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# Cognitive Insight in Youth at Clinical High Risk of Psychosis

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Cognitive insight reflects ones Self-Reflectiveness (recognition of dysfunctional reasoning, corrigibility) and Self-Certainty (overconfidence). In schizophrenia, lower Self-Reflectiveness and higher Self-Certainty has been associated with severity of symptoms and poor functioning. There is some evidence that lower Self-Reflectiveness and higher Self-Certainty are associated with attenuated symptoms in youth at clinical high risk (CHR) of psychosis. The present study evaluated in a CHR sample the relationship between cognitive insight, attenuated symptoms, and current functioning, and evaluated change in cognitive insight at baseline and 1-month follow-up. Twenty-four individuals at CHR of psychosis completed the Beck Cognitive Insight Scale. Attenuated psychotic symptoms were assessed with the Scale of Prodromal Symptoms and functioning with the Global Functioning Social and Role scales. Self-Reflectiveness, Self-Certainty, and Composite Index scores were correlated with clinical and functional variables. In addition, cognitive insight levels were compared at baseline and 1-month follow-up. Trends were observed toward both increased attenuated perceptual abnormalities/hallucinations and higher Self-Reflectiveness, and increased avolition

and increased Self-Reflectiveness. Cognitive insight did not significantly correlate with social or role functioning. Cognitive insight scores did not significantly differ between baseline and 1-month follow-up. These findings provide little evidence for a relation between cognitive insight and clinical and functional variables in CHR, and suggest that cognitive insight remains stable over a 1-month time period in our sample. These data add to a growing body of literature on cognitive insight across the schizophrenia spectrum. **Keywords and Definitions:** Clinical high risk of psychosis: An individual who experiences attenuated or brief intermittent psychotic symptoms, or has a genetic risk for psychosis and functional decline. Cognitive insight: Self-Reflectiveness, ones recognition of dysfunctional reasoning and openness to external feedback, and Self-Certainty, overconfidence in beliefs and judgments. Clinical variables: Attenuated positive symptoms and negative symptoms. Current functioning: Social functioning, an individuals ability to interact with others beyond their family, and role functioning, an individuals ability to be self-sufficient.

## Introduction

Psychosis is a severe mental illness in which the person loses contact with reality. It is characterized primarily by delusions, or fixed false beliefs, and

hallucinations, which are false sensory experiences. Insight is one important clinical consideration in patients with psychosis. Lack of clinical insight (ie, poor awareness of illness) is another core feature of schizophrenia<sup>1</sup> which is one type of psychosis. The clinical concept of insight focuses on the patients understanding that their symptoms and behavior are a consequence of their mental disorder, the need and efficacy of their treatments, and the social consequences of the disorder (i.e. stigma)<sup>2,3</sup>. This form of insight is determined by evaluating an individual's behavior through a clinical interview and is valuable for ascertaining the proper diagnosis, prognosis, and treatment in people with schizophrenia.

Essential to the understanding of clinical insight is an understanding of the individual's ability to distance themselves from their distorted beliefs and misinterpretations, contemplate their rationality, and recognize inaccurate conclusions. Beck and colleagues<sup>4</sup> developed the Beck Cognitive Insight Scale (BCIS) to psychometrically assess these cognitions in people with psychotic disorders. Two constructs are measured: Self-Reflectiveness, defined as one's willingness to acknowledge fallibility, consider alternate explanations, and openness to external feedback, and Self-Certainty, which addresses overconfidence. In order to account for a potential dampening of Self-Reflectiveness caused by an individual's level of certainty about their beliefs, a Composite Index can also be calculated through subtracting one's Self-Certainty score from their Self-Reflectiveness score<sup>4</sup>. A series of studies have reported that relative to healthy people, individuals with psychotic disorders typically endorse lower Self-Reflectiveness and higher Self-Certainty, and this is interpreted as poorer cognitive insight<sup>5</sup>. Developing a better understanding of clinical insight depends upon exploring a patient's ability to identify their distorted beliefs and misinterpretations, reflect on these concepts rationally, and recognize flawed conclusions. Poor cognitive insight is indeed one of many cognitive distortions observed in people with schizophrenia<sup>6</sup>. For example, people with schizophrenia tend to make hasty decisions with little evidence (*jumping to conclusions bias*)<sup>7</sup>, show increased confidence in incorrect responses (*knowledge corruption*)<sup>8</sup>, and an unwillingness to downwardly adjust plausibility ratings to reflect

recently encountered disconfirmatory evidence (*Bias Against Disconfirmatory Evidence*)<sup>9</sup>.

Several studies have evaluated the relationship between cognitive insight and positive symptom severity in people with psychosis. One study found in a sample of schizophrenia patients significant correlations between higher positive symptom severity and lower Self-Reflectiveness, and higher Self-Certainty, and lower Composite Index scores<sup>10</sup>. Another reported significant positive correlations between positive symptoms and Self-Certainty in a more chronic population of schizophrenia and schizoaffective outpatients<sup>11</sup>. Other studies have focused on the role of specific positive symptoms such as delusions, which are fixed false beliefs and hallucinations (sensory experiences) for cognitive insight in this population. For example, Warman and colleagues<sup>12</sup> found that people with psychosis with active delusions endorsed higher Self-Certainty and lower Self-Reflectiveness compared to patients without delusions and healthy controls. A different study reported low Self-Reflectiveness and high Self-Certainty in schizophrenia patients with delusions compared to patients without delusions, regardless of the presence or absence of hallucinations<sup>13</sup>. Buchy and colleagues<sup>14</sup> reported that first-episode psychosis patients with active delusions endorsed lower Self-Reflectiveness than patients without active delusions, but that these two groups were indistinguishable on their Self-Certainty. There is also some data suggesting that delusion proneness in non-clinical samples is associated with poor cognitive insight<sup>15,16</sup>. Warman et al.<sup>15</sup> compared a control group of undergraduate students to individuals with psychotic disorders, and reported increased Self-Certainty and lower Composite Index scores in the latter group. Furthermore, patients with delusions had higher Self-Certainty in comparison to those without delusions and controls. In contrast, patients without delusions endorsed lower Self-Reflectiveness than patients with delusions and controls. A second study attempted to replicate these results in an independent non-clinical sample of undergraduate students. Contrary to the findings of Warman et al.<sup>15</sup>, the study found that higher delusion proneness in the non-clinical sample correlated with both higher Self-Certainty and Self-Reflectiveness<sup>16</sup>. In summary, the research to date suggests that hallucinations, delusions, delusional proneness may

interact with cognitive insight in people with psychosis and in non-clinical subjects high in delusion proneness.

Other studies have explored the relationship between cognitive insight and negative and depressive symptoms in people with psychotic disorders. Two studies found that higher negative symptom severity significantly correlated with lower Self-Reflectiveness, one in a multi-episode schizophrenia sample<sup>10</sup> and a second in a first-episode psychosis cohort<sup>17</sup>, and a third reported that higher negative symptom severity was associated with higher Self-Certainty in a middle-aged and elderly schizophrenia or schizoaffective population<sup>11</sup>. No published studies have evaluated the relationship between specific negative symptoms and cognitive insight in a psychosis sample. Warman et al.<sup>12</sup> reported that greater depressive symptom severity was associated with higher Self-Reflectiveness in a sample of people with psychotic disorders. Another investigation reported that individuals with a psychotic or bipolar disorder had poorer cognitive insight than those with a major depressive disorder<sup>18</sup>. However, the majority of studies have failed to observe a relationship between depressive symptoms and cognitive insight in psychosis<sup>4,11,17,19,20</sup>. Taken together, there is some evidence for a relationship between negative symptoms and cognitive insight in people with psychosis, whereas the role of depression is mixed, creating an unclear picture of how cognitive insight may interact with clinical symptoms prior to the onset of psychosis.

An interesting area of research that has received scant attention is the relationship between cognitive insight and functioning in this population. This represents an important consideration, as symptom severity is known to impact on current levels of functioning<sup>21</sup>. In the only study to date on this topic, people with schizophrenia were divided into groups based on their current living situation, either in a nursing home or independently, and compared on cognitive insight psychosis<sup>20</sup>. The authors reported that relative to patients living independently, patients living in a nursing home endorsed significantly lower Self-Reflectiveness and higher Self-Certainty scores. This finding suggests that patients living in a predetermined environment have poorer cognitive insight compared patients who are able to live independently in a self-determined environment, and

links cognitive insight to current functional capacity in people with psychotic disorders. The relationship between functioning and cognitive insight in CHR has not been examined, and may provide important clinical information as poor social functioning is known to increase the risk of conversion to psychosis in CHR youth<sup>21</sup>.

Very recent research has begun to characterize cognitive insight levels in people at clinical high risk (CHR) of developing psychosis. People at CHR of psychosis show attenuated psychotic symptoms, brief intermittent psychotic symptoms, or have a genetic risk for the disorder and present with a current decline in functioning. Approximately 35% of people who are at CHR for psychosis eventually develop or convert to a psychotic disorder such as schizophrenia<sup>22</sup>. A first study evaluated cognitive insight in people at CHR of psychosis, patients with schizophrenia, and healthy controls<sup>23</sup>. The study found that CHR endorsed lower Self-Certainty and lower Self-Reflectiveness scores than the schizophrenia group, but higher Self-Certainty and similar Self-Reflectiveness scores in comparison to the healthy controls. Further analyses in the CHR group revealed no significant correlations between attenuated or sub-threshold delusional ideation or suspiciousness and scores on any cognitive insight variable. However, CHR participants who were close to meeting threshold criteria for psychotic level of persecutory ideation endorsed significantly higher Self-Certainty scores than those who did not meet this criterion. A second study compared CHR individuals to healthy controls on cognitive insight using a Japanese version of the Beck Cognitive Insight Scale<sup>24</sup>. Results revealed that CHR individuals endorsed significantly higher Self-Certainty compared to the control group, but that groups endorsed comparable levels of Self-Reflectiveness. In addition, a positive correlation was seen between higher Self-Certainty scores and greater sub-threshold delusional symptom severity in the CHR group, and CHR participants with attenuated delusional symptoms had significantly higher Self-Certainty in comparison to those who did not meet the designated criteria<sup>24</sup>. Taken together, the limited data on cognitive insight in CHR youth is somewhat consistent with finding in people psychosis, suggesting poorer cognitive insight than controls and a relation between greater attenuated delusional symptom severity and higher Self-Certainty. However,

with only two published studies on this topic, replication of findings is warranted, and further examination between cognitive insight and social functioning deserves attention given its association in schizophrenia.

There are several limitations in the literature on cognitive insight in CHR youth. Although the two studies discussed above<sup>23,24</sup> have provided important information on cognitive insight in CHR compared with controls, analyses of symptom data were restricted to delusional symptoms, and did not explore other symptoms that have been linked to poorer cognitive insight in psychotic samples such as negative and depressive dimensions<sup>19</sup>. An understanding of cognitive insight and its relation to other subclinical symptomatology in CHR could provide particularly important information on how cognitive insight interacts with symptom severity prior to the onset of psychosis. Further, the relationship between current functioning and cognitive insight in CHR youth has not been explored, and may be of clinical value as there is some evidence that poorer functioning is associated with poorer cognitive insight in people with schizophrenia<sup>20</sup>. This may also be of clinical interest, as impaired functioning is known to predict clinical outcome in CHR individuals<sup>21</sup>. Finally, the longitudinal trajectory of cognitive insight has not been evaluated, and may be of clinical significance in CHR youth, as there is limited data in people with schizophrenia suggesting an improvement in Self-Reflectiveness but not Self-Certainty following inpatient treatment for a psychotic episode.

Therefore, the aim of the present study was to evaluate in a CHR sample the relationship between cognitive insight and a) total attenuated positive and negative symptoms; b) individual attenuated positive (i.e., delusions, perceptual abnormalities/hallucinations) and negative symptoms (i.e., avolition, flat affect); c) current social and role functioning; and d) change in cognitive insight over a 1-month time period. We hypothesized that increased attenuated delusions and hallucinations, greater negative symptom severity and lower in current functioning would correlate with higher Self-Certainty and lower Self-Reflectiveness. The analysis of change over time was exploratory; therefore, no specific hypotheses were formed.

## Methods

### Participants

Twenty-four youth at CHR of psychosis were recruited at the University of Calgary, Alberta, Canada. All participants met the Criteria of Prodromal Syndromes (COPS) using the Structured Interview for Prodromal Syndromes (SIPS)<sup>25</sup>. Participants were excluded if they met criteria for any current or lifetime Axis I psychotic disorder, IQ<70, past or current history of a central nervous system disorder or DSM-IV criteria for current substance dependence disorder. Further description on recruitment, inclusion and exclusion criteria, and participant details can be found in Addington et al.<sup>26</sup>.

The SIPS and Scale of Prodromal Symptoms (SOPS)<sup>25</sup> were used to assess the criteria for a prodromal syndrome and attenuated positive symptom severity. The COPS was used to address the manifestation of prodromal syndromes as Brief Intermittent Psychotic syndrome, Attenuated Positive Symptom Syndrome, and Genetic Risk and Deterioration Syndrome.

### Beck Cognitive Insight Scale (BCIS)

Cognitive insight was assessed with the 15-question self-report BCIS<sup>4</sup>. Nine questions assess Self-Reflectiveness and six address Self-Certainty. Composite index scores (Self-Reflectiveness Self-Certainty) were also calculated. Each question is rated on a 4-point scale, from 0 (does not agree at all) to 3 (agrees completely). Global Functioning Scale: Social Global Functioning Scale: Role (GF:S GF:R) were used to assess participants current level of functioning<sup>27</sup>. The GF:S focuses on an individuals ability to be social and generate interactions with others beyond their family. The GF:R focuses on an individuals ability to be independent and support themselves with regards to their current situation. Both Global Functioning Scales are rated on a 10-point scale, with 10 equivalent to the highest level of functioning.

### Procedure

Post-training agreement on determining the prodromal diagnoses was excellent ( $\kappa=0.90$ ). J.A. conducted a comprehensive clinical assessment to determine if entry criteria were met. A trained

Characteristic	Mean (SD)	Range
Age (years)	16.1 (2.24)	13 to 20
Education (years)	10.0 (1.84)	7 to 13
BCIS scores		
Self-Reflectiveness	11.9 (3.43)	6 to 18
Self-Certainty	6.25 (3.10)	0 to 12
Composite Index	5.67 (5.02)	-1 to 15
	N (%)	
Gender: M:F (%)	11:13 (46:54)	

**Table 1:** Demographic and cognitive insight characteristics of the CHR sample (N=24). BCIS, Beck Cognitive Insight Scale; SD, Standard deviation.

administrator not involved in the treatment of the participant conducted a clinical interview and assessment, which included the BCIS. Prior to the clinical interview, participants were described the details of the study and provided written informed consent. Participants who were under 16 years of age acquired parental consent from their parents/legal guardians. The University of Calgary Conjoint Health Research Ethics Board approved the study.

## Statistical Analysis

BCIS scores were normally distributed; therefore, Pearson correlations were used to examine the relationship between Self-Reflectiveness, Self-Certainty, Composite Index and clinical and functional variables. These included the individual items of the SOPS from the positive subscale (P1, unusual thought content/delusional ideas, P2, suspiciousness/persecutory ideas, P3, grandiosity, P4, perceptual abnormalities/hallucinations, and P5, disorganized communication), negative subscale (N1, social anhedonia, N2, avolition, N3, expression of emotion, N4, experience of emotions and self, N5, ideational richness, and N6, occupational functioning), as well as GF:S and GF:R scores. The critical p-value was set to 0.05 for the analyses of total attenuated positive and negative symptoms and Bonferonni corrected to  $0.05/2=0.025$  for the analyses of the GF:S and GF:R. Bonferonni correction was set to  $0.05/5=0.01$  for analysis of the five individual attenuated positive symptoms and to  $0.05/6=0.008$  for the six individual negative symptoms. Paired t-tests were used to evaluate change in cognitive insight from baseline to 1-month follow-up. The critical p-value was set to 0.05 for these latter analyses.

## Results

Sociodemographic characteristics: Sociodemographic information and cognitive insight scores of the CHR sample are shown in Table 1.

### **Correlations between cognitive insight variables and attenuated positive symptoms**

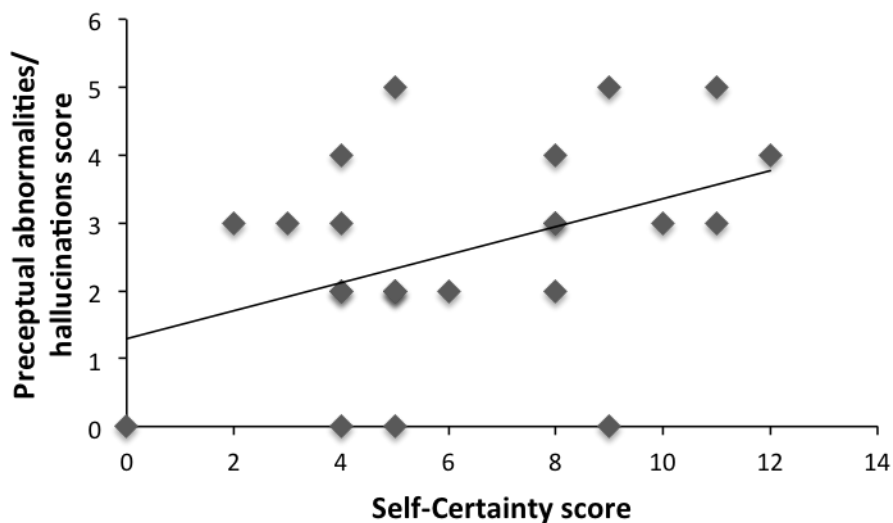
Correlations between cognitive insight variables and attenuated positive symptoms are shown in Table 2. No significant correlations emerged between total attenuated positive symptoms and either Self-Reflectiveness, Self-Certainty, or Composite Index scores. A trend toward higher Self-Certainty and increased severity in perceptual abnormalities/hallucinations was observed (Fig. 1), but not with Self-Reflectiveness or the Composite Index. No other significant correlations were seen between any measure of cognitive insight and symptoms severity on any of the other four individual positive symptoms.

### **Correlations between cognitive insight variables and negative symptoms**

Table 3 displays correlations between SOPS negative symptoms and cognitive insight variables. No significant correlations emerged between total negative symptoms and either Self-Reflectiveness, Self-Certainty, or Composite Index scores. As shown in Fig. 2 & 3, a trend was observed between higher avolition and both higher Self-Reflectiveness and higher Composite Index scores, but not for Self-Certainty. No significant correlations emerged between Self-Certainty and any of the other five

	Self-Reflectiveness	Self-Certainty	Composite Index
Total attenuated positive symptoms	0.14 (0.52)	0.13 (0.56)	0.02 (0.94)
P1: Unusual thought content/ Delusional ideas	0.18 (0.40)	0.05 (0.86)	0.10 (0.65)
P2: Suspiciousness/ Persecutory ideas	-0.01 (0.98)	-0.12 (0.57)	0.07 (0.74)
P3: Grandiosity	-0.04 (0.87)	0.20 (0.35)	-0.15 (0.49)
P4: Perceptual abnormalities/ Hallucinations	0.15 (0.48)	<b>0.42 (0.04)</b>	-0.16 (0.47)
P5: Disorganized communication	0.04 (0.87)	-0.15 (0.47)	0.12 (0.58)

**Table 2:** Correlations between cognitive insight and attenuated positive symptoms. Results expressed as Pearson coefficients with corresponding p-value in brackets. Trend effects are bolded.



**Figure 1:**

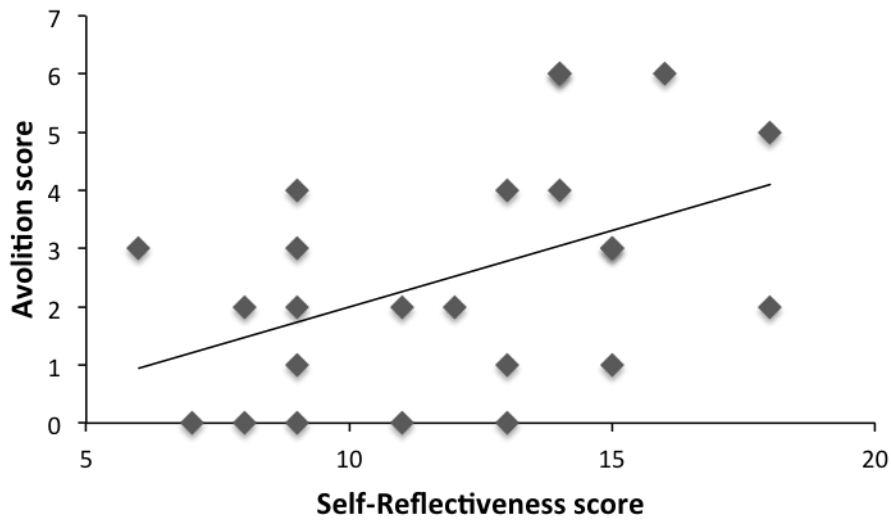
Correlation between the P4, perceptual abnormalities/ hallucinations item of the Scale for Prodromal Symptoms and the Self-Certainty subscale of the Beck Cognitive Insight Scale ( $r = 0.42$ ,  $p = 0.04$ ).

	Self-Reflectiveness	Self-Certainty	Composite Index
Total negative symptoms	0.24 (0.25)	-0.06 (0.79)	0.20 (0.35)
N1: Social anhedonia	0.26 (0.23)	0.01 (0.96)	0.17 (0.43)
N2: Avolition	<b>0.46 (0.03)</b>	-0.19 (0.39)	<b>0.43 (0.04)</b>
N3: Expression of emotion	-0.13 (0.57)	-0.06 (0.77)	-0.05 (0.81)
N4: Experience of emotion	-0.23 (0.29)	0.22 (0.29)	-0.29 (0.17)
N5: Ideational richness	-0.13 (0.54)	0.04 (0.85)	-0.11 (0.60)
N6: Occupational functioning	0.18 (0.52)	-0.06 (0.80)	0.16 (0.46)

**Table 3:** Correlations between cognitive insight variables and negative symptoms. Results expressed as Pearson coefficients with corresponding p-value in brackets. Trend effects are bolded.

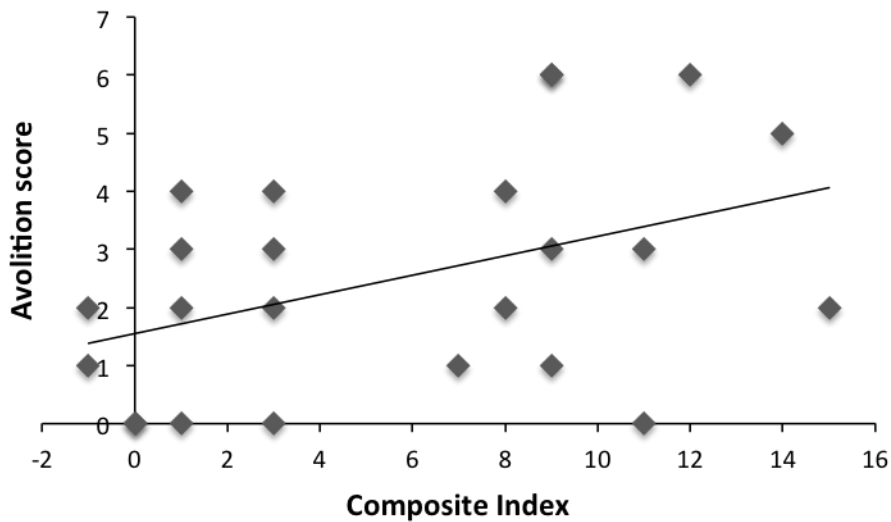
	Self-Reflectiveness	Self-Certainty	Composite Index
Social functioning	-0.21 (0.33)	0.19 (0.38)	-0.26 (0.23)
Role functioning	-0.31 (0.14)	-0.13 (0.53)	-0.29 (0.17)

**Table 4:** Correlations between cognitive insight measures and current functioning. Results expressed as Pearson coefficients with corresponding p-value in brackets.



**Figure 2:**

Correlation between the N2, avolition item of the Scale for Prodromal Symptoms and the Self-Reflectiveness subscale of the Beck Cognitive Insight Scale ( $r = 0.46$ ,  $p = 0.03$ ).



**Figure 3:**

Correlation between the N2, avolition item of the Scale for Prodromal Symptoms and the Composite Index (Self-Reflectiveness and Self-Certainty) ( $r = 0.43$ ,  $p = 0.04$ ).

	Baseline M (SD)	1-month M (SD)	t-value	p-value
Self-Reflectiveness	12.50 (2.62)	13.43 (3.37)	-1.19	0.26
Self-Certainty	6.07 (2.76)	6.07 (3.20)	0.00	1.00
Composite Index	6.43 (4.18)	7.36 (4.58)	-1.21	0.25

**Table 5:** Paired *t*-Tests for cognitive insight variables at baseline and one-month follow-up ( $n = 14$ ).

negative symptoms.

### ***Correlations between cognitive insight variables and functioning***

Correlations between social and role functioning ratings and cognitive insight are displayed in Table 4. Social and role functioning scores did not significantly correlate with scores on any of the three cognitive insight variables.

### ***Longitudinal trajectory of cognitive insight from baseline to 1-month follow-up***

Table 5 displays paired t-Tests for Self-Reflectiveness, Self-Certainty and Composite Index scores of a subsample of CHR participants (n= 14) who completed BCIS ratings at baseline and again at 1-month follow-up. No significant changes were observed for any cognitive insight variable between the two assessments.

## **Discussion**

The purpose of this study was to evaluate the relationship between cognitive insight, symptom severity and current functioning, as well as the longitudinal progression of cognitive insight over 1-month, in 24 individuals at CHR of psychosis. Our results suggested a trend toward increased severity in perceptual abnormalities/ hallucinations and higher Self-Certainty. In addition, a trend was observed between increased avolition and both higher Self-Reflectiveness and Composite Index Scores. No other significant relationships were observed for any other positive or negative symptoms and any cognitive insight measure. In addition, neither social nor role functioning significantly correlated with cognitive insight in our sample. Evaluation of the trajectory of cognitive insight over 1-month indicated that cognitive insight scores remained stable over this period.

Our results indicate that greater severity of attenuated perceptual abnormalities/hallucinations was correlated at a trend level to higher Self-Certainty in our CHR sample. Although no previously published studies in either CHR or people with psychosis have reported associations between cognitive insight and hallucinations, one study in schizophrenia has reported that patients

experiencing delusions and hallucinations showed a trend toward lower Self-Reflectiveness and higher Self-Certainty compared to patients with delusions and no hallucinations<sup>19</sup>. The two previous studies conducted in CHR samples<sup>23,24</sup> have not explored the relationship between perceptual abnormalities/ hallucinations and cognitive insight. The present result may suggest that hallucinations may be differentially associated with cognitive insight across multiple phases of the disease process, and may be more directly associated with aspects of Self-Certainty in CHR youth.

No significant correlations were observed between either total positive symptom scores or any other attenuated positive symptom and cognitive insight in our CHR sample. This negative finding is inconsistent with a previous study reporting that individuals at CHR of psychosis who were closer to the threshold of having persecutory ideation had higher Self-Certainty in comparison to individuals who do not meet this criteria<sup>23</sup>. Lower Self-Reflectiveness scores have also been reported in CHR individuals experiencing severe but not psychotic unusual thought content<sup>23</sup>. Furthermore, CHR individuals with near-threshold delusional symptoms had higher Self-Certainty in comparison to individuals who did not meet this criteria<sup>24</sup>. Overall, the results from the present study suggest a tentative relationship between hallucinations and Self-Certainty, but not for other attenuated positive symptoms including unusual thought content/delusions or total positive symptoms scores, in our CHR sample.

Analysis of the relationship between negative symptoms and cognitive insight indicated a trend toward higher avolition and higher Self-Certainty and Composite Index scores. Two previously published studies that have characterized cognitive insight in CHR did not evaluate the relationship with negative symptoms<sup>23,24</sup>. The current results differ from those collected in first episode psychosis patients where total negative symptom severity was associated with lower Self-Reflectiveness at a trend level of significance<sup>17</sup>. Higher Self-Certainty has also been reported in middle-aged schizophrenia and schizoaffective patients with greater negative symptoms severity<sup>11</sup>. Taken together the literature to date suggests that aspects of cognitive insight may be associated with negative symptom severity in both CHR and in schizophrenia and schizoaffective



patients.

Another novel analysis that was explored in our study was the relationship between current functioning and cognitive insight. Results of these analyses indicated no significant associations between social or role functioning and the three cognitive insight variables. This is contrary to one finding in schizophrenia patients indicating that patients with living conditions that encourage independence show greater cognitive insight compared to those who have living conditions with less independence<sup>20</sup>. In our study, GF:S and GF:R scales were used to measure social and role functioning. In contrast to providing two different options of living situation, social and role functioning are scalar measurements that provide an overall rating of functioning in the given area. Although the present results differ from those reported in the schizophrenia sample<sup>20</sup>, the relationship between current functioning and cognitive insight has been understudied and therefore remains unclear.

Our longitudinal analysis of cognitive insight indicated that Self-Reflectiveness, Self-Certainty and Cognitive Insight remain stable over a 1-month time period. To our knowledge this is the first study to evaluate longitudinal change in cognitive insight in a CHR sample. That cognitive insight did not change over time could reflect a number of underlying processes, for example that Self-Reflectiveness and overconfidence are stable characteristics that may only change with changes in psychotic symptoms or functioning, among other clinical variables. In addition, brain changes that occur during adolescence may in turn change youths reasoning processes, which may be more detectable over longer periods of time such as one or two years. Although no studies have evaluated change in cognitive insight among CHR youth, one study in people with schizophrenia has reported an increase in Self-Reflectiveness and Composite Index from admission to discharge after an acute psychotic episode, but that change in positive and negative symptoms did not significantly correlate with changes in cognitive insight ratings<sup>17</sup>. Evaluation of change in cognitive insight over time in tandem with structural and functional brain changes that occur during adolescence and early adulthood would be particularly important for future works.

We observed in our CHR sample that participants with greater severity of perceptual abnormalities/

hallucinations endorsed higher Self-Certainty at a trend level. Cognitive behavioral therapy (CBT) is one treatment that has been shown to reduce compliance behavior with command hallucinations in people with schizophrenia<sup>28</sup>. CBT helps individuals with psychosis become more willing to accept feedback from others and to improve their objectiveness when reflecting on distorted beliefs<sup>29</sup>, which are cognitions tapped with the BCIS items. As such, it is possible that applying a CBT intervention in CHR individuals may help reduce distress associated with their perceptual abnormalities/hallucinations but also their cognitive insight. Interestingly, two studies have examined cognitive insight in schizophrenia before and after a CBT intervention. Granholm and colleagues<sup>29</sup>. These studies reported an overall improvement in cognitive insight in those who participated in a CBT intervention compared to a control group, with most improvement observed for Self-Reflectiveness<sup>29,30</sup>. Future treatments to promote cognitive insight in CHR may include CBT.

Our study observed a trend toward higher avolition and higher Self-Reflectiveness. In the SIPS, avolition is defined as impairment in initiation, persistence, and control of goal-directed activities. Three of the Self-Reflectiveness items require participants to reflect on their previous experiences. This may lead to the suggestion that people with low avolition may spend more time reflecting on their prior experiences rather than seeking out new ones.

Interestingly, poor social functioning, greater levels of unusual thought content and increased suspiciousness were found to be three of five predictors of conversion to psychosis in a large CHR sample<sup>21</sup>. That cognitive insight did not significantly correlate with any of these measures in the current study may lead to the speculation that cognitive insight may not mediate the relationship between poorer functioning, greater positive symptoms, and conversion in CHR youth. Future work in CHR converters vs. non-converters may be particularly informative in this regard.

## Limitations

Limitations of the current study include the small sample size and lack of a non-clinical control group that would serve as a control group. Unfortunately, longitudinal data on changes in cognitive insight in

CHR are unavailable, and future works may evaluate cognitive insight over multiple time points to gain an understanding of its longitudinal trajectory in both clinical and non-clinical subjects. Previous studies have identified a role of neurocognition for cognitive insight in schizophrenia<sup>5</sup>, and future works may evaluate the role of neurocognition for cognitive insight in CHR. Obtaining a larger sample size in future will help to further understand the relationship between cognitive insight, attenuated symptoms, and current functioning in a CHR sample and to test the replicability of the current findings. These future directions would be valuable in understanding the interaction between cognitive insight and multiple clinical and neurocognitive variables in youth at CHR of psychosis.

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