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## Do paranoid delusions exist on a continuum with subclinical paranoia? A multi-method taxometric study

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### ABSTRACT

**Background:** There is widespread interest in whether psychosis exists on a continuum with healthy functioning. Previous research has implied that paranoia, a common symptom of psychosis, exists on a continuum but this has not been investigated using samples including both patients and non-patients and up-to-date taxometric methods.

**Aim:** To assess the latent structure of paranoia in a diverse sample using taxometric methods.

**Method:** We obtained data from 2836 participants, including the general population as well as at-risk mental state and psychotic patients using the P-scale of the Paranoia and Deservedness Scale. Data were analysed using three taxometric procedures, MAMBAC, MAXEIG and L-MODE (Ruscio, 2016), and two sets of paranoia indicators (subscales and selected items from the P scale), including and excluding the patient groups.

**Results:** Eleven of the twelve analyses supported a dimensional model. Using the full sample and subscales as indicators, the MAMBAC analysis was ambiguous. Overall, the findings converged on a dimensional latent structure.

**Conclusions:** A dimensional latent structure of paranoia implies that the processes involved in sub-clinical paranoia may be similar to those in clinical paranoia.

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### 1. Introduction

There is debate about whether psychotic symptoms lie on a continuum with less severe psychotic-like experiences, which are widespread in the general population (Lawrie et al., 2010). This debate has focused on the distinction between psychosis and schizotypal traits (Lenzenweger, 2010), with less attention being paid to specific symptoms.

Paranoid (persecutory) beliefs are the most common type of delusion, experienced by approximately 90% of first episode schizophrenia-spectrum patients. In a general population sample, Freeman et al. (2005) reported that paranoid beliefs occur on a hierarchy of severity, with rare and severe paranoid delusions building upon much more common forms of suspiciousness. Using latent class analysis and factor mixture modelling, they later found evidence of a paranoia continuum

with four underlying components: interpersonal sensitivity, mistrust, ideas of reference and ideas of persecution (Bebbington et al., 2013).

Taxometric methods, developed by Meehl (1995) are specifically designed to test for discontinuities in a spectrum of psychopathology. These procedures have been strengthened with new interpretational strategies that rely on quantitative indexes and researchers now use multiple analyses to interrogate a dataset (Ruscio et al., 2006). The methods have been used to study whether schizotypy is a dimensional construct, with mixed results (e.g. Rawlings et al., 2008; Lenzenweger, 2010). A systematic review reported that, with the exception of studies of alcoholism and addictions, most high-quality taxometric analyses, including those of schizotypy, have found continua between healthy functioning and mental illness (Haslam et al., 2012). It is possible that one source of ambiguity in the schizotypy findings has been the focus on a broad diagnostic concept, rather than specific symptoms. To our knowledge, no taxometric studies of paranoia have been reported. We therefore conducted taxometric analyses on data collected using a large population sample as well as patients with psychosis or with an at-risk mental state (ARMS; Yung et al., 2005).

The data was compiled from published and unpublished studies conducted over a seven-year period (2008 to 2015). Analyses were

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carried out on scores on the Persecution and Deservedness Scale (PaDS; Melo et al., 2009), a questionnaire designed to assess clinical and sub-clinical paranoia, which includes separate scales measuring beliefs about persecution (P) and beliefs about whether persecution is deserved (D). Only the former is suitable for taxometric analyses because many deservedness items were not designed to measure strength of paranoid conviction and many responses were missing by design (participants complete a deservedness item only if scoring above a threshold of 2 on a corresponding persecution item).

## 2. Methods

### 2.1. Participants

Data was obtained from studies that included 2874 participants who had been asked to complete the PaDS, consisting of 2357 participants from the general population (2157 were students), 157 participants with an at-risk mental state (ARMS) for psychosis and 360 patients with schizophrenia-spectrum diagnoses. Of these, 38 participants (20 students, 2 non-student controls, and 16 clinical patients, 1.3% of the total) did not provide complete PaDS data, so our final sample size was 2836. Participants with missing data did not differ on age or gender compared to those with complete data when the entire data set or individual groups were considered.

Student participants were recruited via cross-sectional studies conducted at Bangor, Lancaster, Liverpool and Manchester Universities: Pickering et al. (2008), Melo et al. (2009), Udachina et al. (2009) and Varese et al. (2011, 2012) and unpublished studies conducted for PhD qualifications by F. Varese and A. Udachina at Bangor University (both awarded 2012). The paranoia measures were completed online or in face-to-face interviews. Responses were mostly not anonymous and participants received course credits for completing the questionnaire; however, data was anonymised during the compilation of the present dataset.

Patients with schizophrenia-spectrum disorders were recruited through a series of cross-sectional and case-control studies, along with the non-student healthy controls. These studies were Varese et al. (2011, 2012), Morrison et al. (2013), Sellwood et al. (2013), Udachina et al. (2014) and Wickham et al. (2015) as well as unpublished studies conducted by K. Sitko and M. Haarmans while undertaking PhDs at Liverpool University (both awarded 2016). Participants varied in their clinical diagnoses which were clinician-assigned. However, the diagnoses for 351/360 patients and 200 non-student controls were supported by a researcher-conducted mental state interview using the Positive and Negative Syndrome Scale (see below). Patients were judged to meet the criteria for schizophrenia (273), acute and transient psychosis (12), schizoaffective disorder (34), delusional disorder (5), unspecified nonorganic psychosis (24), psychosis due to substance misuse (5), bipolar disorder (1) and postpartum psychosis (1). Five participants did not have a diagnosis recorded.

Those with an at-risk mental state were from two of five sites participating in a cognitive behavioural therapy trial (Morrison et al., 2012) and all met the at-risk mental health criteria based on a researcher-administered interview using the Comprehensive Assessment of At-Risk Mental States (CAARMS; Yung et al., 2005).

All studies were approved by relevant university and National Health Service research ethics committees. As many of the studies were carried out at the same sites, care was taken to ensure that no participant contributed data more than once; in these cases, scores were taken from the earliest study. Demographic data (age ranges, gender) and PaDS scores are reported in Table 1.

### 2.2. Measures

The PaDS consists of two ten-item scales measuring strength of persecutory belief (P scale) and appraisals about whether perceived persecution is deserved (D scale, not used in this study). Each item is scored on a 5-point Likert scale. The possible range of P scores is between 0 and 40.

The P scale has been validated in clinical and non-clinical samples and correlates with Fenigstein and Venable's (1992) paranoia scale,  $r = 0.78$ ,  $N = 605$  (Melo et al., 2009). There are no published cut-offs. However, if a cut-off of +1SD was used to estimate a paranoid taxon size, 13.24% of the students, 4.55% of the general population controls, 50.32% of ARMS patients and 36.91% of schizophrenia spectrum patients would be assigned to the paranoid category (498 participants). These figures seem reasonable given that previous studies of young adults have reported that a sizeable minority experience paranoid beliefs (for example, 12.6% of the Dunedin cohort study were judged paranoid; Poulton et al., 2000) and that many of the patients were in remission at the time of assessment.

A principal component analysis of the P items in the present dataset yielded a single component accounting for approximately 48% of the variance. The P scale was reliable with McDonald's coefficient  $\omega_{\text{hierarchical}}$  for the whole scale (Dunn et al., 2014) = 0.88 (95% CI = 0.87–0.89). Additionally, 351 clinical participants and 200 controls were assessed by interviewers using the positive and negative subscales of the Positive and Negative Syndrome Scale (PANSS; Kay and Opler, 1987); PaDS P scores correlated with PANSS delusions,  $r = 0.53$ ,  $p < 0.001$  in the sample as a whole and  $r = 0.42$ ,  $p < 0.001$  in the clinical participants only, and with PANSS suspiciousness,  $r = 0.65$ ,  $p < 0.001$ , in the sample as a whole and  $r = 0.59$ ,  $p < 0.001$  in the clinical participants only (these correlations could not be meaningfully computed in the non-clinical participants alone because these PANSS subscales were required to be  $< 3$ , and hence there was insufficient variance in these data).

Valid quasi-continuous indicators are recommended for taxometric analyses (Walters and Ruscio, 2009) and some procedures (e.g. MAXEIG) require at least three indicators. Of the four subdomains of paranoia identified by Bebbington et al. (2013), PaDS items pertain to three, the exception being ideas of reference. Therefore, using these subdomains, we summed appropriate items to generate indicators at sub-scale level to conduct the analyses. P1, P3 and P9 were judged to constitute the category 'ideas of persecution' or threat of harm (e.g. P1: "There are times when I worry others might be plotting against me"); P2, P4, P6 and P7 were judged to constitute 'interpersonal sensitivity' to the negative opinions of others (e.g. P7: "There are people who think of me as a bad person"). P5, P8 and P10 were judged to represent 'mistrust' (e.g. P10: "You should only trust yourself").

From the same analysis, MacDonald's  $\omega_{\text{subscale}}$  was calculated separately for the three subscales (Dunn et al., 2014). The values were

**Table 1**  
Demographic data and PaDS scores.

	Students from the general population	Controls from the general population	At-risk mental state participants	Clinical patients
Females (N)	1517	120	71	190
Males (N)	621	80	86	170
Not disclosed (N)	19			
Age mean ( $\pm$ SD)	21.6 ( $\pm$ 5.8)	37.4 ( $\pm$ 13.0)	20.2 ( $\pm$ 4.2)	39.8 ( $\pm$ 12.3)
PaDS total scores mean ( $\pm$ SD)	14.1 ( $\pm$ 8.5)	8.5 ( $\pm$ 7.9)	23.9 ( $\pm$ 8.7)	18.7 ( $\pm$ 11.1)

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