



## Psychometric properties of Peters et al. Delusions Inventory-21 in adolescence

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### ABSTRACT

We explored the psychometric properties of the Korean version of the Peters et al. Delusions Inventory-21 (PDI-21) and evaluated the item characteristics of the PDI-21 compared with the Magical Ideation Scale (MIS) in Korean community adolescents. Survey participants comprised 310 Year 10 students who were assessed with the following instruments: the PDI-21, the MIS, the Schizotypal Personality Scale (STA) and the Symptom Checklist-90-R (SCL-90-R). The item characteristics of the PDI-21 and MIS were also explored using item response theory (IRT). The PDI-21 exhibited good internal consistency and demonstrated significant correlations with the MIS, STA and all subscale scores of the SCL-90-R, indicating psychological distress in adolescents with high PDI-21 scores. We also found through IRT analysis that the PDI-21 provides more information at the lower range and the MIS at the higher range of delusion proneness. Our findings suggest that the PDI-21 is an effective and reliable self-report measure for assessment of delusion proneness and that the PDI-21 and the MIS may be used complementarily to assess a broad range of delusion proneness among community adolescents.

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### 1. Introduction

A large body of evidence supports the continuity of delusion-like experiences in the general population (Johns and van Os, 2001), while a recent meta-analysis showed that the median 1-year incidence of psychotic experiences in the general population is 3.1% (van Os et al., 2009). Furthermore, several studies have shown that the sub-threshold psychotic symptoms lead to an increased risk of psychotic disorders in both the general population (Poulton et al., 2000; Welham et al., 2009) and the treatment-seeking population (Cannon et al., 2008). Because adolescence seems to be a critical period for the emergence of

psychotic symptoms (Walker and Bollini, 2002), psychotic like experiences during this period cannot be overlooked from the developmental perspective of psychotic disorders (Poulton et al., 2000). However, there have been suggestions that these so-called 'psychotic-like' experiences may possess only limited specificity (Meng et al., 2009) due to the frequency of identity problems, depersonalization experiences and irritability arising from the adaptation problems of this age group (Harrop and Trower, 2003).

Understanding the inherent characteristics of rating instruments is a prerequisite to conducting behavioral studies on adolescent populations. Several instruments have been developed to assess psychotic-like experiences in community adolescents (Fonseca-Pedrero et al., 2011; Kelleher et al., 2011). It is still disputed whether delusion proneness, as observed in community samples, is a variation of the 'psychoticism' dimension of personality (fully dimensional view) or a phenotypic expression of a schizotypal feature such as attenuated psychotic symptom (quasi-dimensional view) (Kim, 2004; Meehl, 1989). The Magical Ideation Scale (MIS) (Eckblad and Chapman, 1983) and the Peters et al. Delusions Inventory-40 (PDI-40) (Peters et al., 1999), based on Meehl's quasi-dimensional view of 'schizotypy' (Meehl, 1989), were originally developed to measure delusional thinking in the non-clinical population.

*Abbreviations:* ANOVAs, analysis of variances tests; IRT, item response theory; MIS, Magical Ideation Scale; PDI-21, Peters et al. Delusions Inventory-21; PDI-40, Peters et al. Delusions Inventory-40; STA, Schizotypal Personality Scale; SCL-90-R, Symptom Checklist-90-R

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The PDI-40 was designed to measure a wider range of delusion proneness in the general population, including delusions of reference, persecution, expansiveness, guilt, depersonalization, control and being controlled (Peters et al., 1999). Each item on the PDI-40 was softened by the insertion of 'as if' to ensure some endorsement in the general population (Peters et al., 1999). The Peters et al. Delusions Inventory-21 (PDI-21), which was also standardised by Peters et al. (2004), is an abbreviated version of the PDI-40 with 21 items. The PDI-21 is a self-report measure that assesses the presence of delusion proneness and its three dimensions: distress, preoccupation and conviction. The total Yes/No score for delusion proneness is derived by assigning one point to each item answered 'Yes' and 0 points to 'No' replies, and thus the maximum total Yes/No score is 21. In the case of a 'Yes' response, the three dimensions are additionally rated on a five-point Likert scale (1–5). The subscore of each dimension is obtained by summing up the scores for that dimension from all 21 items (range: 0–105) (Peters et al., 2004).

The aim of this study was to investigate the psychometric properties of the Korean version of the PDI-21 and to explore the item characteristics of the PDI-21 and the MIS in community adolescents.

## 2. Method

### 2.1. Participants

Year 10 students from one girls high school and one boys high school located in Incheon (population density: 2690/km<sup>2</sup>, area: 1002 km<sup>2</sup>) agreed to participate in the study. Out of 660 written informed consent forms sent out, 310 (47.0%) were returned, resulting in a total of 310 Year 10 students between 15 and 17 years in age, who completed the Korean version of the PDI-21, the MIS, the STA and the SCL-90-R. In the recruiting process, students who had a history of psychiatric illness, a history of psychiatric treatment or family members with a psychiatric history were asked not to participate. This recruitment method was similar to the method used by Peters et al. in the standardization of the original PDI-40 (Peters et al., 1999). We specifically chose the Year 10 students (15–17 year-old age range), because the onset of the first episode of psychosis typically occurs during late adolescence or early adulthood (Yung et al., 2009). All participants agreed to participate in the 6-month follow-up. Accordingly, the students were contacted through their school and asked to complete another PDI-21 after 6 months. A total of 276 adolescents completed and returned the 6-month follow-up questionnaire. This study was conducted in accordance with the latest version of the Declaration of Helsinki. The details of the study design were approved by the Institutional Review Board of SMG-SNU Boramae Medical Center (06-2006-23).

### 2.2. Measures

#### 2.2.1. The 21-item Peters et al. Delusions Inventory (PDI-21)

The PDI-21 was translated by two board-certified psychiatrists (HYJ and JSY) into Korean, after which it was translated back into English by a native English speaker (SH) and compared with the original PDI-21 items to verify that the meaning of the scale items had not been changed during the translation process. Finally, the translation was confirmed by both Korean- and English-language specialists.

#### 2.2.2. Magical Ideation Scale (MIS)

The MIS is a self-report measure consisting of 24 Yes/No items (Eckblad and Chapman, 1983). The total score on the MIS is obtained by assigning one point to each positive reply (Yes) and zero points to each negative reply (No) and then summing the number of positive answers (maximum score=24). The Korean version of the MIS was standardized and validated with adequate reliability (Cronbach's alpha=0.81, test-retest reliability=0.83) (Choi and Yang, 1997).

#### 2.2.3. Schizotypal Personality Scale (STA)

The Korean version of the STA (Jung et al., 2008; Kim, 2004) is a self-report measure composed of 37 Yes/No items and is designed to examine the various characteristics of general schizotypal traits (Claridge and Broks, 1984).

#### 2.2.4. Symptom Checklist-90-R (SCL-90-R)

The SCL-90-R is a self-report measure of psychiatric symptoms that is widely used in both community and clinical populations (Derogatis, 1977; Kim and Kim, 1984). Consisting of a five-point Likert scale (ranging from 0 to 4), the measure is

designed for individuals 13 years of age and older. The SCL-90-R yields 10 separate scores: a total score and subscores for somatization, obsession-compulsion, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation and psychoticism.

### 2.3. Statistical methods

Statistical analyses were performed using SPSS 13.0 for Windows (SPSS Inc., Chicago, IL). According to the results of the normality test, Student's *t*-tests, analyses of variances (ANOVAs), and Mann-Whitney *U*-tests were used for between-group comparisons. Pearson and Spearman tests were performed to examine correlations between continuous variables, and chi-square tests were used for comparison of categorical variables. Cronbach's (1951) alpha and the item-to-total (Yes/No) score correlation were used to confirm the internal consistency of the scale. Correlations among the PDI-21, MIS, STA, and SCL-90-R were examined to confirm criterion validity, and the test-retest reliability was compared using the intra-class correlation coefficient. A principal component analysis with a varimax rotation was also conducted to investigate the internal structure of the PDI-21.

We performed item response theory (IRT) analysis to quantitatively evaluate and compare the PDI-21 and the MIS in terms of item-level usefulness and measurement precision (Ferrando, 2001). The two-parameter logistic item response model, which consisted of two essential determinants, the level of the delusion proneness (item difficulty) and the differential discrimination among persons (item discrimination), was used based on a previous IRT analysis of the Korean version of the PDI-40 in adults (Jung et al., 2008).

The difficulty parameter in this study represents the level of delusion proneness corresponding to a 50% chance of endorsing the item. The discrimination parameter represents how well the item differentiates the adolescents with a low level of delusion proneness from adolescents with a high level of delusion proneness. According to Baker's (1985) suggestions regarding verbal descriptions of difficulty and discrimination levels, five levels of item difficulty were applied: 'very easy (< -2.0)', 'easy (from -2.0 to -0.5)', 'medium (from -0.5 to +0.5)', 'difficult (from +0.5 to +2.0)' and 'very difficult (> +2.0)'. In addition, seven levels of item discrimination were applied in the logistic model: 'none (0)', 'very low (0.01–0.34)', 'low (0.35–0.64)', 'moderate (0.65–1.34)', 'high (1.35–1.69)', 'very high (> 1.70)' and 'perfect (+ infinity)'. Finally, we derived test information curves for the PDI-21 and the MIS to compare the respective range of maximum information for delusion proneness. The test information curve visually summarizes test information at a specific level of delusion proneness, thus indicating the efficacy of the test (PDI-21 or MIS) in estimating the 'delusion proneness' across the entire range of delusion proneness (Grimm and Yarnold, 2000).

## 3. Results

### 3.1. Sample characteristics

The clinical and demographic features of the participants are summarized in Table 1. There were no significant gender differences in the total scores for the PDI-21, MIS, STA, or SCL-90-R. Similarly, there were no significant gender differences in the distress, preoccupation and conviction dimension scores of the PDI-21.

### 3.2. Convergent validity: inter-correlations among the measures

The total Yes/No score of the PDI-21 showed significant correlation with the total scores of the MIS ( $r=0.58$ ), the STA ( $r=0.64$ ) and the SCL-90-R ( $r=0.58$ ). The PDI dimension scores (distress, preoccupation, conviction) also showed significant correlation with the total scores of the MIS ( $r=0.53$ – $0.58$ ), the STA ( $r=0.63$ – $0.65$ ) and the SCL-90-R ( $r=0.58$ – $0.63$ , Table 2). All subscale scores of the SCL-90-R also showed significant correlation with the total score of the PDI-21 ( $r=0.37$ – $0.54$ ). The somatisation ( $r=0.37$ ) and phobic ( $r=0.43$ ) subscale demonstrated weakest correlation with PDI-21 total Yes/No scores, whereas the paranoid ideation ( $r=0.53$ ) and psychoticism ( $r=0.54$ ) subscales demonstrated the strongest correlation.

### 3.3. Reliability: internal consistency

Item to total score correlations ranged from 0.18 to 0.57 for the PDI-21 and the MIS ( $p < 0.01$ , Tables 3 and 4), while the

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