending the psychosocial rehabilitation centers and healthy individuals from the community to screen for inclusion criteria. Eligible participants signed an informed consent approved by the Ethical Committee for Clinical Research of the Príncipe de Asturias University Hospital in Alcalá de Henares (Madrid, Spain). Study participation consisted of a single session. Clinical and psychosocial data for the patient sample was collected using the PANSS and GAF. For both patient and the healthy control sample, the SCIP was then administered for approximately 15 min, and lastly, the MASC was administered for approximately 30–40 min. For the MASC, each participant was seated about 50 cm. from a computer monitor on which the video was projected. Patients with limitations that precluded independent task operation had the help of research assistants to complete this measure.

Data analysis was carried out with the Statistical Package for Social Sciences program (IBM SPSS Statistics Version 20). The normality of variables with less than 30 cases was evaluated using the Shapiro–Wilk Test. For variables that violated normal distribution assumptions, non-parametric tests were used. To better interpret differences between patients and healthy controls on the MASC and SCIP, effect sizes were calculated with Cohen's *d*. To determine which domain of cognitive impairment was the best predictor of mentalizing deficits in patients, correlations were run among MASC and SCIP variables, and a standard stepwise linear regression analysis was performed. The significance level in all hypothesis contrast tests was .05.

Results

Table 1 shows the sociodemographic and clinical characteristics of patients and healthy participants. Both groups were similar across age, sex, educational level, and living

arrangement variables ($ps > .05$). Patients with schizophrenia who received rehabilitation treatment had a mean duration of illness of 15.7 years ($SD = 10.9$) and a mean GAF score of 51.9 ($SD = 16.1$), suggesting moderate to serious functional impairment [27].

The mean MASC score of correct answers was 21.5 in the patient group and 31.2 in the healthy control group (maximum possible score was 45; see Table 2). In absolute values, patients made more errors on this measure and, specifically, more undermentalizing errors and no mentalizing errors than the healthy controls. However, no group differences were found on overmentalizing errors (see Table 2). Regarding the percentages of each type of error (i.e., taking into account the total number of errors committed by each group of participants), significant differences were found between groups (see Fig. 1). Patients had a higher percentage of undermentalizing errors ($t = -3.06$; $p < .01$) and of no mentalizing errors ($t = -4.36$; $p < .01$), and healthy controls had a higher percentage of overmentalizing errors ($t = 6.29$; $p < .01$). Finally, the scenes of the MASC starring female and male characters were analyzed. There was no effect of character type on performance. Patients with schizophrenia answered significantly fewer questions correctly based on both types of characters compared with healthy controls (see Table 2).

The performance of men and women on the MASC was also analyzed and is presented in Table 3. No significant sex differences were found on the total score of the MASC or total errors across patients and healthy controls. Regarding patients, no significant differences were found between men and women on the three mentalizing errors. However, in the healthy control group, there was a trend effect for women to make fewer overmentalizing errors than men ($p = .06$) and to better understand the mental states of female characters than men ($p = .06$).

Relationships between cognitive functioning, symptoms, and mentalizing errors in patients are presented in Table 4. Regarding cognitive functioning, the patients' scores between the

Table 1 Sociodemographic and clinical characteristics of the participants

	Schizophrenia ($n = 53$) Mean (SD) or %	Controls ($n = 42$) Mean (SD) or %	t / X^2	p
Age	37.4 (10.8)	37.7 (10.7)	.13	.895
Sex	36 males 17 females	27 males 15 females	.14	.709
Highest education level			4.87	.181
No studies	28.5%	21.8%		
Elementary	28.5%	12.5%		
High school	33.3%	43.7%		
University	9.5%	21.8%		
Living arrangement			3.69	.297
Alone	4.7%	9.3%		
With parents	69.0%	56.2%		
Own family	21.4%	34.3%		
Residency	4.7%	0.0%		
Duration of illness	15.7 (10.9)			
No. of hospitalizations	1.5 (0.3)			
GAF	51.9 (16.1)			
PANSS total	47.0 (23.6)			
PANSS positive	17.0 (10.3)			
PANSS negative	18.9 (8.2)			
PANSS general	7.5 (17.8)			

GAF Global Assessment Functioning Scale, *PANSS* Positive and Negative Syndrome Scale

Table 2 Performance on cognitive measures of patients with schizophrenia who received psychosocial rehabilitation and healthy controls

	Schizophrenia	Controls			
	Mean (SD)	Mean (SD)	*t*	*p*	*Cohen's d*
MASC total	21.5 (6.9)[a]	31.2 (6.3)[b]	7.11	.00	−1.46
Total errors	23.5 (6.9)[a]	13.8 (6.3)[b]	−7.11	.00	1.46
Overmentalizing errors	7.2 (3.9)[a]	6.9 (3.1)[b]	−.45	.66	.08
Undermentalizing errors	10.2 (4.6)[a]	4.7 (2.5)[b]	−7.49	.00	1.48
No mentalizing errors	6.1 (3.9)[a]	2.2 (2.2)[b]	−6.08	.00	1.23
Correct answers to female characters	12.2 (4.2)[c]	16.5 (4.4)[d]	4.16	.00	−.99
Correct answers to male characters	8.0 (3.7)[c]	13.1 (2.4)[d]	7.13	.00	−1.63
SCIP total	55.3 (16.0)[c]	83.1 (12.9)[e]	7.84	.00	−1.91
VLT-I	15.8 (5.0)[c]	22.5 (4.0)[e]	6.27	.00	−1.47
VLT-D	4.0 (2.8)[c]	6.8 (2.4)[e]	4.37	.00	−1.07
WMT	14.4 (5.2)[c]	20.9 (3.0)[e]	6.65	.00	−1.53
VFT	13.6 (4.8)[c]	20.3 (6.2)[e]	5.15	.00	−1.20
PST	7.7 (3.3)[c]	12.7 (2.3)[e]	7.52	.00	−1.75

MASC Movie for the Assessment of Social Cognition, *SCIP* Screen for Cognitive Impairment in Psychiatry, *VLT-I* Verbal Learning Test-Immediate, *VLT-D* Verbal Learning Test-Delayed, *WMT* Working Memory Test, *VFT* Verbal Fluency Test, *PST* Processing Speed Test; [a] $n = 52$; [b] $n = 42$; [c] $n = 41$; [d] $n = 31$; [e] $n = 30$

total SCIP and four of its subscales (VLT–I, VLT–D, VFT, and PST) negatively and significantly correlated with total errors on the MASC; the SCIP WMT subscale score also tended to correlate with MASC total errors ($p = .053$). Furthermore, patient scores between the total SCIP and all subscales negatively and significantly correlated with the MASC no mentalizing errors. Lastly, the total SCIP scores were negatively correlated with the MASC undermentalizing errors; the SCIP VFT and PST subscales scores also tended to correlate with the MASC undermentalizing errors ($p = .074$ and .065, respectively). No significant correlations were found between any of the PANSS subscales and MASC errors (see Table 4). Regarding the relationship between mentalizing and global functioning, total errors on the MASC were negatively correlated with GAF scores ($r = -.62$; $p < .01$; $n = 49$), as were undermentalizing errors ($r = -.41$; $p < .01$) and no mentalizing errors ($r = -.52$; $p < .01$). A standard stepwise linear regression analysis was carried out. The independent variables were

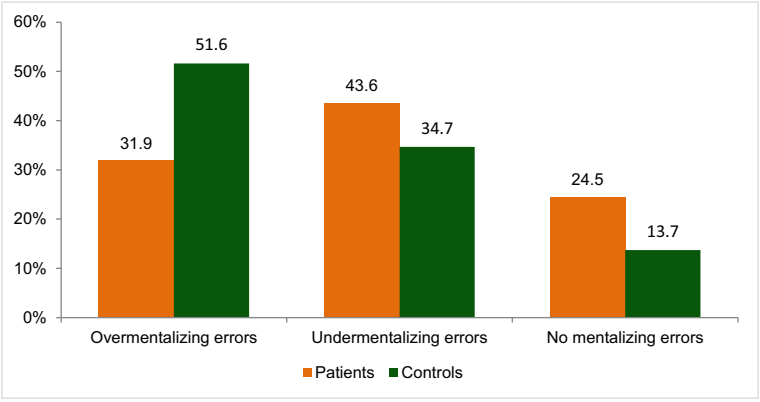

Fig. 1 Percentages of mentalizing errors committed by patients with schizophrenia who received psychosocial rehabilitation and by control subjects

Table 3 Sex differences in mentalizing between patients with schizophrenia who received psychosocial rehabilitation and healthy controls

	Schizophrenia				Controls			
	Males Mean (SD)	Females Mean (SD)	*t*	*p*	Males Mean (SD)	Females Mean (SD)	*t/U*	*p*
MASC total	21.0 (6.8)[a]	22.5 (7.1)[b]	−.73	.47	30.3 (6.5)[c]	32.8 (5.7)[d]	−1.25	.22
Total errors	24.0 (6.8)[a]	22.5 (7.1)[b]	.73	.47	14.7 (6.5)[c]	12.2 (5.7)[d]	1.25	.22
Overmentalizing errors	7.11 (3.9)[a]	7.44 (4.0)[b]	−.28	.78	7.6 (2.9)[c]	5.7 (3.2)[d]	1.94	.06
Undermentalizing errors	10.4 (4.3)[a]	9.9 (5.2)[b]	.31	.76	4.6 (2.6)[c]	4.9 (2.3)[d]	−.47	.64
No mentalizing errors	6.5 (3.9)[a]	5.1 (3.8)[b]	1.20	.24	2.6 (2.3)[c]	1.6 (1.8)[d]	146.50	.13
Correct answers to female characters	12.3 (4.2)[e]	12.0 (4.2)[f]	.21	.83	15.3 (4.4)[g]	18.3 (4.0)[h]	−1.92	.06
Correct answers to male characters	8.3 (3.8)[e]	7.0 (3.3)[f]	.97	.34	12.9 (2.6)[g]	13.4 (2.2)[h]	−.58	.57

MASC Movie for the Assessment of Social Cognition; [a] $n = 36$; [b] $n = 16$; [c] $n = 27$; [d] $n = 15$; [e] $n = 31$; [f] $n = 10$; [g] $n = 19$; [h] $n = 12$

the total SCIP score and the VLT–I, VLT–D, VFT, and PST subscales scores; the dependent variable was the MASC total errors. In the first and only step of this analysis, the PST subscale was selected ($B = -.55$; $t = -4.10$; $p < .01$; $R^2 = .31$; $R^2_{change} = .31$; $F_{change\ (df)} = 16.80$ [1,38]; $p < .01$), the process was stopped, and the other independent variables were excluded from the model since none surpassed the entry criteria (i.e., $p < .05$). Therefore, the SCIP PST subscale explained 31% of the variance of the MASC total errors in the patient group.

Discussion

The present case-control study examined mentalizing in patients with schizophrenia engaged in daily psychosocial rehabilitation. To date, this group of individuals with schizophrenia has been understudied, a subtype of patients who usually present with more impaired functioning than those engaged exclusively in standard outpatient care (e.g., medication management and psychotherapy). In the present study, patients engaged in psychosocial rehabilitation exhibited a significant mentalizing deficit; specifically, patients made more undermentalizing errors and more no mentalizing errors than healthy controls. In patients and healthy controls, no differences were found between men and women in mentalizing. Furthermore, in patients with schizophrenia, worse cognitive functioning (i.e., immediate and delayed verbal learning, verbal fluency, and processing speed) was associated with poorer mentalizing. Finally, in patients, mentalizing deficits were also associated with poorer overall functioning.

The mentalizing deficit of patients with schizophrenia receiving daily psychosocial rehabilitation had a large effect size when compared with healthy controls. This is consistent with what was found in three previous meta-analyses [7–9] and with the statements of Green et al. [1] that a deficit in mentalizing is a central and relatively stable characteristic of schizophrenia. Additionally, the meta-analysis by Kronbichler, Tschernegg, Martin, Schurz, & Kronbichler [36] demonstrated that patients with schizophrenia simultaneously show over- and under-activation in different brain regions related to mentalizing ($k = 21$ studies). Regarding the type of mentalizing errors, patients made more undermentalizing and no mentalizing errors compared with healthy controls, a pattern also found by Montag et al. [23]. The current study

Table 4 Correlations between cognitive impairment, symptomatology, and mentalizing deficits in patients with schizophrenia who received psychosocial rehabilitation

	SCIP ($n = 41$)						PANSS ($n = 21$)		
	Total[1]	VLT-I[1]	VLT-D[1]	WMT[1]	VFT[1]	PST[1]	PANSS-P[2]	PANSS-N[1]	PANSS-GPS[1]
MASC Total	.49**	.39*	.40*	.31	.32*	.55**	−.24	−.30	−.14
Total errors	−49**	−.39*	−.40*	−.31	−.32*	−.55**	.24	.30	.14
Overmentalizing errors	.04	.00	−.04	.10	.08	−.12	.17	.08	.16
Undermentalizing errors	−.32*	−.25	−.19	−.23	−.29	−.30	−.02	.33	.06
No mentalizing errors	−.54**	−.41**	−.47**	−.38*	−.32*	−.53**	.19	.04	.00

SCIP Screen for Cognitive Impairment in Psychiatry, *PANSS* Positive and Negative Syndrome Scale; [1] Pearson's correlation coefficient, [2] Spearman's correlation coefficient; *VLT-I* Verbal Learning Test-Immediate, *VLT-D* Verbal Learning Test-Delayed, *WMT* Working Memory Test, *VFT* Verbal Fluency Test, *PST* Processing Speed Test, *PANSS-P* Positive Scale of PANSS, *PANSS-N* Negative Scale of PANSS, *PANSS-GPS* General Psychopathology Scale of PANSS, *MASC* Movie for the Assessment of Social Cognition; * $p < .05$; ** $p < .01$ (bilateral)

improves on previous research by examining the percentage of each type of mentalizing error, an important addition since most mentalizing studies, to date, discuss mentalizing errors only in absolute numbers. One explanation for the lack of differences in overmentalizing errors between patients and healthy controls, and a higher percentage of overmentalizing errors in healthy controls, may be the presence of a hyper-associative cognitive style in healthy controls, characterized by an exaggeration of the normal tendency to attribute mental states to others [37]. Finally, patient deficits in mentalizing observed in response to both female and male characters on the MASC, demonstrate that perceived sex is likely irrelevant for patients when they infer the mental states of others.

The lack of differences in mentalizing of men and women with schizophrenia found in the present study is in line with the results of the study by Fretland et al. [12]. However, the lack of differences in mentalizing between healthy men and women contrasts with the results of Giovagnoli [11]; however, Giovagnoli [11] used a different mentalizing measure in a larger sample of healthy controls. In any case, the trend found in the present study that healthy women make fewer overmentalizing errors than men and better understand women's mental states should be examined in a larger sample.

Regarding the relationship between cognitive impairment and mentalizing deficits in patients, correlations between scores on the SCIP (total and subscales) and errors on the MASC were moderate (range *of r's* = −.31 – -.55). That is, lower cognitive performance was associated with more mentalizing errors and, specifically, with more no mentalizing errors. Furthermore, processing speed explained 31% of the variance in total errors on the MASC. These results are in line with previous studies which used different measures of cognitive impairment and mentalizing, suggesting a robust relationship between these domains (e.g., Deckler, Hodgins, Pinkham, Penn, & Harvey [38]; Fanning, Bell, & Fiszdon [39]; Fernández-Modamio et al. [15]). In Deckler et al.

[38], working memory and processing speed explained (mainly the working memory) more than 30% of the variance in mentalizing (evaluated with the Reading the Mind in the Eyes Test and The Awareness of Social Inferences Test). Recently, in a sample of Spanish patients with schizophrenia, Fernández-Modamio et al. [15] found that the total SCIP, as well as some SCIP subscales (i.e., processing speed, verbal fluency, immediate verbal learning, delayed verbal learning) correlated significantly with a mentalizing measure (i.e., Hinting Task). Finally, Fanning et al. [39] found that processing speed was the only cognitive domain that predicted mentalizing (measured with the Hinting Task) but the percentage of variance explained was low. In the current study, as well as previous work, processing speed demonstrates a robust relationship with mentalizing deficits. Processing speed, a domain of neurocognition, consistently demonstrates a strong relationship with schizophrenia symptom presentation and functioning. For example, impairment in processing speed is a risk factor that is present in the latent stages of the disease [40], as well as in first-degree relatives [41], and this deficit is also associated with worse global functioning [42]. Therefore, in light of previous research, the finding that processing speed predicted mentalizing performance of patients was not surprising. This finding is also unsurprising when considering individual components of processing speed (i.e., perceptual, coding, retention, information transformation, retrieval, and decision-making processes) and the reliance on these components to understand and make inferences about other people's thoughts and intentions. The lack of a significant relationship between symptoms and no mentalizing deficits agrees with the results of Fretland et al. [12] and demonstrates the independence of symptoms and no mentalizing.

Mentalizing deficits demonstrate an important relationship with global functioning in patients with schizophrenia. In the present study, mentalizing deficits were associated with lower global functioning scores. This is consistent with findings of previous large-scale meta-analyses which show significant correlations (*r*s .25–.48) between mentalizing and community functioning [43, 44]. Thus, better mentalizing performance corresponds with better daily functioning (e.g., more independent living skills and better social and work functioning).

The present study has several limitations to consider. First, the cross-sectional design allowed us to examine the relationship between mentalizing, cognitive ability, symptoms, and global functioning at a certain time point; however, it did not make it possible to identify causal relationships between these variables and may not be representative of relationships across the lifespan. Second, it is possible that the impairment of patients in the present study is greater than that of other studies (since they received rehabilitation treatment). The present results address an important gap in our current understanding of the relationship between mentalizing, cognitive performance, and functioning in individuals engaged in psychosocial rehabilitation, but the results may not be generalizable to patients experiencing less impairment. Lastly, cognitive performance was not assessed through an extensive neuropsychological battery, but rather through a screening test (i.e., SCIP). Despite these limitations, the sample of patients was homogeneous in terms of age, diagnosis, and treatment, and, unlike other studies utilizing the MASC in schizophrenia, all patients received psychosocial rehabilitation. Additionally, a mentalizing test with good ecological validity with everyday social interactions was used underscoring real-world implications of the present findings.

The implications of the results of this study are clear: clinicians, especially within psychosocial rehabilitation settings, should be aware that patients with schizophrenia have mentalizing deficits, that cognitive impairments (especially processing speed) are related to these deficits, and that these deficits affect global functioning. Therefore, clinicians should minimize the use of double meanings, ironies, suggestions, and misunderstandings and strive for clear, succinct, direct, and unhurried communication. Furthermore, recent developments in

training programs for social cognition demonstrate promising results targeting mentalizing deficits and may warrant integration in psychosocial rehabilitation settings. For example, the meta-analysis by Kurtz, Gagen, Rocha, Machado, & Penn [45] found that psychosocial interventions produced a significant improvement on mentalizing ($d = .70$ in 13 studies), and the review by Grant, Lawrence, Preti, Wykes, & Cella [46] showed a significant effect for all the studies that used an intervention targeting mentalizing.

In conclusion, mentalizing deficits are present in patients with schizophrenia in psychosocial rehabilitation settings. These mentalizing deficits demonstrate strong relationships with functioning, suggesting integration of treatments targeting mentalizing within psychosocial rehabilitation settings may improve treatment outcomes. Future directions should delve into the biological bases of mentalizing deficits, use measures that better reflect the performance of patients in everyday life (e.g., active procedures such as an online MASC or passive procedures through smartphones), multicenter studies with large samples of patients, use prospective designs to better understand causal relationships between mentalizing deficits and functioning, and explore effective treatments for mentalizing deficits in a psychosocial rehabilitation setting and their durability.

Contributors All authors have seen, approved, and contributed significantly to this manuscript.

Compliance with Ethical Standards

Human Participants All procedures performed in this study were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

Declarations of Interest Dr. Andrade-González, Miss Sarasa, Miss García-López, Mr. Leones, and Miss Halverson, have no conflict of interest to declare.
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