

# Validation of the Italian version of the Davos Assessment of Cognitive Biases Scale (DACOBS) in a sample of schizophrenia spectrum disorder patients and healthy controls

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**Summary. Purpose.** Recently two instruments were developed to address the study of the cognitive biases in schizophrenia spectrum disorders (SSD): the Cognitive Biases Questionnaire for Psychosis (CBQ-P) and the Davos Assessment of Cognitive Biases Scale (DACOBS). Aim of this study was to validate the Italian version of the DACOBS. **Methods.** We investigated factor structure, reliability, discriminative and convergent validity of the instrument by comparing to the CBQ-P in an Italian sample of 102 patients diagnosed with SSD and 330 healthy controls (HC), matched by age, education and gender. **Results.** The second-order seven-factor solution provided the best results among the four models tested. Reliability proved to be very satisfactory, with  $\omega$  coefficient ranged from 0.75 for Jumping to conclusions to 0.89 for Safety Behavior. The Italian version of DACOBS could discriminate psychosis from HC (Wilks' Lambda=0.64,  $F=34.284$ ,  $p<0.001$ ;  $\eta^2=0.364$ ). All seven DACOBS subscales were significantly correlated with the CBQ-P subscales (total sample:  $r=0.331-0.707$ ; SSD group:  $r=0.424-0.735$ ; HC group:  $r=0.177-0.460$ ). **Conclusions.** The Italian version of DACOBS is a valid instrument for measuring cognitive biases for patients with psychosis, confirming previous results regarding the psychometric properties of the tool.

**Key words.** Assessment, cognitive bias, psychometric properties, schizophrenia spectrum disorders, validation.

*Validazione della versione italiana della Davos Assessment of Cognitive Biases Scale (DACOBS) in un campione di pazienti con disturbo dello spettro della schizofrenia e controlli sani.*

**Riassunto. Scopo.** Recentemente sono stati sviluppati due strumenti per la valutazione dei bias cognitivi nei disturbi dello spettro della schizofrenia (DSS): il Cognitive Biases Questionnaire for Psychosis (CBQ-P) e la Davos Assessment of Cognitive Biases Scale (DACOBS). Scopo di questo studio è stato quello di validare la versione italiana della DACOBS. **Metodi.** È stata realizzata l'analisi fattoriale confermatrice e sono state valutate l'affidabilità e la validità discriminativa e convergente dello strumento confrontandole con il CBQ-P in un campione italiano di 102 pazienti con diagnosi di DSS e 330 controlli sani, appaiati per età, istruzione e genere. **Risultati.** L'alternativa a sette fattori di secondo ordine ha fornito i migliori risultati tra i quattro modelli testati. L'affidabilità si è rivelata molto soddisfacente, con un coefficiente compreso tra 0,75 per "Jumping to conclusions" e 0,89 per "Safety behavior". La versione italiana della DACOBS discrimina tra pazienti con psicosi e controlli sani (Lambda di Wilks=0,64,  $F=34.284$ ,  $p<0,001$ ;  $\eta^2=0,364$ ). Tutte e sette le sottoscale della DACOBS erano significativamente correlate con le sottoscale del CBQ-P (campione totale:  $r=0,331-0,707$ ; pazienti psicotici:  $r=0,424-0,735$ ; controlli sani:  $r=0,177-0,460$ ). **Conclusioni.** La versione italiana della DACOBS è uno strumento valido per misurare i bias cognitivi nei pazienti con psicosi, confermando i risultati precedenti relativi alle proprietà psicometriche del test.

**Parole chiave.** Assessment, bias cognitivi, disturbi dello spettro della schizofrenia, proprietà psicometriche, validazione.

## Introduction

Schizophrenia is mainly characterized by positive (e.g., hallucinations and delusions) and negative (e.g., avolition, blunted affect and anhedonia) symptoms in addition to behavioral disorganization and persistent cognitive impairments<sup>1</sup>. Indeed, individuals with psychosis show pervasive cognitive biases, described as systematic errors in both cognitive processing and content meaning across specific situations<sup>2</sup>.

Cognitive biases are conceptualized as a me-

thodical orientation toward appraising, processing, selecting and remembering specific information<sup>3</sup>. Moreover, cognitive biases influence several cognitive domains, such as attention, decision-making/reasoning, memory recall, motivation and style of attribution of meaning<sup>4</sup>. Some cognitive biases include jumping to conclusions<sup>5</sup>, confirmatory bias or bias against disconfirmatory evidence<sup>6</sup>, inflexibility of belief<sup>7</sup>, attributional biases<sup>8</sup>.

Recently, two assessment tools were developed to address the study of the cognitive biases prevalent in psychosis: the Cognitive Biases Questionnaire for

Psychosis (CBQ-P)<sup>9</sup> and the Davos Assessment of Cognitive Biases Scale (DACOBS)<sup>10</sup>.

The DACOBS was developed by van der Gaag et al.<sup>10</sup> and consists of 42 items regarding seven subscales, each including 6 items. To date, the discrimination potential of DACOBS between patients with psychosis and healthy population has been little investigated and to the best of our knowledge, the DACOBS has been translated and validated only with Polish<sup>11</sup>, Dutch<sup>12</sup> and Flemish<sup>13</sup> populations. Furthermore, in the Italian context, there is only a validated version of the CBQ-P<sup>14</sup> and it is missing of assessment tools to evaluate and measure specific cognitive biases in psychosis, overlapped and extended by the DACOBS.

Aim of this study was the validation of the Italian version of the DACOBS, through the examination of: 1) the factor structure; 2) the reliability of the questionnaire; 3) the discriminative validity to differentiate patients from non-clinical subjects; 4) the convergent validity of the Italian version of DACOBS by comparing to the CBQ-P.

## Materials and methods

### PARTICIPANTS AND PROCEDURE

Participants were outpatients aged 18-65 years afferent to the Psychiatry Unit of the University of Catanzaro (Italy), between April 2019 and August 2020. We included all patients admitted in the unit for at least twelve months with a diagnosis of Schizophrenia Spectrum Disorder (SSD) according to DSM-5 criteria (American Psychiatric Association, 2013), formulated through the Structured Clinical Interview for DSM-5 (SCID-5-CV)<sup>15</sup> by experienced psychiatrists who were trained in the administration of neuropsychiatric tests and used these tools in their daily clinical practice.

A control group was also collected from the local community via Internet advertisements and from local university working staff and was chosen to match the patients' group based on age, education and gender. Prior the assessment, they were all interviewed and asked about the lifetime presence of schizophrenia spectrum disorder and were excluded if so. All participants had to be aged between 18 and 65 years and competent in the Italian language.

A total number of 432 participants were included in this study, of which 330 healthy controls (HC) and 102 patients diagnosed with SSD.

The study was carried out in accordance with the latest version of the Declaration of Helsinki<sup>16</sup> and was approved by the local research ethics committee. All patients and controls signed a written infor-

med consent according to the Ethical Committee's guidelines before any data was collected.

A bilingual Dutch researcher did the original Dutch to Italian translation of DACOBS. Subsequently a bilingual Italian researcher, blind to the original Dutch version, performed the back translation of the test from Italian to Dutch. A third bilingual researcher validated the validity of both translations. After verifying the similarity with the original test, the DACOBS was given to a small group of 20 volunteers who evaluated the comprehensibility of the items. All raters considered it to be clear and easy to rate (see appendix 1 online at [www.rivistadipsichiatria.it](http://www.rivistadipsichiatria.it)).

### MEASURES

*Davos Assessment of Cognitive Biases (DACOBS)*<sup>10</sup>: is made up of 42 Likert type items ranging from 1 (strongly disagree) to 7 (strongly agree) and refers to the last two weeks. This self-report questionnaire specifically aims to measure four cognitive biases (Jumping to conclusions bias, Belief Inflexibility bias, Attention to threat bias, External Attribution bias), two cognitive limitations (Social Cognition problems, Subjective Cognitive problems) and avoidance behavior (Safety behaviors). The DACOBS has demonstrated a good reliability with an internal consistency ranging from 0.64 to 0.90 and discriminating satisfactorily SSD and HC samples<sup>10</sup>. Regarding convergent validity, five of seven subscales showed significant associations among the validation measures ranging from 0.36 to 0.63: Jumping to conclusions bias with Beads task<sup>17</sup>, Belief Inflexibility bias related to the Dogmatism Scale (DOG scale)<sup>18</sup>, Attention to threat bias and External Attribution bias with Green Paranoid Thoughts Scale (GPTS)<sup>19</sup>, Safety behaviors with Safety Behaviors Questionnaire-Paranoid Delusions (SBQ-PD)<sup>20</sup>.

*Cognitive Biases Questionnaire for Psychosis (CBQ-P)*<sup>9</sup>: assessment was developed from the Cognitive Style Test (CST)<sup>21</sup>, made up of 30 vignettes of ordinary life events (half-pleasant and half-unpleasant). In the CST, the interviewees visualize that they are in each of the proposed scenarios and must choose 1 of the 4 possible cognitive responses to the situation, which represent general depressive cognitive distortions such as selective abstraction and excessive generalization. Thus, these illustrations were adapted to psychosis in the CBQ-P by creating new vignettes in order to include 2 subjects of great significance to psychosis: "Anomalous Perceptions" (AP) and "Threatening Events" (TE). Each scenario includes a forced-choice answer among 3 options, illustrating absence of bias (score of 1); possible presence of bias (score of 2); and likely presence of bias (score of 3).

Scores can range between 30 and 90 points (15-45 for each theme and 6-18 for each thinking bias). Moreover, in such a way to reduce potential respon-

se biases, the order of the responses was randomized across items. In the present study, we used the Italian validation of CBQ-P scale<sup>14</sup>. The McDonald  $\omega$  coefficient in our sample was 0.912.

## STATISTICAL ANALYSIS

Different confirmatory factor analyses (CFA) were conducted using JASP open-source software (JASP, Version 0.13.1, University of Amsterdam, The Netherlands) to examine the best latent structure of the Italian DACOBS version. We tested a one-, a three-, and a seven-factor model based on van der Gaag et al.<sup>10</sup> and a second-order seven-factors solution. The diagonally weighted least squares (DWLS) estimator, using a polychoric correlation matrix was used to estimate the parameters because it provides the best option for modelling ordered data<sup>22</sup>.

The Tucker-Lewis Index (TLI), The Comparative Fit Index (CFI), the Root Mean Square Error of Approximation (RMSEA), Standardized Root Mean Squared Residual (SRMR) and relative chi-square ( $\chi^2/df$ ) were used to assess the data's goodness-of-fit to a proposed model. For TLI and CFI, values of 0.90 and above were considered adequate, whereas values of 0.95 or above were considered very good; for RMSEA values of 0.08 and below was considered adequate and 0.05 or less very good; for SRMR a cut-off value close to 0.08 was considered adequate. Values of  $\chi^2/df < 3.0$  are good and those  $< 2.0$  are very good. The levels of these indices were evaluated according to the recommendations of Hu and Bentler<sup>23</sup>. The McDonald's  $\omega$  reliability coefficient was calculated. Correlations between DACOBS and CBQ-P were calculated to measure construct validity, considering that correlation coefficients greater than 0.30 are recommended<sup>24</sup>.

A multivariate analysis of covariance (MANCOVA) was performed to explore whether the DACOBS was able to differentiate between SSD patients and

healthy controls, controlling for age, sex and years of education. A  $p < 0.05$  was considered statistically significant.

## Results

### DEMOGRAPHICS

The sociodemographic characteristics of the sample are shown in table 1. No differences were evident between groups for age, gender and education level. The groups differed significantly for civil status as SSD patients were more frequently single.

### CONFIRMATORY FACTOR ANALYSIS

According to the fit indices of the four CFA models (table 2) the second-order seven-factors solution (figure 1) is the best demonstrating a very good model fit.

### RELIABILITY OF THE SCORES

The McDonald  $\omega$  coefficient of the seven DACOBS subscales ranged from 0.75 for Jumping to conclusions bias, 0.80 for Belief inflexibility bias, 0.76 for Attention to threat bias, 0.81 for External attribution bias, 0.83 for Social cognition problems, 0.85 for Subjective cognitive problems and 0.89 for Safety behaviors indicating a high score reliability. The total DACOBS's  $\omega$  coefficient was 0.96, corresponding to an excellent reliability.

### DISCRIMINANT VALIDITY

We performed a MANCOVA using the status of SSD or HC as independent variable. Age, gender and educational level were covariates.

Overall, a significant main effect of case-control (Wilks' Lambda=0.64,  $F=34.284$ ,  $p < 0.001$ ;  $\eta^2=0.364$ )

**Table 1.** Socio-demographics characteristics of the sample.

		HC		SSD		Statistics	p
		n=330		n=102			
Age <sup>a</sup>		38.4	(13.0)	38.6	(10.2)	t=0.128	0.898
Gender <sup>b</sup>	Men	193	(58.5)	65	(63.7)	χ <sup>2</sup> =0.890	0.346
	Women	137	(41.5)	37	(36.3)		
Civil status <sup>b</sup>	Married	171	(51.8)	13	(12.7)	χ <sup>2</sup> =49.913	<0.001
	Divorced	9	(2.7)	8	(7.8)		
	Single	150	(45.5)	81	(79.4)		
Education (years) <sup>a</sup>		13.5	(2.9)	12.9	(3.3)	t=-1.616	0.107

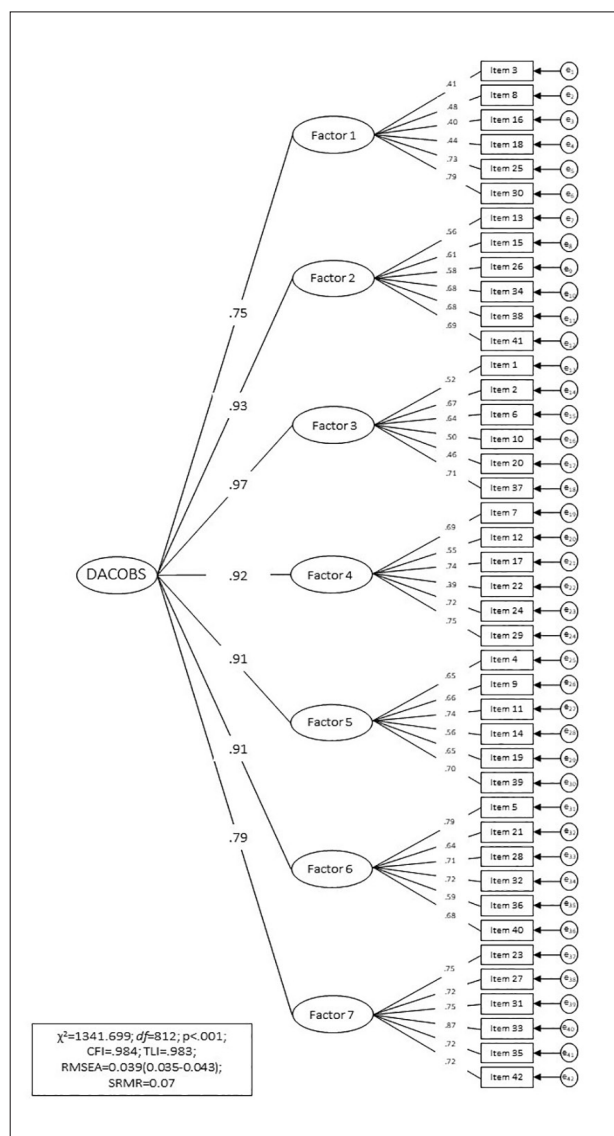
Legend: HC= Healthy control; SSD= Schizophrenia Spectrum Disorder.

<sup>a</sup> Data are presented as means (SD); <sup>b</sup> Data are presented as frequencies (%).

**Table 2.** Fit indices of the tested models.

	$\chi^2/df$	CFI	TLI	RMSEA (90% CI)	SRMR
Threshold for good models	$\leq 2$	$\geq 0.95$	$\geq 0.95$	$\leq 0.05$	$\leq 0.05$
Threshold for acceptable models	$\leq 3$	$\geq 0.90$	$\geq 0.90$	$\leq 0.08$	$\leq 0.08$
One-factor model	4.2	0.71	0.70	0.086 (0.083-0.089)	0.075
Three-factor model	3.6	0.77	0.76	0.077 (0.074-0.080)	0.072
Seven-factor model	3.0	0.82	0.80	0.070 (0.067-0.073)	0.070
Second-order seven factor model	1.7	0.98	0.98	0.039 (0.035-0.043)	0.070

**Legend:** CFI= Comparative Fit Index; RMSEA (90% CI): Root Mean Square Error of Approximation (90% confidence interval); SRMR= Standardized Root Mean Squared Residual; TLI= Tucker-Lewis Index;  $\chi^2/df$ = relative chi-square.

**Figure 1.** Fit indices of the calculated confirmatory factor analysis models with all seven-factors solutions.

but not of age emerged. Gender and educational level were also significantly related to the DACOBS subscales (gender: Wilks' Lambda=0.963,  $F=2.276$ ,

$p=0.028$ ;  $\eta^2=0.037$  educational level: Wilks' Lambda=0.939,  $F=3.871$ ,  $p<0.001$ ;  $\eta^2=0.061$ ).

More specifically, male gender was positively associated to the DACOBS Jumping to conclusions subscale ( $F=7.622$ ,  $p=0.006$ ;  $\eta^2=0.018$ ) and educational level was positive associated to all the DACOBS scales ( $p<0.05$ ) except for Jumping to conclusions.

Regarding to the main effect of status (table 3), we found that SSD patients scored significantly higher than healthy controls on all seven DACOBS scales.

### CONVERGENT VALIDITY

As displayed in table 4, all seven DACOBS scales were significantly correlated with the CBQ-P subscales, in the total sample (ranging 0.331-0.707) as well as in the patient group (ranging 0.424-0.735) and healthy control group (ranging 0.177-0.460) separately.

### Discussion

The aim of the present study was to validate the Italian version of the DACOBS. To the best of our knowledge, no other study has investigated the psychometric properties of this tool in an Italian sample.

Regarding the factor structure, van der Gaag et al.<sup>10</sup> described a seven factor model as the best fit for their data. In our study the one-, three- and seven-factor models showed poor fit indexes, instead our findings are consistent with a second-order seven-factor as the best solution among those tested for the DACOBS, indicating that the total score well re-assumes the characteristics of all the seven factors.

Reliability also proved to be very satisfactory, with  $\omega$  coefficient ranging from 0.75 to 0.89, that indicate adequate levels of omega reliability for clinical decisions<sup>25,26</sup>. The results from van der Gaag et al.<sup>10</sup> also showed good internal consistency, but they used Cronbach's alpha that ranged from 0.64 to 0.90. For multidimensional constructs, omega coef-



**Table 3.** Comparison of DACOBS between patients and controls.

	SSD		HC		t	p	d
	Mean	(SD)	Mean	(SD)			
Jumping to conclusions	26.2	(8.1)	23.4	(6.2)	3.774	<0.001	0.39
Belief inflexibility	25.5	(8.5)	16.8	(6.0)	11.517	<0.001	1.18
Attention to threat	24.0	(9.2)	19.8	(6.4)	5.179	<0.001	0.53
External attribution	24.8	(9.1)	17.1	(5.8)	10.111	<0.001	1.01
Social cognition problems	25.4	(9.1)	20.9	(7.1)	5.226	<0.001	0.55
Subjective cognitive problems	24.9	(9.7)	17.3	(7.0)	8.749	<0.001	0.90
Safety behaviors	18.9	(10.1)	9.9	(4.1)	13.069	<0.001	1.17
DACOBS total score	162.6	(54.8)	125.0	(32.9)	10.047	<0.001	0.83

*Legend:* DACOBS= Davos Assessment of Cognitive Biases Scale; HC= Healthy control; SSD= Schizophrenia Spectrum Disorder.

ficient has the advantage of considering the strength of association between items and constructs as well as item-specific measurement errors. Thus, omega provides more realistic estimates about the true reliability of the scale<sup>27,28</sup>.

Regarding the discriminant power, in accordance with the results of van der Gaag et al.<sup>10</sup>, all seven DACOBS subscales clearly differentiated patients with SSD and healthy controls in the current Italian sample.

Several studies confirmed the association between cognitive bias and psychosis. Bastiaens et al.<sup>12</sup> reported that cognitive biases were equally present in patients diagnosed with non-psychotic disorders compared with SSD patients. Moreover, a meta-analysis established that Jumping to conclusions bias was more robust in patients diagnosed with psychotic disorders than among healthy individuals and patients with non-psychotic disorders, as depression, OCD and anxiety disorders<sup>29</sup>.

On the other hand, positive psychotic-like experiences (e.g. perceptual abnormalities, delusional thoughts) have been related with some cognitive biases such as Attention to threat, Externalizing, Belief inflexibility and Jumping to conclusions in both healthy and Ultra High Risk (UHR) individuals<sup>30</sup>. Jumping to conclusion and the alteration of neuropsychological domains occurs during early stages of psychotic illnesses<sup>31</sup> and there exist evidence supporting the role of cognitive biases in the onset and the maintenance of psychotic symptoms<sup>32</sup>.

Regarding convergent validity, significant correlations between DACOBS and CBQ-P scales were found, both in the total sample as well as in the patient and healthy control groups independently, according to the findings of Bastiaens et al.<sup>13</sup>, so the DACOBS has proved to be appropriate to measure cognitive biases.

However, the results of this study should be evaluated in the context of some potential limitations. The first limit of the study is the use of self-report questionnaires that are exposed to the risk of hiding, social desirability, and misunderstanding. Surely task-based tests are more adequate in providing evidence for the presence or not of a specific cognitive bias. The second weakness is that the protocol did not include a test-retest reliability. However, reproducibility over time (test-retest) is one of several ways to classify and measure reliability, which include also internal consistency. Indeed, internal consistency measures how the individual scores of the items well correlate with each other<sup>33</sup>, and in the current study it has proved to be satisfactory. The last limitation is that the clinical data on healthy controls were partial. Subjects with a current or previous clinical diagnosis of psychosis were excluded, however data did not include measurement of "at-risk mental state" (ARMS)<sup>34</sup>. ARMS individuals are commonly identified using cognitive basic symptoms or 'ultra-high-risk' (UHR) criteria<sup>35</sup>, therefore theoretically the sample could include high risk subjects.

On the other hand, our study presents some strengths. First, the validation was performed in a clinical and community sample, made up of both patients with psychosis and healthy participants, and second, the large sample size. Indeed, recommendations for the sample size used to validate a scale suggest ranging from 2 to 20 subjects per item<sup>36</sup>, with an absolute minimum of 100 to 250 subjects<sup>37</sup>. Moreover, Comrey and Lee<sup>38</sup> provided the following guidance: 100 subjects= poor, 200= fair, 300= good, 500= very good, ≥1000= excellent. Therefore, according to all these recommendations, our sample can be considered more than good.

**Table 4.** Correlations between DACOBS and CBQ-P scores.

		1	2	3	4	5	6	7	8	9
1. Jumping to conclusions	Patients	-								
	Controls	-								
	Total	-								
2. Belief inflexibility	Patients	0.653	-							
	Controls	0.439	-							
	Total	0.532	-							
3. Attention to threat	Patients	0.727	0.714	-						
	Controls	0.515	0.542	-						
	Total	0.609	0.634	-						
4. External attribution	Patients	0.627	0.697	0.762	-					
	Controls	0.409	0.591	0.631	-					
	Total	0.513	0.711	0.703	-					
5. Social cognition problems	Patients	0.668	0.736	0.870	0.755	-				
	Controls	0.437	0.548	0.684	0.610	-				
	Total	0.536	0.640	0.765	0.684	-				
6. Subjective cognitive problems	Patients	0.611	0.818	0.758	0.700	0.763	-			
	Controls	0.323	0.593	0.592	0.515	0.682	-			
	Total	0.456	0.735	0.680	0.657	0.730	-			
7. Safety behaviors	Patients	0.498	0.655	0.639	0.590	0.597	0.709	-		
	Controls	0.313	0.440	0.552	0.569	0.497	0.513	-		
	Total	0.417	0.651	0.602	0.664	0.555	0.666	-		
8. CBQ-P Threat estimation	Patients	0.424	0.518	0.590	0.620	0.521	0.557	0.659	-	
	Controls	0.177	0.299	0.388	0.380	0.460	0.405	0.334	-	
	Total	0.331	0.518	0.521	0.590	0.513	0.551	0.642	-	
9. CBQ-P Anomalous perception	Patients	0.504	0.596	0.655	0.654	0.564	0.632	0.735	0.866	-
	Controls	0.213	0.333	0.356	0.297	0.358	0.354	0.348	0.511	-
	Total	0.381	0.581	0.537	0.590	0.487	0.573	0.707	0.795	-

*Legend:* CBQ-P= Cognitive Biases Questionnaire for Psychosis; DACOBS= Davos Assessment of Cognitive Biases Scale. All correlations are  $p < 0.001$  (2-tailed).

## Conclusions

Self-reports instruments assessing cognitive biases as the DACOBS are simple to use and should be taken during routine clinical practice and research in order to facilitate early recognition. Our findings suggest that the DACOBS is a valid instrument for measuring cognitive biases and limitations in psychosis for Italian speakers, confirming previous results regarding the psychometric properties of the tool.

Since cognitive biases are an important target of the clinical intervention, an effective tool is needed for their accurate detection and measurement in the clinical settings.

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*Conflict of interests:* no potential competing interest was reported by the authors.

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