

COGNITIVE FLEXIBILITY AND POSITIVE PSYCHOTIC SYMPTOMS IN INDIVIDUALS WITH SCHIZOPHRENIA

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ABSTRACT

This research aimed to examine the relationship between cognitive flexibility and positive psychotic symptom severity among individuals with schizophrenia and to determine whether cognitive flexibility significantly predicts the severity of positive psychotic symptoms in this population. A cross-sectional was employed. Data were collected from 150 adults with a clinical diagnosis of schizophrenia recruited from psychiatric clinical settings in Pakistan using a purposive sampling technique. Demographic and clinical characteristics (age, gender, education, and duration of illness) were recorded using a structured form. Cognitive flexibility was assessed using the Cognitive Flexibility Inventory (CFI), and positive psychotic symptom severity was assessed using the positive symptom subscale of the Positive and Negative Syndrome Scale (PANSS). Data were analyzed using descriptive statistics, frequency and percentage distributions, reliability analysis (Cronbach's alpha), Pearson product-moment correlation, and simple linear regression. Pearson correlation revealed a significant, moderate, negative relationship between cognitive flexibility and positive psychotic symptom severity, $r(148) = -.42$, $p < .001$. Simple linear regression confirmed that cognitive flexibility significantly predicted positive symptom severity, $\beta = -.42$, $p < .001$, accounting for 17.6% of the variance in positive symptom scores ($R^2 = .176$). Lower cognitive flexibility is significantly and robustly associated with greater severity of positive psychotic symptoms in schizophrenia. Cognitive flexibility appears to be a clinically meaningful psychological correlate of positive symptom severity, with implications for psychological assessment and for the design of cognitively oriented interventions delivered alongside antipsychotic treatment.

I. INTRODUCTION

Schizophrenia is a chronic and frequently disabling psychiatric disorder that affects approximately 24 million people worldwide and is characterized by pervasive disturbances across perceptual, cognitive, emotional, and behavioral domains (World Health Organization, 2022). Its clinical presentation is conventionally organized into positive symptoms (hallucinations, delusions, and conceptual disorganization) and negative symptoms, such as blunted affect and social withdrawal (American Psychiatric Association, 2022). Positive symptoms are particularly

prominent during acute presentations and remain central to diagnosis, relapse monitoring, and treatment planning; nevertheless, considerable variability persists in their severity across patients, even when antipsychotic treatment regimen and illness duration are broadly comparable. This unexplained variability points to psychological factors that may shape symptom expression independently of pharmacological management, and cognitive flexibility has emerged as one such candidate mechanism. A large and consistent body of neuropsychological research demonstrates that schizophrenia is accompanied by cognitive deficits spanning memory, attention, language, and executive function, with effect sizes in the moderate-to-large range relative to healthy controls (Fioravanti et al., 2005). Among executive functions, cognitive flexibility (the capacity to shift mental sets, generate alternative interpretations of events, and adapt behavior to changing task demands) is among the domains most consistently found to be impaired in this population (Tyburski et al., 2017). Deficits on classic neuropsychological measures of set-shifting, such as the Wisconsin Card Sorting Test, are well documented in schizophrenia and have been linked to broader difficulties in reality testing and thought organization. More recently, self-report measures such as the Cognitive Flexibility Inventory (CFI; Dennis & Vander Wal, 2010) have extended this work by capturing the everyday, subjectively experienced dimension of flexible thinking, namely the tendency to perceive difficult situations as controllable and to generate multiple alternative explanations and solutions. Together, these performance-based and self-report approaches converge on the same broad conclusion: flexible cognition is compromised in schizophrenia, and this compromise is unlikely to be an artifact of any single assessment method.

Cognitive models of psychosis provide a direct theoretical bridge between inflexible thinking and positive symptoms specifically. Garety and Freeman's influential cognitive account of delusions proposes that biased reasoning processes, most notably a 'jumping to conclusions' data-gathering bias, contribute causally to the formation and persistence of delusional beliefs, as ambiguous experiences are appraised rapidly and a conclusion is reached without adequate consideration of alternatives (Garety & Freeman, 1999). Building directly on this framework, Colbert et al. (2010) demonstrated that belief inflexibility, a reduced willingness to generate and consider alternative explanations or to revise beliefs in light of new evidence, was robustly associated with delusions and was not confined to the content of the delusional belief itself, but instead reflected a broader, trait-like inflexible thinking style. Subsequent research has confirmed that reduced belief flexibility is among the cognitive processes most closely tied to delusion severity in psychosis, alongside jumping-to-conclusions reasoning biases. Taken together, this literature suggests at least three plausible pathways by which reduced cognitive flexibility could elevate positive symptoms: (a) an inflexible thinking style may curtail the generation and weighing of alternative, non-delusional explanations for ambiguous or anomalous experiences; (b) impaired set-shifting may directly disrupt the organization of thought, contributing to conceptual disorganization; and (c) rigid cognitive appraisal may make it harder to reality-test or disengage from intrusive perceptual experiences such as hallucinations. These pathways are not mutually exclusive and plausibly operate in combination to shape the overall severity of the positive symptom cluster.

Empirical support for a link between flexible cognition and symptom severity is accumulating well beyond the delusions literature narrowly defined. In first-episode psychosis, cognitive inflexibility assessed via the Wisconsin Card Sorting Test prospectively predicted symptom severity one year later, independent of duration of untreated psychosis and premorbid functioning (Mantonakis et al., 2024). In chronic schizophrenia-spectrum samples, psychological flexibility and related constructs have been associated with overall symptom burden and have emerged as candidate mechanisms underlying the benefits of mindfulness- and acceptance-based interventions (Hahne et al., 2025). Deficit-syndrome patients, who typically present with more severe and enduring symptomatology, also show disproportionate impairment on flexibility-dependent executive tasks relative to their non-deficit counterparts (Tyburski et al., 2017). Encouragingly, cognitive flexibility is not static: cognitive remediation approaches produce medium-sized improvements in executive performance and small but reliable reductions in symptom severity (McGurk et al., 2007), suggesting that flexibility-focused intervention is a tractable clinical target rather than a fixed trait. This growing body of evidence positions cognitive flexibility as a plausible transdiagnostic mechanism linking executive dysfunction to symptom severity, rather than as a peripheral correlate confined to a single diagnostic subgroup.

Despite this convergent evidence, most existing studies have examined negative symptoms, general psychopathology, or performance-based executive tasks in isolation, and comparatively few have directly examined the relationship between self-reported everyday cognitive flexibility and positive symptom severity specifically. Moreover, the large majority of this literature originates from high-income Western or East Asian settings, and comparatively little is known about this relationship among individuals with schizophrenia in South Asia, where the illness carries a substantial and under-studied burden and where access to specialized psychological services remains limited (Nawaz et al., 2020). Given the largely biomedical, hospital-based, and resource-constrained nature of psychiatric care in Pakistan, and the considerable burden that schizophrenia already places on patients and their families in this setting (Nasr & Kausar, 2009), identifying modifiable cognitive correlates of positive symptoms could inform low-cost, psychologically oriented adjuncts to pharmacological treatment. Addressing this gap is particularly timely given renewed calls for psychologically informed, culturally adapted models of psychiatric care in the region. The present study therefore examined the relationship between cognitive flexibility and positive psychotic symptom severity among adults with schizophrenia recruited from psychiatric clinical settings in Pakistan.

Objectives

1. To examine the relationship between cognitive flexibility and positive psychotic symptom severity among individuals with schizophrenia.
2. To determine whether cognitive flexibility significantly predicts positive psychotic symptom severity in this population.

Hypothesis

- Cognitive flexibility is significantly and negatively associated with, and significantly predicts, positive psychotic symptom severity among individuals with schizophrenia.

Figure 1: Hypothesized pathway linking cognitive flexibility to positive psychotic symptom severity



Figure 1 summarizes the hypothesized pathway tested in this study.

II. METHOD

A quantitative, cross sectional, correlational research design was used to explore the relationship between cognitive flexibility and positive psychotic symptom severity at one time. The study had descriptive and predictive goals, and this was well suited to the goals of the study. It was also well suited to the efficient, ethically appropriate assessment of psychological and clinical variables in a clinically vulnerable population.

Participants

A total of 150 adults with a clinical diagnosis of schizophrenia were recruited from outpatient and inpatient psychiatric clinical settings in Pakistan using a purposive sampling technique. Participants were aged 18 years or older, had a clinical diagnosis of schizophrenia made by a psychiatrist, and the treating clinician determined that they were clinically stable enough to complete the self-report measures, and gave written informed consent. In an effort to protect the validity of self-reported data, individuals with a co-occurring neurological disorder, intellectual disability, or acute florid psychosis that precluded reliable self-report were excluded.

Measures

Demographic and Clinical Information Form. Structured demographic and clinical information form was used to record age, gender, education level and duration of illness for all participants. **[I] Cognitive Flexibility Inventory (CFI).** Cognitive flexibility was assessed with the CFI (Dennis & Vander Wal, 2010) a 20-item instrument that yields a total score representing an individual's tendency to think of difficult situations as manageable and to provide a variety of alternative explanations and solutions. The items are scored on a 7-point scale, with a higher total score indicating higher cognitive flexibility. In previous studies, the CFI has good internal consistency and construct validity and presented the same level of reliability in the present sample ($\alpha = .88$). **[II] Positive and Negative Syndrome Scale (Positive subscale) (PANSS-P).** Positive psychotic symptom severity was measured by the positive symptom subscale of the PANSS (Kay et al., 1987), which consists of seven items: delusions, conceptual disorganization, hallucinatory behavior, excitement, grandiosity, suspiciousness/persecution, and hostility. A trained rater rates each item from 1 (absent) to 7 (extreme) and higher scores represent more severe positive symptoms. The PANSS is considered a gold standard in schizophrenia symptom assessment research (Kay et al., 1988) and also showed good internal consistency in this sample ($\alpha = .84$).

Procedure

Data collection was preceded by ethical approval from the appropriate IRB. Patients were approached at psychiatric clinical sites following a confirmation of the diagnostic and clinical eligibility from the treating clinician. The rationale and methodology of this study was explained thoroughly and written informed consent was obtained from each participant. Demographic form and the CFI were completed directly by the participants; items were read to participants, if needed, due to literacy-related and/or symptom-related difficulties. The trained raters completed the PANSS-positive subscale based on a semi-structured clinical interview that was separate from the self-report questionnaires. Confidentiality and the right of disclosing or not disclosing data and stopping at any point without impacting further treatment was guaranteed and reiterated across data collection. Data were analysed with SPSS. Demographic and clinical characteristics were summarized using descriptive statistics (means, standard deviations, frequencies and percentages). Internal consistency of the CFI and the PANSS-positive subscale was assessed using Cronbach's alpha, which ranges from .70 or higher, reflecting acceptable internal consistency. The correlation between cognitive flexibility and positive symptom severity was examined using Pearson product-moment correlation and simple linear regression was performed to check the significance of the correlation between cognitive flexibility and positive symptom severity. Prior to the regression analysis, assumptions of linearity, normality of residuals and homoscedasticity were tested. All analysis was considered statistically significant at $p < .05$. Ethical principles contained in the Declaration of Helsinki were followed. All participants were fully informed and had the opportunity to participate voluntarily, with no pressure on clinical information being shared and the right to opt out at any point without affecting their treatment.

III. RESULTS

Table I: Demographic and Clinical Characteristics of the Sample (N = 150)

Variables	Categories	n	%
Gender	Male	96	64.0
	Female	54	36.0
Education	No formal / primary	29	19.3
	Secondary	61	40.7
	Higher secondary	38	25.3
	Graduate or above	22	14.7
Duration of illness	≤ 5 years	47	31.3
	6–10 years	54	36.0
	> 10 years	49	32.7

Adult patients (N = 150; 96 males, 54 females) with schizophrenia were included in the final sample, with a mean age of 35.72 years (SD = 8.41) ranging from 19 to 58 years. The demographic and clinical characteristics of the sample are given in detail in table 1.

Table II: Descriptive Statistics and Reliability Coefficients for Study Variables (N = 150)

Variables	<i>M</i>	<i>SD</i>	Range	α
Age (years)	35.72	8.41	19-58	—
Cognitive Flexibility	74.36	10.82	42-98	.88
Positive Symptoms	18.47	5.63	9-34	.84

Note. α = Cronbach's alpha

The descriptive statistics, 95% confidence intervals, and internal consistency (Cronbach's α) of the study variables are presented in Table 2. In this sample, the CFI and PANSS-positive subscale had good internal consistency both for the whole scale and for the subscale, indicating that these scales were suitable for correlational and regression analyses.

Table III: Correlation Between Cognitive Flexibility and Positive Psychotic Symptoms (N = 150)

Variables	<i>M</i>	<i>SD</i>	1	2
1. Cognitive Flexibility	74.36	10.82	—	
2. Positive Symptoms	18.47	5.63	-.42**	—

** $p < .001$.

Pearson product-moment correlation analysis showed a moderate, significant, negative correlation between cognitive flexibility and severity of positive psychotic symptoms ($r(148) = -.42, p < .001$), meaning that higher levels of positive symptoms were associated with lower levels of cognitive flexibility. The means, standard deviations and inter-correlations of the study variables are shown in Table 3.

Figure II: Relationship between cognitive flexibility (Cognitive Flexibility Inventory score) and positive psychotic symptom severity (PANSS positive-subscale score), with fitted linear regression line

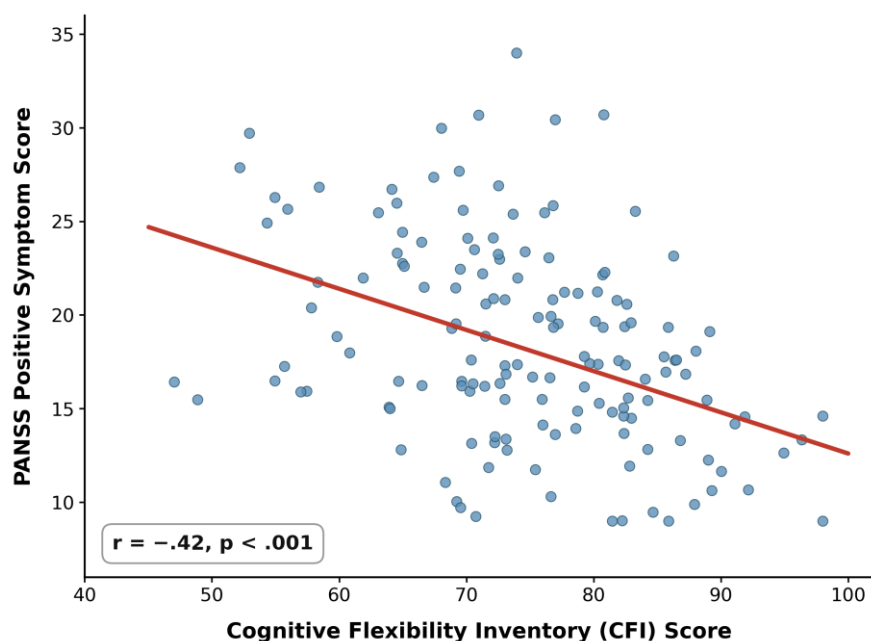


Figure 2 displays this relationship graphically, illustrating the downward trend in positive symptom scores as cognitive flexibility increases.

Table IV: Summary of Simple Linear Regression Analysis for Cognitive Flexibility Predicting Positive Psychotic Symptoms (N = 150)

Predictor	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>p</i>	95% CI for <i>B</i>
(Constant)	34.60	2.71	—	12.77	< .001	[29.25, 39.95]
Cognitive Flexibility	-0.22	0.03	-.42	-5.66	< .001	[-0.28, -0.16]

Note. 95% CI for *B* = 95% confidence interval for the unstandardized coefficient; $R^2 = .176$, Adjusted $R^2 = .171$, $F(1, 148) = 32.04$

Cognitive flexibility was used as the predictor and positive psychotic symptom severity was used as the outcome for a simple linear regression. The overall model was statistically significant, $F(1, 148) = 32.04$, $p < .001$, and cognitive flexibility accounted for a medium-sized effect of about 17.6% of the variance in positive symptoms ($R^2 = .176$, adjusted $R^2 = .171$) by conventional benchmarks. The results of the regression analysis showed that cognitive flexibility was significantly related to positive symptom severity ($\beta = -.42$, $p < .001$), with each one-point increase in the CFI score corresponding to an estimated 0.22-point decrease in the PANSS-positive score, and the 95% confidence interval for the regression coefficient, which was entirely negative, did not contain zero.

IV.DISCUSSION

The study aimed to explore the association between cognitive flexibility and positive psychosis symptom severity in 150 adult psychiatric patients with schizophrenia recruited from psychiatric clinical settings of Pakistan. As predicted, there was a significant and negative correlation between cognitive flexibility and positive symptom severity, and regression analysis revealed that cognitive flexibility significantly accounted for 17.6% of the variance in positive symptoms, which was a moderate but clinically meaningful effect. These results support the hypothesis that difficulties in flexible, adaptive thinking are meaningfully linked to the severity of hallucinations, delusions, and conceptual disorganisation in schizophrenia, and extend a large body of literature on flexible thinking and psychosis to a clinical population in South Asia that has so far been relatively understudied. The observed negative association is consistent with, and directly extends, cognitive models of positive symptoms. Garety and Freeman's (1999) influential account suggests that biased reasoning processes (inadequate sampling of evidence before decision making) play a causal role in the onset of delusions, with ambiguous experiences being appraised in a hasty manner with little attention paid to alternative explanations. Based on this model, Colbert et al. (2010) demonstrated that belief inflexibility, characterised by a diminished ability to entertain and consider alternative interpretations and to modify beliefs when confronted with new findings, was strongly correlated with delusions, and was found to be part of a broader trait-like inflexible thinking style rather than being limited to the content of delusions. The present finding of a relationship between lower cognitive flexibility (CFI) and increased positive symptom severity is consistent with this account and suggests that the conceptual disorganization and hallucinatory behavior dimensions of the positive symptom cluster may be closely related to this specific cognitive domain. In this regard, the present findings support a common theory that a single cognitive style (rigid and insufficiently exploratory reasoning) is responsible for several, seemingly independent aspects of positive psychopathology.

The result confirms the general literature on executive dysfunction in schizophrenia. People with schizophrenia have been found to have moderate-to-large impairments relative to their healthy counterparts in all areas of cognition (Fioravanti et al., 2005), and also in set-shifting and concept formation, as assessed by performance-based tasks like the Wisconsin Card Sorting Test (Tyburski et al., 2017). It also mirrors longitudinal studies showing cognitive inflexibility is a predictor of symptom trajectories in early psychosis (Mantonakis et al., 2024), and other studies that have shown a link between related constructs, such as psychological flexibility, and overall symptom burden in schizophrenia-spectrum disorders (Hahne et al., 2025). The results of this collection of studies indicate that flexible cognition, measured using behavioral tasks, clinical reasoning paradigms, and self-report measures like the CFI, is a transdiagnostic correlate of symptom severity that holds specifically to the positive symptom domain that was examined here, and is consistent across culturally and clinically diverse samples. One possible explanation is that people with lower cognitive flexibility may lack the ability to come up with, entertain, and evaluate multiple possibilities when they have less than clear information about their internal experiences or

environmental cues. Where a cognitively flexible individual might entertain and test a variety of possible interpretations of an unusual perceptual experience, a less flexible thinking style may instead reinforce delusional beliefs or resistance to disconfirming evidence, the mechanism suggested by Colbert et al. (2010). Likewise, the conceptual disorganization item of the PANSS-positive subscale may also be reflected behaviorally, such as in disorganized speech or thought. Although this is a cross-sectional study and thus cannot establish the direction of the relationship between variables, the present combination of mechanisms is coherent and parsimonious and provides testable predictions for future experimental and longitudinal research designs.

There are also practical implications from these findings. Because cognitive flexibility accounted for a meaningful but limited percentage of variance in positive symptoms, interventions specifically aimed at flexible thinking have potential as a viable adjunct to treatment with currently available antipsychotics, as opposed to an alternative to them. Structured cognitive remediation has shown medium-sized effects on cognitive performance and small but reliable reductions in symptoms, especially when combined with other aspects of psychiatric rehabilitation (McGurk et al., 2007); neuroimaging research also indicates that these effects are probably not a result of practice effects alone, but represent measurable changes in prefrontal cortical physiology during executive tasks (Pu et al., 2016). This approach might be particularly useful in settings like Pakistan, where there is limited availability of specialized psychological services and psychological care remains largely biomedical and hospital based (Nawaz et al., 2020). The use of a brief assessment of cognitive flexibility, like the CFI, in routine clinical assessment may help identify patients who may benefit the most from these additional tools, without requiring any extra cost to already stretched clinical services.

Limitations and Future Directions

The results of these analyses should be interpreted with some caveats. First, the cross-sectional design does not allow causal inferences: is reduced cognitive flexibility linked to positive symptoms, does symptom severity limit flexible cognition, or are both the result of a common underlying vulnerability in the neurocognitive networks that give rise to them? Second, this was a purposive sample collected in a clinical setting in Pakistan that may not be representative of community samples, non-clinical samples, or other cultural and healthcare settings. Third, cognitive flexibility was measured using a self-report measure, which can be affected by insight, symptom severity, or social desirability, and future studies would benefit from the use of additional measures of executive functioning, such as the Wisconsin Card Sorting Test, which would provide another source of triangulation between self-reported and performance-based indices of cognitive flexibility. Fourth, other developmental and environmental factors that affect cognitive flexibility, such as adverse early life experiences, were not examined and could not be tested as potential confounders or moderators, even though these have been shown to decrease cognitive flexibility in both clinical and non-clinical samples (Kalia et al., 2021). Fifth, there was no systematic documentation of the types or doses of medications administered, and antipsychotic treatment is known to affect both cognitive functioning and symptom presentation, effects which should be directly assessed in future investigations. Finally, this model accounted for a modest percentage of variance in positive symptoms (17.6%), suggesting that other clinical, cognitive, and psychosocial factors (e.g., insight, duration of untreated psychosis, medication adherence) also matter and should be incorporated into future multivariable models. Longitudinal and intervention-based designs are needed to better clarify causal pathways and to test whether the benefits of a structured intervention to improve cognitive flexibility (e.g., targeted cognitive remediation; McGurk et al., 2007) are sustained over time.

V. CONCLUSION

Cognitive flexibility was significantly associated with, and significantly predicted, positive psychotic symptoms among psychiatric clinic-based adult patients with schizophrenia in Pakistan, and it explained a moderate amount of variance in positive psychotic symptom scores. The results identify cognitive flexibility as a clinically relevant and potentially modifiable psychological variable in schizophrenia, indicating the need for further investigation of cognitively based therapies as complementary, not alternative, to pharmacotherapy. Further longitudinal and intervention studies are required to establish the causal relationship between increasing cognitive flexibility and a

decrease in positive symptom severity, as well as to confirm the impact of improved cognitive flexibility on functional outcomes in people with schizophrenia.

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