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# The reliability and validity of the Revised Green et al. Paranoid Thoughts Scale in individuals at clinical high-risk for psychosis

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## Abstract

**Introduction:** Paranoia is a common and impairing psychosis symptom, which exists along a severity continuum that extends into the general population. Individuals at clinical high-risk for psychosis (CHR) frequently experience paranoia and this may elevate their risk for developing full psychosis. Nonetheless, limited work has examined the efficient measurement of paranoia in CHR individuals. The present study aimed to validate an often used self-report measure, the Revised Green Paranoid Thoughts Scale (RGPTS), in this critical population.

**Method:** Participants were CHR individuals ($n$ = 103), mixed clinical controls ($n$ = 80), and healthy controls ($n$ = 71) who completed self-report and interview measures. Confirmatory factor analysis (CFA), psychometric indices, group differences, and relations to external measures were used to evaluate the reliability and validity of the RGPTS.

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***Author Note.*** The authors report no conflicts of interest.

**Results:** CFA replicated a two-factor structure for the RGPTS and the associated *Reference* and *Persecution* scales were reliable. CHR individuals scored significantly higher on both *Reference* and *Persecution*, relative to both healthy (*d*s = 1.03, .86) and clinical controls (*d*s = .64, .73). In CHR participants, correlations between *Reference* and *Persecution* and external measures were smaller than expected, though showed evidence of discriminant validity (e.g., interviewer-rated paranoia, $r = .24$). When examined in the full sample, correlation magnitude was larger and follow-up analyses indicated that *Reference* related most specifically to paranoia ($\beta = .32$), whereas *Persecution* uniquely related to poor social functioning ($\beta = -.29$).

**Conclusion:** These results demonstrate the reliability and validity of the RGPTS, though its scales related more weakly to severity in CHR individuals. The RGPTS may be useful in future work aiming to develop symptom-specific models of emerging paranoia in CHR individuals.

### Keywords

paranoia; clinical high risk; psychosis; psychometric; construct validity

## 1. Introduction

The terms suspiciousness, paranoia, and persecutory delusions all capture a spectrum of biased thought processes regarding perceived threat to one's self, distinct from social anxiety in their emphasis on physical or social threat.[1,2] In psychosis spectrum disorders, paranoid delusions are distressing, impairing, and may be related to poor prognosis.[3–6] Individuals at clinical high-risk for psychosis (CHR) experience attenuated positive symptoms, such that the paranoia they experience generally lacks the delusional conviction present in psychosis. Nonetheless, paranoia is common in CHR individuals and predicts development of full psychosis, impaired social functioning, depression, and sleep difficulties within this group.[7–11] Studying paranoia within CHR individuals is important for understanding symptom development, early identification, and intervention; however, this promise is predicated on valid and efficient measurement.

Despite the importance of paranoia as a CHR symptom, research has been limited by existing instruments. In CHR samples, paranoia is primarily measured through structured clinical interviews, which are lengthy, require expertise to administer, and provide a single rating that collapses distinct aspects of paranoia. In contrast, self-report questionnaires are simple and efficient to administer, such that they can be easily used in larger samples, longer batteries, and busy clinical settings. In addition, well-developed self-report measures can provide more perspective and depth (e.g., specificity) on a single symptom. Nonetheless, there is no research on the construct validity of scales measuring paranoia in CHR samples. In particular, it is necessary to show that such measures differentiate CHR individuals from controls, as well as demonstrate a robust factor structure, convergent and discriminant validity, and clinical utility.

The Green Paranoid Thoughts Scale (GPTS) is a commonly used questionnaire assessing paranoia and has underwent considerable research.[2,12] A Revised GPTS (RGPTS) was recently published with the aim of improving the measure's psychometric properties and providing item response theory-based cut-off scores to indicate the severity of paranoia,

using a large sample spanning healthy subjects to those with psychosis and persecutory delusions.[13] This recent study demonstrated a clear two factor structure, supporting the validity of separate scales for ideas of persecution (*Persecution*, others intend to cause one harm) and ideas of reference (*Reference,* neutral events are directed toward or especially significant to oneself). Despite the potential value of the RGPTS, no CHR studies have used this measure and few CHR studies have used the original GPTS.[14,15] Previous studies using the original GPTS found that CHR participants score higher than healthy controls, sometimes in the range of psychotic participants; however, the sample sizes for these comparisons have been small (e.g., $N < 30$) and these studies have failed to account for comorbid disorders in CHR participants.[15,16] This last point regarding comorbid disorders common to CHR individuals is of particular importance, as the continuum of paranoia is thought to overlap with social-evaluative concerns common to many such disorders (depression, anxiety disorders, etc.) and other trauma-related disorders may include non-psychotic paranoia as a symptom.[17,18] Better representing the pre-psychotic continuum of paranoia and evaluating CHR individuals in the context of this continuum, as measured by the RGPTS, is thus an important goal for further research.

Beyond between-group differences, the RGPTS has not been validated in relation to important measures from the CHR literature. A critical measure in this regard is the Structured Interview of Psychosis Risk Syndromes (SIPS),[19] which has an interviewer-rated suspiciousness/paranoia item that captures a continuum of severity; the RGPTS should be at least moderately correlated with this SIPS item and show relatively lower correlations with other SIPS positive symptoms (e.g., hallucinations). Another common measure in the CHR literature is the Global Functioning Scale: Social (GFS-S),[20] which captures broad disruptions to an individual's social functioning, which are expected in individuals with paranoia. Finally, the RGPTS would be expected to correlate with self-report measures commonly used in the CHR literature. In particular, the Prodromal Questionnaire-Brief (PQB) was designed for psychosis-risk research and has a paranoia/thought delusions scale[21,22] that should be correlated with the RGPTS. Notably, instruments such as the SIPS, GFS-S, and PQB not only differentiate CHR individuals and controls, but also are sensitive to symptom severity and psychosis risk within CHR individuals. It is important to understand whether the RGPTS is related to such measures in CHR individuals.

The present study sought to validate the RGPTS in a large sample and to better represent the pre-psychotic continuum of paranoia than previous work, by including a large number of CHR individuals, alongside clinical and healthy controls. As a first step, we examined the reliability and factor structure of the RGPTS in the full sample, predicting that we would replicate the high reliability and two-factor structure from Freeman et al. (2021). Second, we tested differences between groups and examined the distributions of scores, relative to Freeman et al.'s interpretive guidelines. In this regard, we predicted that CHR individuals would have higher RGPTS scores relative to healthy and clinical control groups. Third, we examined the construct validity of the RGPTS in relation to important measures from the CHR literature, including the SIPS, GF-S, and PQB. We predicted that the RGPTS scores would correlate most strongly with scores from delusion measures and that RGPTS *Persecution* scores would be most specifically related to scores from other measures of suspiciousness/paranoia.

# 2. Method

## 2.1 Participants

Participants ($N$ = 254) were recruited across six sites as part of the Computerized Assessment of Psychosis Risk project, a large multi-site study of psychosis risk within the United States of America (see reference for details).[23] Recruitment is ongoing and uses methods such as public transportation advertising, online advertisements, and mail-outs to community health care providers. The present study reflected an early phase of recruitment, occurring during January 2021-February 2022; the study will ultimately enroll 1500 participants. Exclusion criteria for all participants consisted of severe head injury, the presence of a neurological disorder, and lifetime history of a psychotic disorder. Participants were interviewed by trained assessors and recruited into three groups: CHR, healthy controls (HC), and a mixed clinical control group (CLN). The HC group was defined by the absence of psychosis in a 1st degree relative, past/current serious psychopathology (specific phobia and past mild substance use disorder were exceptions), use of current psychotropic medication (e.g., antidepressants), and any history of antipsychotic medication use. The CHR group was defined by the presence of a psychosis risk syndrome. The CLN participants were defined by the absence of a psychosis risk syndrome and not meeting criteria for the HC group (e.g., current psychopathology). At the time of the present study, data were available on 103 CHR, 80 CLN, and 71 HC participants. Demographic are presented in Table 1. The study was approved by the Northwestern University IRB (STU00211351) and all participants provided informed consent.

## 2.2 Clinician-Rated Measures

Participants were interviewed by postdoctoral fellows, graduate students, and research assistants that completed formal training on all assessments. Weekly case conferences were attended by all sites to ensure reliability.

*The Structured Interview of Psychosis Risk Syndromes (SIPS)* is a semi-structured interview designed to assess psychosis risk symptoms (i.e., positive, negative, disorganized, and general symptoms).[19] Positive symptoms are central in identifying the presence of a psychosis risk syndrome and are assessed in five domains: unusual/delusional thoughts, suspiciousness/persecutory ideas, grandiosity, perceptual abnormalities, and disorganized communication. The SIPS was used to determine the presence of the following psychosis risk syndromes: brief intermittent psychosis syndrome, attenuated positive symptom syndrome, and genetic risk and functional decline. Individual positive symptom ratings were also used as indicators of convergent (e.g., suspiciousness/persecutory ideas) and discriminant validity (e.g., perceptual abnormalities).

*The Structured Clinical Interview for DSM-5, Research Version (SCID)*[24] was used to determine the presence of other mental disorders. Modules for psychotic, bipolar, depressive, anxiety, obsessive-compulsive, trauma-related, eating, and substance use disorders were administered to all participants. SCID diagnoses are summarized in Table 1 in terms of current internalizing disorders (depressive, anxiety, trauma-related, and eating disorders) and externalizing disorders (substance use and attention deficit hyperactivity

disorders). In the present study, the SCID-5 was used only to determine participant inclusion status and provide descriptive information.

*The Global Functioning Scale: Social and Role, Current (GFS-S/R)*[20] separately measures overall social and role functioning at the time of the interview. Both ratings use a 10-point Likert scale ranging from extreme dysfunction/isolation (1) to superior functioning (10). For both ratings, interviewers use question prompts to obtain information about relationships, social satisfaction, interaction initiation, employment, school grades, household task management, and feedback from others on their performance.

## 2.3 Self-Report Questionnaires

*The Revised Green Paranoid Thoughts Scale (RGPTS)* is a freely available questionnaire contains 18-items, reflecting a revision of the original 32-item instrument, which contained a number of problematic items (high cross-loadings, poor wording, etc.).[2,13] This measure consists of two scales, Part A – Ideas of Reference (8 items) and Part B – Ideas of Persecution (10 items); for simplicity, these scales are referred to as “Reference” and “Persecution” for the remainder of this article. These items are rated based on the past month on a 0 (“Not at all”) to 4 (“Totally”) Likert scale. Freeman and colleagues (2021)[13] validated the structure of the RGPTS in a clinical-community sample and provided item response theory-based cut-off scores for clinical interpretation. Notably, this sample included individuals with psychosis and a subset with persecutory delusions, though no individuals with identified psychosis risk syndromes (i.e., CHR) were included. The present study examines the psychometric properties and construct validity of the RGPTS.

*The Prodromal Questionnaire Brief (PQB)* is a 21-item, abbreviated version of the full Prodromal Questionnaire.[22,25] The abbreviated version includes items that were aligned with the SIPS and not over-endorsed in undergraduates. Participants rate each item based on the past month and to exclude the influence of alcohol, drugs, or medications. The presence of each symptom is responded to in a Yes/No format and, if present, participants rate the symptom-related distress related on a 5-point Likert-type scale. A recent factor analytic study identified three factors that were used to score the following scales in the present study: perceptual abnormalities (6 items), grandiose/unusual ability delusions (3 items), and a paranoia/thought delusions scale (4 items).[21] Notably, this latter scale includes a mixture of unusual thoughts that include persecution, ideas of reference, and unreality. The PQB was used to examine the convergent and discriminant validity of the RGPTS.

## 2.4 Statistical Analyses

All analyses were performed in RStudio 4.0.2 (RStudio Team, 2020), using the tidyverse, psych, and ggplot2 packages.[26–28] A confirmatory factor analysis (CFA) was conducted on the full sample (i.e., includes CHR, CLN, HC) to replicate previous findings on the RGPTS. A two-factor model was specified in which items for Parts A (Reference) and B (Persecution) loaded on separate, but correlated factors. The CFA was estimated using a maximum likelihood estimator. Model fit was evaluated using the chi-square ($\chi^2$) test, root mean square error of approximation (RMSEA; ≤ .06 is good, > .10 is poor), Comparative Fit Index (CFI; ≥ .95 is good, ≥ .90 is acceptable), and Standardized Root Mean Square

Residual (SRMR; ≤ .08 is good).[29] Following this, internal consistency and omega were computed to estimate internal consistency.

To examine construct validity, we tested group differences with an analysis of variance (ANOVA) to determine whether the RGPTS was sensitive to group differences in psychosis risk. Relatedly, we examined the distribution of participants within the severity groupings.

Finally, correlations between scales were examined using Pearson's *r* correlation. Correlations were estimated for within the CHR sample and within the full sample, as full sample correlations estimate the full continuum of paranoid thought and correlations within the CHR sample may speak to the utility of the measure in at-risk individuals.

## 3. Results

There were no significant differences among groups on demographic variables, with the exception being the proportion of the sample identifying as Hispanic or Latino. Nonetheless, *t*-tests indicated that whether a participant identified as Hispanic or Latino was unrelated to levels of paranoia (*p*s > .05). In terms of diagnostic characteristics, CHR and CLN groups did not differ in internalizing diagnoses present ($\chi^2$[1] = 1.33, p = .25), but did differ in the proportion of externalizing diagnoses present ($\chi^2$[1] = 8.55, p < .01). Within externalizing disorders, no subcategory of disorders showed differences across groups (substance use, 19% vs. 9%, $\chi^2$[1] = 3.27, p = .07; ADHD, 21% vs. 10%, $\chi^2$[1] = 3.45, p = .06). Given the small magnitude of the difference and the fact that these diagnoses are less clearly linked to paranoia, they were not considered in the remainder of analyses.

### 3.1 Structure and Reliability Results

A CFA was conducted in the full sample (*N* = 254). The hypothesized 2-factor model fit adequately ($\chi^2$[134]=422.29, p < .001; CFI=.91, RMSEA=.09; SRMR=.06) and all indicators had significant loadings on their intended factors (all standardized loadings > .50, *p* < .001; see Supplemental Table 1 for all factor loadings). A correlation of .69 between scores from the RGPTS-A (Reference) and RGPTS-B (Persecution) scales was observed. Both scales had good internal consistency (e.g., alpha > .80, Omega General > .70). Descriptive statistics for the scales and all primary study variables are provided in Table 2.

As a follow-up analysis, the CFA was repeated in only CHR participants (*n*=103), producing similar though slightly poorer model fit (e.g., CFI=.89, RMSEA=.11, SRMR=.07). An exploratory factor analysis demonstrated that one *Reference* scale item loaded more strongly on the *Persecution* factor. Given the smaller sample size and potential range restriction, this is a relatively minor deviation in factor structure. Further information on these follow-up analyses are provided in the Supplement to this article.

### 3.2 Group Differences and Scoring Distribution

ANOVAs and post-hoc tests indicated that CHR individuals had significantly higher scores on both Reference (*F*[2, 251]=24.75, *p* < .001) and Persecution scales (*F*[2, 251]=22.07, *p* < .001). Post-hoc tests indicated CHR participants had significantly elevated scores on both

Reference (HC $d$=1.03, CLN $d$=0.64) and Persecution (HC $d$=0.86, CLN $d$=0.73), compared to the two other groups. No differences were found between CLN and HC groups on either of these scales. To further explore these group differences and understand symptom severity, the RGPTS scoring cut-offs were used to categorize individuals (see Figure 1). Consistent with the ANOVA results, approximately half of CHR individuals had elevated scores on one or both of the RGPTS scales. Furthermore, a number of CHR individuals had relatively severe scores. In contrast, for both HC and CLN groups, most individuals were in the average range for these scales and very few reported ideas of reference or persecution in the "severe" range.

### 3.3 Validity Correlations

The external correlates of the RGPTS scores were examined in both the full sample and within the CHR group (see Table 3). The correlations within the CHR group represent the ability of the scales to measure individual differences within individuals with attenuated positive symptoms, whereas the full sample correlations reflect the ability of the scales to measure individual differences within the population.

Within the CHR group, the RGPTS Reference scale most strongly correlated with the PQB paranoia/thought delusion scale ($r$=.46), but also correlated significantly with the hallucinations and total scales. The Reference scale's only significant correlation was with the SIPS Suspiciousness (P2) rating ($r$=.24). The RGPTS Persecution scale was significantly correlated with all PQB scales, within the PQB group, with its strongest correlation being with the total score ($r$=.41) and showing similar correlations with the PQB paranoia/thought delusion ($r$=.37) and hallucinations scales ($r$=.36). Interestingly, RGPTS Persecution scores correlated only with Unusual Thought Content scores from the SIPS (P1; $r$=.23). Neither RGPTS scale correlated with social functioning ratings within the CHR group.

In the full sample, correlations between the RGPTS and other scales tended to be larger (i.e., $M$ $r$=.33 [full] vs. 18 [CHR]). The Reference scale continued to correlate most strongly with the PQB paranoia/thought delusion scale ($r$=.56) and the Persecution scale continued to correlate most strongly with the PQB total scale ($r$=.52). On the SIPS, within the full sample, both the RGPTS scales showed similar correlations ($r$s=.32-.41) with the SIPS total, Unusual Thought Content rating (P1), and Suspiciousness rating (P2), whereas weaker but significant correlations ($r$s=.23-.25) with perceptual abnormalities (P4) and disorganized communication (P5). Finally, in the full sample, Persecution was significantly related to worse social ($r$=−.26) and role functioning ($r$=−.25).

### 3.4 Follow-Up Validity Analyses

Given the overlap between the RGPTS Reference and Persecution scales (e.g., latent $r$=.69), we examined the unique associations between these scales and external variables that there were a priori hypotheses concerning (e.g., see underlined correlations, Table 3). Specifically, we conducted multiple regression analyses in the full sample, with both RGPTS scales entered as independent variables, thus controlling for their overlap.

The specific dependent variables of interest were the PQB paranoia/thought delusions scale, the SIPS unusual thought (P1) and suspiciousness (P2) ratings, and social functioning

(GF-S). For the PQB paranoia/thought delusions scale ($R^2$=.32), the Reference scale showed the strongest unique association ($\beta$=.43, $p < .001$), though the Persecution also accounted for unique variance in this PQB scale ($\beta$=.18, $p < .05$). For the SIPS unusual thought rating ($R^2$=.18), both scales had similar unique associations (Reference, $\beta$=.20, $p < .05$; Persecution, $\beta$=.27, $p < .001$). For the SIPS suspiciousness rating ($R^2$=.15), only Reference had a significant unique association ($\beta$=.32, $p < .001$). Finally, for the GF-S ($R^2$=.05), only the Persecution scale had a significant unique association ($\beta$=−.29, $p < .001$).

## 4. Discussion

Paranoia is an important psychotic symptom that exists on a continuum. The RGPTS is one of the best-researched measures of paranoia[12] and this is the first study to validate this measure in a CHR sample. The RGPTS was found to be reliable and was elevated in CHR individuals relative to not only healthy controls, but also clinical controls. Additionally, the RGPTS correlated with interview and self-report measures of paranoia, delusional thought, and social functioning. Interestingly, the RGPTS subscales of Reference and Persecution diverged in terms of their specific correlates, which may have implications for the use of this measure going forward.

### 4.1 Reliability and Validity

Previously, Freeman and colleagues reviewed and revised the GPTS, into the RGPTS and also provided interpretive cut-offs for understanding paranoia severity.[13] Nonetheless, no previous study had attempted to validate the RGPTS (or GPTS) in a CHR sample. CHR individuals are important for understanding symptom development and measures in the CHR literature are uniquely suited to assessing symptom severity, consistent with the goals of the RGPTS.[30] The present study demonstrated that RGPTS provides a reliable and valid measure of paranoia in a mixed sample that included a large number of CHR individuals.

Specifically, as hypothesized, we replicated the two-factor structure of the RGPTS and the reliability of its scales, also demonstrating that these scales are sensitive to the emerging, attenuated psychotic symptoms present in CHR individuals. CHR individuals scored higher than healthy and clinical controls on both RGPTS scales. In particular, the clinical control group included individuals with a number of diagnoses with symptoms and social dysfunction that overlap with paranoia in some ways (social anxiety disorder, post traumatic stress disorder, etc.). Thus finding that CHR individuals scored more highly than individuals with such comorbid disorders is an important demonstration of the RGPTS's ability to measure a severity continuum. Further underscoring this point, it was evident that CHR individuals had a greater distribution of severity on the RGPTS, suggesting that the measure has good variability in this population.

Finally, validity correlations indicated that, in the CHR sample, RGPTS Reference and Persecution scale scores were specifically related to SIPS-rated suspiciousness and unusual thought, respectively. This suggests that these scales do capture differences in severity for relevant attenuated delusions, capturing degrees of severity within CHR individuals. Nonetheless, correlations with the SIPS were relatively small within CHR individuals and larger effects were more evident when examining the full sample, which included

healthy controls, clinical controls, and CHR individuals. This is consistent with the RGPTS capturing a continuum of paranoid thought.[13] Notably, when considered in the full sample, RGPTS Persecution was related to interviewer-assessed social and role functioning deficits, indicating that this measure may be relevant for predicting functional outcomes.

### 4.2 Implications for Symptom-Specific Measurement

The present study was partly motivated by the success of symptom-specific research in psychosis.[31] Advances have been made by separately studying hallucinations,[32] anhedonia,[33] and motor symptoms,[34] beyond what has been achieved in diagnosis-centered research. Being able to measure paranoia specifically, offers opportunities to develop models for this symptom.[35] The present study indicates that the RGPTS may be useful in such work, though findings regarding the measure's specific convergent and discriminant validity are complex. Based on relations to the SIPS and PQB, it would appear that the RGPTS Reference and Persecution scales are strongly related to delusional thought tendencies, in general (e.g., including paranoia), with some evidence that the Reference scale may have somewhat better specificity with regard to measuring paranoia and the Persecution scale has stronger relations to functional deficits.

The findings that Reference scores relate more specifically to paranoia ratings than Persecution ratings are contrary to predictions; however, this may make sense when interpreted within a broader perspective on paranoia. In Freeman et al. (2005)'s model of paranoia, ideas of reference are conceptualized as part of the paranoia continuum, such that they may serve as precursor to more distinctly persecutory delusions.[18] Relatedly, it may be that some referential thought patterns are more closely tied to paranoia than others. Previous work has identified two dimensions of referential thinking: a communication dimension (double meanings, television ads, etc.) that is less related to persecutory thinking and delusions, and an observation dimension (surveillance, gossip, etc.) that is strongly related to persecution and delusions.[36] The RGPTS Reference scale emphasizes the observation aspect more strongly, with 4 of the 8 items related to hearing others talk about oneself (e.g., gossip), another item focused on others' criticism, and the remaining items pertaining to potential unusual behavior in others (e.g., "avoiding me"). Notably, the SIPS suspiciousness item incorporates ideas of reference in interviewer prompts (e.g., whether others are thinking about the individual in a negative way). It may be that the RGPTS Reference scale accounts for important precursors of paranoia of particular relevance to CHR individuals.

### 4.3 Future Directions, Limitations, and Conclusions

The present study benefits from a multimethod assessment strategy and large sample of CHR individuals; however, several factors limit the conclusions of this study. First, the present study was cross-sectional and therefore cannot speak to the development of paranoia across time (e.g., into psychosis). Future studies should examine the value of the RGPTS for predicting the progression of paranoia in CHR individuals and eventual conversion to full psychosis. Relatedly, research comparing CHR individuals to those with full psychosis may provide further information on the sensitivity of the RGPTS. Second, to truly identify the value of the RGPTS for symptom-specific research, it would be beneficial to examine both RGPTS scales in relation to behavioral tasks and neural processes that have previously been

identified as relevant to paranoia (e.g., perceptions of environmental volatility).[35] Third, although the RGPTS showed convergent and discriminant validity within CHR individuals, correlations between the SIPS and RGPTS were smaller than expected. Interestingly, these correlations were much larger in the full, combined sample, suggesting range restriction may be one factor that decreased correlation magnitude, as the full sample included more participants without paranoia or with very low severity of paranoia. Additionally, self-reports are only one assessment method and they have their limitations (e.g., participants may lack insight); combining multiple methods of assessment (self-report, interview, task, etc.) will ultimately provide the most valid assessment of paranoia. Nonetheless, the present study provides the first evidence that the RGPTS has sound psychometric properties in a CHR sample and that it may be useful for capturing clinically relevant levels of paranoia and delusional thought processes in this population.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

## Acknowledgments

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## Data Availability Statement.

Data are freely available and updated three times per year and uploaded to the National Institute of Mental Health Data Archive (https://nda.nih.gov/).

## References

1. Bentall RP, Corcoran R, Howard R, Blackwood N, Kinderman P. PERSECUTORY DELUSIONS: A REVIEW AND THEORETICAL INTEGRATION. Clin Psychol Rev. 2001;21(8):1143–1192. doi:10.1016/S0272-7358(01)00106-4 [PubMed: 11702511]
2. Green CEL, Freeman D, Kuipers E, et al. Measuring ideas of persecution and social reference: the Green et al. Paranoid Thought Scales (GPTS). Psychol Med. 2008;38(1):101–111. doi:10.1017/S0033291707001638 [PubMed: 17903336]
3. Bergstein M, Weizman A, Solomon Z. Sense of coherence among delusional patients: prediction of remission and risk of relapse. Compr Psychiatry. 2008;49(3):288–296. doi:10.1016/j.comppsych.2007.06.011 [PubMed: 18396189]
4. Keers R, Ullrich S, DeStavola BL, Coid JW. Association of Violence With Emergence of Persecutory Delusions in Untreated Schizophrenia. Am J Psychiatry. 2014;171(3):332–339. doi:10.1176/appi.ajp.2013.13010134 [PubMed: 24220644]
5. Pinkham AE, Harvey PD, Penn DL. Paranoid individuals with schizophrenia show greater social cognitive bias and worse social functioning than non-paranoid individuals with schizophrenia. Schizophr Res Cogn. 2016;3:33–38. doi:10.1016/j.scog.2015.11.002 [PubMed: 27990352]
6. Startup H, Freeman D, Garety PA. Persecutory delusions and catastrophic worry in psychosis: Developing the understanding of delusion distress and persistence. Behav Res Ther. 2007;45(3):523–537. doi:10.1016/j.brat.2006.04.006 [PubMed: 16782048]
7. Calkins ME, Woods SW, Bearden CE, et al. Concordance and factor structure of subthreshold positive symptoms in youth at clinical high risk for psychosis. Schizophr Res. 2021;227:72–77. doi:10.1016/j.schres.2020.08.014 [PubMed: 32943313]

8. Cannon TD, Yu C, Addington J, et al. An Individualized Risk Calculator for Research in Prodromal Psychosis. Am J Psychiatry. 2016;173(10):980–988. doi:10.1176/appi.ajp.2016.15070890 [PubMed: 27363508]
9. Combs DR, Finn JA, Wohlfahrt W, Penn DL, Basso MR. Social cognition and social functioning in nonclinical paranoia. Cognit Neuropsychiatry. 2013;18(6):531–548. doi:10.1080/13546805.2013.766595 [PubMed: 23445398]
10. Goines KB, LoPilato AM, Addington J, et al. Sleep problems and attenuated psychotic symptoms in youth at clinical high-risk for psychosis. Psychiatry Res. 2019;282:112492. doi:10.1016/j.psychres.2019.112492 [PubMed: 31387769]
11. Hajdúk M, Klein HS, Harvey PD, Penn DL, Pinkham AE. Paranoia and interpersonal functioning across the continuum from healthy to pathological - Network analysis. Br J Clin Psychol. 2019;58(1):19–34. doi:10.1111/bjc.12199 [PubMed: 30028025]
12. Statham V, Emerson LM, Rowse G. A systematic review of self-report measures of paranoia. Psychol Assess. 2019;31(2):139–158. doi:10.1037/pas0000645 [PubMed: 30234319]
13. Freeman D, Loe BS, Kingdon D, et al. The revised Green et al., Paranoid Thoughts Scale (R-GPTS): Psychometric properties, severity ranges, and clinical cut-offs. Psychol Med. 2021;51(2):244–253. doi:10.1017/S0033291719003155 [PubMed: 31744588]
14. Appiah-Kusi E, Fisher HL, Petros N, et al. Do cognitive schema mediate the association between childhood trauma and being at ultra-high risk for psychosis? J Psychiatr Res. 2017;88:89–96. doi:10.1016/j.jpsychires.2017.01.003 [PubMed: 28103519]
15. Yiend J, Allen P, Lopez ND, Falkenberg I, Tseng HH, McGuire P. Negative Interpretation Biases Precede the Onset of Psychosis. Behav Ther. 2019;50(4):718–731. doi:10.1016/j.beth.2018.11.002 [PubMed: 31208682]
16. Palmier-Claus J, Berry K, Darrell-Berry H, et al. Childhood adversity and social functioning in psychosis: Exploring clinical and cognitive mediators. Psychiatry Res. 2016;238:25–32. doi:10.1016/j.psychres.2016.02.004 [PubMed: 27086207]
17. Addington J, Piskulic D, Liu L, et al. Comorbid diagnoses for youth at clinical high risk of psychosis. Schizophr Res. 2017;190:90–95. doi:10.1016/j.schres.2017.03.043 [PubMed: 28372906]
18. Freeman D, Garety PA, Bebbington PE, et al. Psychological investigation of the structure of paranoia in a non-clinical population. Br J Psychiatry. 2005;186(5):427–435. doi:10.1192/bjp.186.5.427 [PubMed: 15863749]
19. McGlashan T, Walsh B, Woods S. The Psychosis-Risk Syndrome: Handbook for Diagnosis and Follow-Up. Oxford University Press, USA; 2010.
20. Carrión RE, Auther AM, McLaughlin D, et al. The Global Functioning: Social and Role Scales—Further Validation in a Large Sample of Adolescents and Young Adults at Clinical High Risk for Psychosis. Schizophr Bull. 2019;45(4):763–772. doi:10.1093/schbul/sby126 [PubMed: 30351423]
21. Azis M, Rouhakhtar PR, Schiffman JE, Ellman LM, Strauss GP, Mittal VA. Structure of positive psychotic symptoms in individuals at clinical high risk for psychosis. Early Interv Psychiatry. 2021;15(3):505–512. doi:10.1111/eip.12969 [PubMed: 32337849]
22. Loewy RL, Pearson R, Vinogradov S, Bearden CE, Cannon TD. Psychosis risk screening with the Prodromal Questionnaire — Brief Version (PQ-B). Schizophr Res. 2011;129(1):42–46. doi:10.1016/j.schres.2011.03.029 [PubMed: 21511440]
23. Mittal VA, Ellman LM, Strauss GP, et al. Computerized Assessment of Psychosis Risk. J Psychiatry Brain Sci. 2021;6(3):e210011. doi:10.20900/jpbs.20210011
24. First MB, Williams JB, Karg RS, Spitzer RL. Structured Clinical Interview for DSM-5—Research Version (SCID-5 for DSM-5, Research Version; SCID-5-RV). American Psychiatric Association; 2015.
25. Loewy RL, Bearden CE, Johnson JK, Raine A, Cannon TD. The prodromal questionnaire (PQ): Preliminary validation of a self-report screening measure for prodromal and psychotic syndromes. Schizophr Res. 2005;79(1):117–125. doi:10.1016/j.schres.2005.03.007 [PubMed: 16276559]
26. Wickham H Ggplot2: Elegant Graphics for Data Analysis. Springer-Verlag; 2009.
27. Wickham H, Averick M, Bryan J, et al. Welcome to the Tidyverse. J Open Source Softw. 2019;4(43):1686. doi:10.21105/joss.01686

28. Revelle W Psych: Procedures for personality and psychological research. Published online 2017.
29. Hu LT, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. Struct Equ Model. 1999;6(1):1–55. doi:10.1080/10705519909540118
30. Walker EF, Trotman HD, Goulding SM, et al. Developmental mechanisms in the prodrome to psychosis. Dev Psychopathol. 2013;25(4pt2):1585–1600. doi:10.1017/S0954579413000783 [PubMed: 24342857]
31. Gold JM, Corlett PR, Strauss GP, et al. Enhancing Psychosis Risk Prediction Through Computational Cognitive Neuroscience. Schizophr Bull. Published online July 10, 2020:sbaa091. doi:10.1093/schbul/sbaa091
32. Alderson-Day B, Lima CF, Evans S, et al. Distinct processing of ambiguous speech in people with non-clinical auditory verbal hallucinations. Brain. 2017;140(9):2475–2489. doi:10.1093/brain/awx206 [PubMed: 29050393]
33. Strauss GP, Frank MJ, Waltz JA, Kasanova Z, Herbener ES, Gold JM. Deficits in Positive Reinforcement Learning and Uncertainty-Driven Exploration Are Associated with Distinct Aspects of Negative Symptoms in Schizophrenia. Biol Psychiatry. 2011;69(5):424–431. doi:10.1016/j.biopsych.2010.10.015 [PubMed: 21168124]
34. Mittal VA, Bernard JA, Northoff G. What Can Different Motor Circuits Tell Us About Psychosis? An RDoC Perspective. Schizophr Bull. 2017;43(5):949–955. doi:10.1093/schbul/sbx087 [PubMed: 28911048]
35. Sheffield JM, Suthaharan P, Leptourgos P, Corlett PR. Belief Updating and Paranoia in Individuals With Schizophrenia. Biol Psychiatry Cogn Neurosci Neuroimaging. Published online April 14, 2022. doi:10.1016/j.bpsc.2022.03.013
36. Startup M, Startup S. On two kinds of delusion of reference. Psychiatry Res. 2005;137(1):87–92. doi:10.1016/j.psychres.2005.07.007 [PubMed: 16226316]

### Significant Outcomes

- This is the first evidence that the RGPTS is reliable, valid, and captures significant variation along a severity continuum that includes individuals at clinical high risk for psychosis.
- Distinct aspects of paranoia may have unique value in this population, with ideas of reference (e.g., others are gossiping) more strongly capturing subtle paranoia and ideas of persecution (e.g., someone wishes me harm) relating more strongly to functional impairment.

**Limitations**

- The present study was cross-sectional and thus cannot be used to evaluate the ability of the RGPTS to predict increases in paranoia or psychosis spectrum disorders.
- Behavioral task and neuroimaging data were not included in the present study, which may provide more information on the relation of the RGPTS to symptom-specific mechanisms identified in previous work.

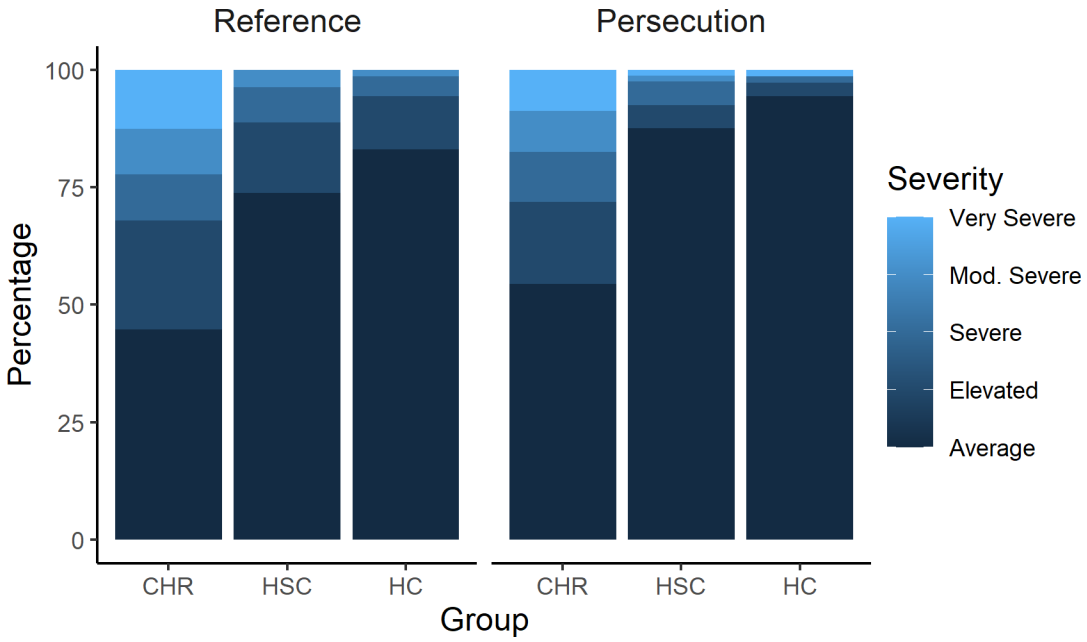


**Figure 1.**

Distribution of scores for the RGPTS *Reference* and *Persecution* scales, based on Freeman et al.'s (2021) severity cut-offs.

**Table 1.**

Sample demographics

| | CHR (*n* = 103) | CLN (*n* = 80) | HC (*n* = 71) |
|---|---|---|---|
| Age *M* (*SD*) | 23.09 (4.30) | 23.69 (4.05) | 23.40 (4.17) |
| Sex (% Female) | 69.90% | 75.00% | 66.19% |
| Race (%) | | | |
| White or Caucasian | 53.40% | 51.25% | 52.11% |
| Asian | 17.48% | 23.75% | 23.94% |
| Black or African American | 13.59% | 13.75% | 16.90% |
| Multiracial | 11.65% | 8.75% | 7.04% |
| Hispanic or Latino (%) | 21.36% | 12.50% | 4.22% |
| Household Income *Mdn* | $60,000 | $70,000 | $100,000 |
| *SCID* Diagnoses | | | |
| Internalizing | 72.81% | 63.75% | 1.41% |
| Externalizing | 36.89% | 16.25% | 2.82% |

*Note*. Participants were allowed to check more than one category under race, resulting in the Multiracial category. Internalizing disorders include depressive, anxiety, trauma-related, and eating disorders. Externalizing disorders include substance use and attention deficits hyperactivity disorders.

**Table 2.**

Descriptive statistics by inclusion group

| | *n* | M | SD | Mdn | Min | Max |
|---|---|---|---|---|---|---|
| *Clinical High Risk (CHR)* | | | | | | |
| RGPTS-A: Reference | 103 | 11.83 | 8.87 | 11 | 0 | 29 |
| RGPTS-B: Persecution | 103 | 8.17 | 9.88 | 4 | 0 | 36 |
| SIPS Positive Total | 103 | 10.68 | 3.34 | 11 | 4 | 19 |
| Unusual Thought (P1) | 103 | 3.19 | 1.25 | 4 | 0 | 5 |
| Suspiciousness (P2) | 103 | 2.28 | 1.39 | 2 | 0 | 5 |
| Grandiose Ideas (P3) | 103 | 0.98 | 1.16 | 1 | 0 | 5 |
| Perceptual Abnormalities (P4) | 103 | 2.65 | 1.30 | 3 | 0 | 5 |
| Disorganized Comm. (P5) | 103 | 1.57 | 1.26 | 1 | 0 | 5 |
| GF-Social | 103 | 7.30 | 1.33 | 7 | 3 | 10 |
| GF-Role | 103 | 7.62 | 1.47 | 8 | 1 | 10 |
| PQB Total | 103 | 7.19 | 4.39 | 6 | 0 | 17 |
| Grandiose | 103 | 0.71 | 0.87 | 0 | 0 | 3 |
| Paranoia/Thought | 103 | 2.29 | 1.35 | 2 | 0 | 4 |
| Hallucinations | 103 | 2.18 | 1.79 | 2 | 0 | 6 |
| *Mixed Clinical Controls (CLN)* | | | | | | |
| RGPTS-A: Reference | 80 | 6.91 | 6.16 | 6 | 0 | 24 |
| RGPTS-B: Persecution | 80 | 2.51 | 4.83 | 1 | 0 | 28 |
| SIPS Positive Total | 80 | 3.81 | 2.73 | 4 | 0 | 10 |
| Unusual Thought (P1) | 80 | 1.25 | 1.06 | 1 | 0 | 4 |
| Suspiciousness (P2) | 80 | 0.86 | 0.98 | 1 | 0 | 4 |
| Grandiose Ideas (P3) | 80 | 0.24 | 0.53 | 0 | 0 | 2 |
| Perceptual Abnormalities (P4) | 80 | 0.78 | 0.83 | 1 | 0 | 3 |
| Disorganized Comm. (P5) | 80 | 0.69 | 0.72 | 1 | 0 | 2 |
| GF-Social | 80 | 7.88 | 1.24 | 8 | 3 | 10 |
| GF-Role | 80 | 8.39 | 1.14 | 8 | 2 | 10 |
| PQB Total | 80 | 2.65 | 2.54 | 2 | 0 | 10 |
| Grandiose | 80 | 0.17 | 0.52 | 0 | 0 | 3 |
| Paranoia/Thought | 80 | 1.01 | 1.11 | 1 | 0 | 4 |
| Hallucinations | 80 | 0.69 | 0.96 | 0 | 0 | 4 |
| *Healthy Controls (HC)* | | | | | | |
| RGPTS-A: Reference | 71 | 4.39 | 4.96 | 3 | 0 | 21 |
| RGPTS-B: Persecution | 71 | 1.61 | 4.26 | 0 | 0 | 31 |
| SIPS Positive Total | 71 | 2.61 | 2.38 | 2 | 0 | 9 |
| Unusual Thought (P1) | 71 | 0.83 | 0.79 | 1 | 0 | 2 |
| Suspiciousness (P2) | 71 | 0.46 | 0.63 | 0 | 0 | 2 |
| Grandiose Ideas (P3) | 71 | 0.30 | 0.60 | 0 | 0 | 2 |
| Perceptual Abnormalities (P4) | 71 | 0.58 | 0.73 | 0 | 0 | 2 |
| Disorganized Comm. (P5) | 71 | 0.44 | 0.63 | 0 | 0 | 2 |

| | *n* | M | SD | Mdn | Min | Max |
|---|---|---|---|---|---|---|
| GF-Social | 71 | 8.52 | 1.09 | 9 | 4 | 10 |
| GF-Role | 71 | 8.99 | 1.18 | 9 | 1 | 10 |
| PQB Total | 71 | 1.45 | 1.78 | 1 | 0 | 7 |
| Grandiose | 71 | 0.18 | 0.42 | 0 | 0 | 2 |
| Paranoia/Thought | 71 | 0.41 | 0.65 | 0 | 0 | 2 |
| Hallucinations | 71 | 0.51 | 0.83 | 0 | 0 | 3 |

*Note.* RGPTS = revised Green Paranoid Thoughts Scale, PQB = Prodromal Questionnaire Brief, and GF = Global Functioning scale.

**Table 3.**

Validity correlations

| | CHR Group | | Full Sample | |
|---|---|---|---|---|
| | **Reference** | **Persecution** | **Reference** | **Persecution** |
| PQB Total | **.37** | **.41** | **.52** | **.52** |
| Grandiose | .19 | **.25** | **.30** | **.36** |
| Paranoia/Thought | **.46** | **.37** | **.56** | **.48** |
| Hallucinations | **.28** | **.36** | **.41** | **.45** |
| SIPS Positive total | .04 | .14 | **.38** | **.39** |
| Unusual Thought (P1) | .09 | **.23** | **.39** | **.41** |
| Suspiciousness (P2) | **.24** | .14 | **.39** | **.32** |
| Grandiose Ideas (P3) | −.10 | −.03 | .11 | .14 |
| Perceptual Abnormal. (P4) | −.18 | −.08 | **.23** | **.25** |
| Disorganized Comm. (P5) | .02 | .10 | **.24** | **.25** |
| GF-Social | .04 | −.10 | −.16 | **−.26** |
| GF-Role | −.02 | −.11 | −.17 | **−.25** |

*Note*. CHR only correlations $n = 103$ and full sample correlations $N = 254$. Predicted convergent correlations are underlined and correlations ≥ .20 are in bold. In CHR group, correlations ≥ .20 are significant ($p < .05$); in the full sample, correlations ≥ .13 are significant ($p < .05$).