

Measuring Delusional Ideation: The 21-Item Peters et al. Delusions Inventory (PDI)

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Abstract

There is increasing evidence that in the general population there are schizotypal traits and symptoms that can be measured psychometrically. Norms are reported for a new 21-item version of the Peters et al. Delusions Inventory (PDI; Peters et al. 1999b). The PDI, originally based on the Present State Examination, incorporates the multidimensionality of delusions by including measures of distress, preoccupation, and conviction. A total of 444 healthy individuals completed the 21-item PDI and two other questionnaires measuring florid delusions and social desirability. A subsample also filled out an in-depth schizotypal personality scale. Thirty-three deluded inpatients also completed the PDI. The PDI's psychometric properties confirmed that it remains a reliable and valid instrument to measure delusional ideation in the general population. Consistent with the 40-item PDI, it was normally distributed, no sex differences were found, and there was an inverse relationship with age. Individual items were endorsed by just over one in four healthy adults. Although the deluded sample scored significantly higher, the range of scores overlapped considerably, with 11 percent of healthy adults scoring higher than the mean of the deluded group. As with our previous findings, the two samples were differentiated by their ratings on the distress, preoccupation, and conviction scales. These results suggest that these dimensions may be more important than the content of belief alone for placing an individual on the continuum between normal and delusional thinking.

Keywords: Delusions, schizotypy, questionnaire.
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It is becoming increasingly recognized that the existence of disorders that do not fit conventional diagnostic categories is a more accurate reflection of the realities of psychological aberration. Originating in the seminal work of Rado (1953) and Meehl (1962), the continuity, or dimen-

sionality, of psychotic characteristics is now firmly established among psychologists (Eysenck 1986; Costello 1994; Claridge 1997) and, increasingly, among psychiatrists (van Os et al. 1996, 1999; Spitzer 1998). Thus, psychotic symptoms are recognized as the severe expression of schizotypal traits that are present in the general population and that manifest themselves as psychological variations observable among individuals that range from the perfectly well adjusted to those who, while showing signs of psychopathology, would not be considered clinically psychotic. Large-scale, unselected general population surveys have confirmed the high incidence of seemingly benign positive symptoms in the general population (Eaton et al. 1991; Poulton et al. 2000; van Os et al. 2000), with some studies showing prevalence rates as high as 28.4 percent (Kendler et al. 1996). Furthermore, psychotic symptomatology in community samples shares the same epidemiological patterns of variation (Sharpley and Peters 1999; Johns and van Os 2001; van Os et al. 2001) and dimensions (Stefanis et al. 2002; Hanssen et al. 2003) as psychotic disorders.

The presence of schizotypal traits in the general population can be measured psychometrically from both the “fully” (i.e., schizotypy as a personality trait) and “quasi” (i.e., schizotypy as attenuated psychotic symptoms) dimensional viewpoints (Claridge 1994). Individuals with high scores on such indexes resemble schizophrenia patients on a number of experimental correlates (Peters et al. 1994; Linney et al. 1998) and are at a modestly higher risk for experiencing more severe psychotic-like experiences and for developing psychotic disorders (Chapman et al. 1994; Kwapil et al. 1997). Such findings provide some support for both the phenomenological and the vulnerability dimensional views discussed by Costello (1994).

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Schizotypy scales published recently have tended to be based on the “quasi-dimensional” model and to center around individual symptoms, mirroring recent trends in the symptom-oriented approach to psychiatric research (Bentall et al. 1988). There are now specific scales available to measure hallucinations (Launay and Slade 1981), perceptual aberrations (Chapman et al. 1978), thought disorder (Coleman et al. 1993), referential thinking (Lenzenweger et al. 1997), self-consciousness/paranoia (Fenigstein and Vanable 1992), and paranoia/suspiciousness (Rawlings and Freeman 1996). While referential thinking and paranoia are relevant to delusional thinking, they represent only a subset of delusional themes found in psychosis.

The two questionnaires available to measure delusions, however, both have limitations. The items on the Magical Ideation Scale (MgI; Eckblad and Chapman 1986) sample a mixture of first rank symptoms, which are rarely endorsed in the general population (Eaton et al. 1991), and of superstitious beliefs, which, in contrast, are so common that they can hardly be regarded as delusional (Cox and Cowling 1989). Indeed, Peters et al. (1999b) found that the MgI was only just significantly higher in floridly deluded than in healthy individuals. The Foulds Delusions-Symptoms-State Inventory (DSSI; Foulds and Bedford 1975) was designed for use in clinical diagnosis, and its items depict florid symptoms that are not appropriate for use in the general population. This was confirmed by Peters et al. (1999b), who found that its distribution was highly skewed in the general population. Such a dearth of measures on delusions is surprising because they occur in a wide variety of disorders (Garety and Hemsley 1994) and even within psychotic disorders have been shown to load on a number of different factors (Kitamura et al. 1995), unlike other symptoms of psychosis.

The Peters et al. Delusions Inventory (PDI; Peters et al. 1999b) was designed to fill this gap in the literature. The Present State Examination (PSE; 9th ed., Wing et al. 1974) was taken as a template for the construction of the items. The delusions section of the PSE comprises seven categories: delusions of control; misinterpretations, misidentifications, and delusions of reference; delusions of persecution; expansive delusions; delusions concerning various types of influence and primary delusions; other delusions; and simple delusions based on guilt, depersonalization, and hypochondriasis. In addition, an eighth category depicting experiences of disturbed thinking was also included: thought reading, insertion, echo, and broadcast. Five questions were constructed for each category, yielding 40 items. The use of an overinclusive measure such as the PSE ensured that a wide range of delusions was sampled.

Taking the psychotic state as a reference point ensured the face validity of the items, although each item was toned down by adding an “as if” at the beginning of each statement to capture its normal equivalent. The measurement of continuous traits rather than categorical states was obtained by also including “do you ever think” or “do you ever feel” at the beginning of each statement. Therefore, the PSE example “Is anyone deliberately trying to harm you?” became “Do you ever feel as if someone is deliberately trying to harm you?”

The multidimensional aspect of delusions was incorporated in the PDI by adding the three dimensions of distress, preoccupation, and conviction to be rated for each item. Accordingly, a five-point Likert scale was created on the right-hand side of the inventory for each of these dimensions. Respondents were instructed to rate the flanking scales for only the statements that had been endorsed. Although the incorporation of these three scales makes the questionnaire somewhat cumbersome, their importance was confirmed by Peters et al. (1999a, 1999b), who found that different samples can be differentiated by their scores on the three dimensions, despite an overlap in the endorsement of delusional items. These findings suggest that form may be more important diagnostically than content: it is not *what* you believe but *how* you believe it.

Peters et al. (1999b) found that the 40-item PDI had good psychometric properties. A principal components analysis (PCA) was carried out on the 40 items, giving rise to an abbreviated version with 21 items based on the selection of the highest loading items. The 21-item PDI has already been used successfully in a number of studies, including large-scale surveys of the occurrence of delusional ideation in French general practitioner (GP) attendees (Verdoux et al. 1998a, 1998b) and in British twins (Linney et al. 2003); comparisons of the cognitive performance of low- and high-PDI scorers (Linney et al. 1998; Green et al. 2001; Colbert and Peters 2002; Lawrence and Peters 2004); and comparisons of the multidimensionality of delusional ideation in specific groups such as members of certain New Religious Movements (NRMs) (Peters et al. 1999a) and cannabis smokers (Nunn et al. 2001). This study reports fully the psychometric properties of the 21-item PDI.

Method

Construction of the 21-Item PDI. Please refer to Peters et al. (1999b) for details on the construction of the original 40-item PDI. The selection of the 21-item PDI was based on a PCA with varimax rotation, carried out on the data from 272 healthy individuals who completed the original 40-item PDI (reported in Peters et al. 1999b).

Although the data from 20 deluded individuals on the 40-item PDI were also available, they were not used for item selection for two reasons. First, the sample was too small to capture a truly representative range of delusions: for instance, none of the patients included suffered from depressive delusions. Second, this inventory is based on a philosophy of continuity, and it would therefore be inconsistent to select only items that significantly discriminated between clinical and healthy populations, because this was not the purpose of the PDI. The selection of items was therefore conducted on the healthy sample only.

A total of 11 components accounting for 59.1 percent of the variance were obtained. A scree plot (Cattell 1966) would have suggested a three- or five-component solution. However, the purpose of the PDI was not to measure a limited number of well-defined subscales with high internal reliability but rather to sample as wide a variety of delusions as possible. Therefore, the item selection was based on the entire 11 components, rather than forcing a three- or five-component solution, despite the fact that some of the components were not easily interpretable. This inclusive approach parallels that taken by the PSE, which includes categories, such as "other delusions," that have no central focus but nevertheless cover all aspects of delusional beliefs. The construction of an inventory with three or five meaningful, internally consistent subscales would have produced an attenuated version of the DSSI, which was criticized for being too narrow in its range of delusions.

The size of loading is the sine qua non of item selection (Kline 1993), and the two items with the highest loadings on each component were selected, although only one item had a loading of > 0.4 for Component 11 (see Peters et al. 1999b for a more thorough description of the components). This gave a total of 21 items (Appendix 1).¹ Paranoia seemed to be a central issue, with three of the components converging on this theme: persecution (items 4 and 5), suspiciousness (items 1 and 3), and paranoid ideation (items 13 and 15). The religiosity component (items 8 and 11) accounted for the highest proportion of the variance. Three further components were easily identifiable: grandiosity (items 6 and 7), paranormal beliefs (items 9 and 12), and thought disturbances (items 18 and 20). The themes of the last four components were less clear-cut and were labeled negative self (items 14 and 21), depersonalization (item 16), catastrophic ideation and thought broadcast (items 17 and 19), and ideation of reference and influence (items 2 and 10).

¹ Translations of the 21-item PDI currently exist in French, Dutch, Portuguese, Italian, Spanish, Russian, Korean, Chinese, and Japanese and are available from the first author on request.

Participants and Procedure

Healthy sample

21-item PDI. A "shotgun" approach to recruitment for the completion of the newly created 21-item PDI was deliberately chosen in an attempt to reach as wide a range of respondents as possible, so that the final sample would be representative of the general population. One disadvantage of this approach, however, was that it was not possible to determine the percentage of individuals who returned their PDIs, and unfortunately no information is available about the response rate. Recruitment was completed over approximately 2 years.

A total of 444 individuals (187 males, 257 females), with an age range of 16 to 67 (mean = 30.7; $n = 389$,² standard deviation [SD] = 9.6), had complete data on the 21-item PDI. Approximately half of the sample was recruited from mature students attending the Open University Summer School. Individuals with a professional background in mental health or with a psychiatric history were asked not to participate. The Open University is an adult education institution run by correspondence tuition on a part-time basis. It practices a policy of open admission, with no academic requirements necessary, and can be joined without enrolling for a degree, unlike mainstream universities. As a result, its students are a diverse group encompassing all socioeconomic classes, a large variety of ethnic backgrounds, and a wide range of intellectual abilities, again unlike typical student populations at mainstream universities. Approximately another quarter was recruited through acquaintances, colleagues, and secretarial staff. A further quarter was recruited from the undergraduate population of City University, London, and University College London.

There were missing data on profession for 163 respondents. For the rest of the sample, 81 people were classified as "skilled occupation," 77 as "managerial/technical," 56 as "students," 30 as "no profession/job," 26 as "professional," 10 as "partly skilled," and 1 as "unskilled" (Standard Occupational Classification [SOC], Office of Population Census and Surveys 1991).

There were missing data on ethnic background for 156 respondents. For the rest of the sample, 223 people identified themselves as "white British," 31 as "black Caribbean," 20 as "white European," 3 as "black African," 2 as "Indian," 1 as "white African," 2 as "black British," 2 as "Asian," and 1 for each of the following ethnic backgrounds: "Australian," "Jewish," "Chinese," and "mixed."

² Fifty-five respondents neglected to provide their age.

There were missing data on religious affiliation for 51 respondents. For the rest of the sample, 170 reported their religious affiliation as "none," 160 as "Church of England/Christian," 31 as "Catholic," 14 as "Muslim," 4 as "Hindu," 3 as "Baptist," 2 as "personal God," 2 as "Sikh," and 1 for each of the following affiliations: "Methodist," "Mormon," "Orthodox," "Quaker," "Buddhist," "Jewish," and "Christian Scientist."

Other scales completed. Three hundred and thirty-one of the 444 participants (132 males, 199 females) also had complete data on the Social Desirability (SD) scale of the Eysenck Personality Questionnaire (EPQ; Eysenck and Eysenck 1975), and 337 (129 males, 208 females) also had complete data on the DSSI (Foulds and Bedford 1975).

A small subsample ($n = 49$; 24 males, 25 females) with an age range of 20 to 53 (mean = 30.8, SD = 8.4) also completed the Oxford-Liverpool Inventory of Feelings and Experiences (O-LIFE; Mason et al. 1995). The O-LIFE is based on the Combined Schizotypal Traits Questionnaire (Bentall et al. 1989) and reduced 16 schizotypy questionnaires to four factors using factor analysis: unusual experiences (UnEx), cognitive disorganization (CogDis), introverted anhedonia (IntAn), and impulsive nonconformity (ImpNon). UnEx represents the positive symptomatology aspect of the schizotypal personality, characterized by aberrant perceptions and beliefs; CogDis has also been conceptualized as positive symptomatology but relates more to social anxiety, emotional sensitivity, and attentional difficulties; IntAn represents negative symptomatology and is concerned with a lack of enjoyment in social contact and a lack of physical sources of pleasure; ImpNon includes poor self-control, mood swings, and antisocial tendencies and is the least well related to schizotypy.

Also included in the O-LIFE is the extroversion scale of the EPQ (Eysenck and Eysenck 1975), and the Schizotypal Personality Scale (STA; Claridge and Broks 1984). The O-LIFE has 159 items overall; individuals answer "yes" or "no" to each item on a separate answer sheet.

Follow-up sample. A proportion of the original 444 individuals consented to be contacted at a later stage. These individuals were contacted by mail 6 months to 1 year later and asked to complete another PDI. Eighty-six participants (27 males, 59 females) returned their questionnaires, with an age range of 19 to 58 (mean = 34.2, SD = 8.4). They did not differ significantly from the rest of the sample in any of the five PDI scores or the DSSI, or in gender distribution, but they were significantly older ($t = -3.7$, $df = 387$, $p < 0.001$) and scored significantly higher on the SD (EPQ) ($t = -5.3$, $df = 329$, $p < 0.001$).

Deluded sample (from Peters et al. 1999a). The PDI data of 33 deluded individuals (12 females, 21 males) with an age range of 20 to 62 (mean = 33.9, SD = 8.4) were used to determine the criterion validity of the PDI. Their PDI scores have already been published as one of the four groups in Peters et al. (1999a), but these data did not include reliability, validity, or endorsement frequency data. The deluded participants were all inpatients at the Maudsley and Bethlem Hospitals. Only patients who were described by the responsible clinician as having psychotic features with no history of neurological impairment or alcohol abuse were selected, irrespective of diagnosis. This information was confirmed by case note review. All participants had a score of 2 (moderate severity: i.e., "overinvolved ideas and ideas of reference, or undoubted misinterpretations; special meanings") or higher on the Delusion Subscale of the Manchester Scale (Krawiecka et al. 1977) as assessed by the psychiatrist in charge of their care. They had a range of diagnoses, namely schizophrenia ($n = 8$), bipolar disorder ($n = 4$), paranoid schizophrenia ($n = 16$), schizoaffective ($n = 3$), and manic episode ($n = 2$). All patients were receiving neuroleptic medication at the time of testing. The experimenter sat with all patients while they filled out the PDI, reading the questions aloud if necessary to ensure correct completion of the questionnaires.

In terms of ethnic background, 16 people identified themselves as "white British," 6 as "black African," 4 as "black Caribbean," 3 as "black British," and 1 each for the following ethnic backgrounds: "Indian," "Asian," "Gypsy," and "mixed."

There were missing data on profession for 1 respondent. For the rest of the sample, 24 people were classified as "no profession/job," and 2 for each of the following professions: "skilled occupation," "student," "professional," and "partly skilled" (SOC, Office of Population Census and Surveys 1991).

There were missing data on religious affiliation for 8 respondents. For the rest of the sample, 8 reported their religious affiliation as "none," 6 as "Catholic," 5 as "Church of England/Christian," 2 as "personal God," and 1 person for each of the following affiliations: "Methodist," "Mormon," "pagan," and "Hare Krishna."

Results

Four separate scores are obtained from the 21-item PDI: a PDI yes/no score, a distress score, a preoccupation score, and a conviction score. The PDI yes/no scores were obtained by assigning a 1 to each "yes" answer and a 0 to each "no" answer and adding up the 21 items. Therefore, the possible range of scores was 0 to 21. The distress, preoccupation, and conviction ratings ranged from 0 to 5 for

each item. A "no" answer automatically scored 0 on each of the three dimensions. A rating between 1 and 5 was obtained if the item had been answered "yes." Total scores on each dimension were obtained by adding up the ratings on that dimension for all 21 items. The possible range of scores for each dimension was 0 to 105. In addition, a grand total PDI adding up the three dimensions and the PDI yes/no scores can also be obtained, with a possible range of scores of 0 to 336. Such a score is useful if a global measure of delusional ideation is required that includes distress, preoccupation, and conviction—for instance, when comparing individuals with low and high proneness to delusions on a behavioral measure.

Table 1 shows the descriptive statistical data for the three main scales: PDI, SD (EPQ), and DSSI. This includes means, SDs, ranges, medians, modes, indexes of kurtosis and skewness, gender differences, and correlations with age.

No differences were found between males and females on the PDI yes/no scores, and all further analyses were carried out on the total sample. There was a significant inverse correlation with age, as has been found with other psychosis-proneness scales (Claridge et al. 1996).

The distribution of PDI yes/no scores was slightly skewed (figure 1), although both the kurtosis and skewness were within acceptable limits ($< \pm 1$). The average endorsement frequency for the 21 items was 29.8 percent.

No gender differences were found on the distress, preoccupation, or conviction ratings, or on the total PDI. Significant inverse relationships with age were found with the three dimension ratings and the total PDI. All three ratings, and consequently the total PDI, had skewed distributions.

Females scored significantly higher than males on the SD (EPQ), but there were no gender difference on the DSSI. The DSSI showed an inverse significant relationship with age, while the SD (EPQ) showed a positive relationship with age. Both questionnaires, but especially the DSSI, had skewed distributions.

Reliability

Internal consistency. The Cronbach alpha coefficient was 0.82, indicating that the internal consistency of the PDI is more than adequate. The item-whole correlations, reported in table 2, ranged between 0.35 and 0.60. A further PCA on the 21 PDI items with a forced one-compo-

Table 1. Descriptive statistical data for the PDI, DSSI, and SD (EPQ)

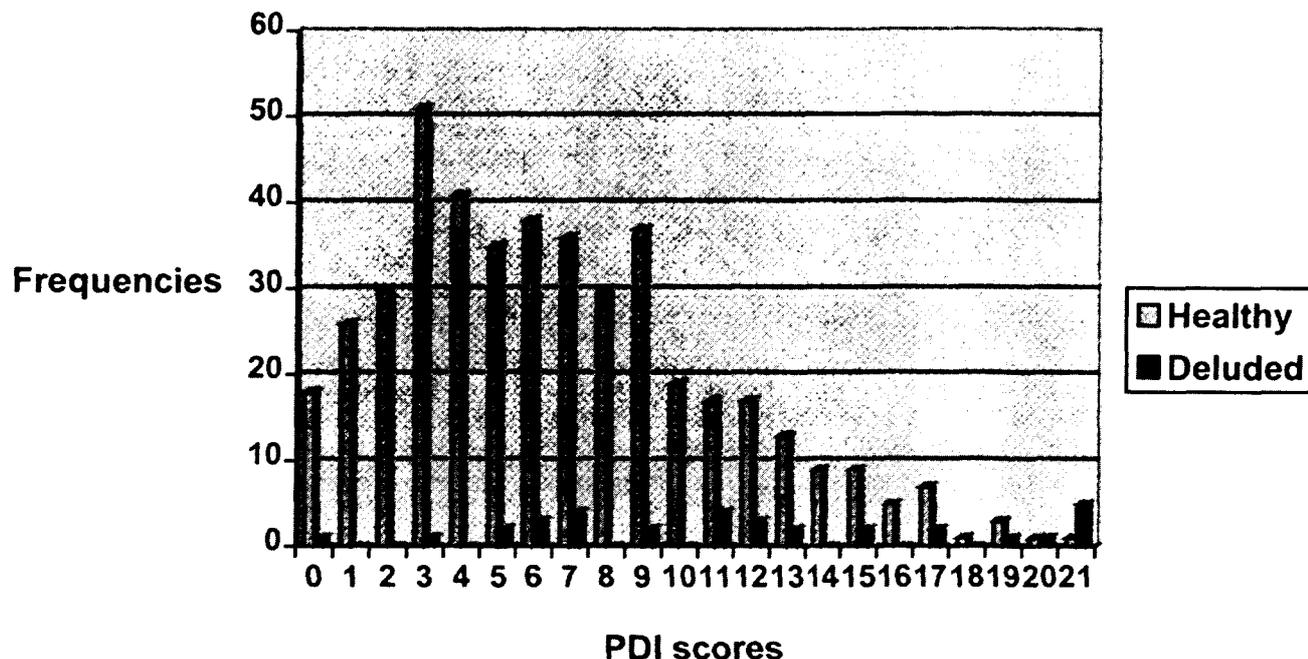
	PDI Y/N (n = 444)	D (n = 435)	P (n = 439)	C (n = 423)	Total PDI (n = 385)	DSSI (n = 337)	SD (EPQ) (n = 331)
n (males/ females)	187/257	180/255	182/257	177/246	160/225	129/208	132/199
Males, mean (SD)	6.4 (4.4)	14.4 (14.1)	15.1 (14.6)	20.1 (16.7)	55.8 (48.7)	2.6 (3.8)	6.8 (4.9)
Females, mean (SD)	6.8 (4.3)	16.2 (14.1)	15.7 (13.8)	20.7 (15.4)	61.0 (47.5)	2.0 (2.9)	8.6 (4.5)
Total, mean (SD)	6.7 (4.4)	15.5 (14.1)	15.4 (14.1)	20.4 (16.0)	58.9 (48.0)	2.2 (3.3)	7.9 (4.8)
Range	0–21	0–84	0–93	0–93	0–291	0–16	0–17
Median	6	11	12	17	49	1	8
Mode	3	2	6	16	0	0	12
Kurtosis	0.01	2.9	4.3	1.9	2.6	4.5	–1.3
Skewness	0.70	1.6	1.8	1.2	1.4	2.1	–0.16
Gender, z^1	–1.3	–1.8	–0.9	–0.9	–1.4	–0.5	–3.4***
Age, r^2	–0.24***	–0.30***	–0.28***	–0.26***	–0.28***	–0.26***	0.5***

Note.—C = conviction rating scale; D = distress rating scale; DSSI = Delusions-Symptoms-State Inventory (Foulds and Bedford 1975); P = preoccupation rating scale; PDI Y/N = Peters et al. Delusions Inventory, total of yes/no scores; SD = standard deviation; SD (EPQ) = Social Desirability scale of the Eysenck Personality Questionnaire (Eysenck and Eysenck 1975); total PDI = total of PDI Y/N + D + P + C.

¹ Mann-Whitney tests (2-tailed).

² Spearman's correlations (2-tailed).

*** $p < 0.001$

Figure 1. Range of scores and distributions of PDI yes/no scores in the healthy and deluded samples

Note.—PDI = Peters et al. Delusions Inventory.

ment solution was carried out; the loadings of each item on this factor are also presented in table 2. No item loading was less than 0.30 (ranging from 0.31 to 0.63), providing evidence for the adequacy of a unidimensional scoring system.

Test-retest reliability. The correlations between the initial and subsequent PDI scores were calculated. Highly significant relationships were found for all scores (PDI yes/no: Spearman's $r = 0.78$, $n = 83$, $p < 0.001$; distress: Spearman's $r = 0.81$, $n = 74$, $p < 0.001$; preoccupation: Spearman's $r = 0.81$, $n = 76$, $p < 0.001$; conviction: Spearman's $r = 0.78$, $n = 70$, $p < 0.001$). These significant relationships confirm the test-retest reliability of the PDI.

Validity. The criteria for three main types of validity must be satisfied to establish the validity of a scale (Barker et al. 1994). The first is "face validity"—to ensure the items adequately sample the different aspects of the construct being measured. The face validity of the PDI was established by taking the psychotic state as a template. "Construct validity" is met by the demonstration that the scale in question is correlated with other scales based on a similar construct ("convergent validity") but uncorrelated with unrelated constructs ("discriminant validity"). Both convergent and discriminant validities

were established by the use of other schizotypal measures, because schizotypy is a multidimensional construct. A delusion measure should be related to questionnaires tapping positive, but not negative, symptomatology. Lastly, "criterion validity"³ can be established in one of two ways: whether the scale is correlated with a current criterion, for instance a clinician's ratings, or whether a scale can separate two criterion groups. The second method was used to establish criterion validity—that is, comparing deluded patients with a healthy sample.

Construct validity

1. **Convergent validity.** The correlation between the PDI and the DSSI was highly significant (Spearman's $r = 0.61$, $n = 327$, $p < 0.001$), establishing the convergent validity of the PDI. Although the inverse correlation between the PDI and the SD (EPQ) reached significance, it was nevertheless of small value (Spearman's $r = -0.14$, $n = 323$, $p = 0.01$).

³ "Predictive validity" is a second type of criterion validity that relates to whether the scale correlates with a future criterion—that is, whether the PDI predicts future psychotic breakdown. This requires longitudinal data and was therefore not established in this article.

Table 2. Item-whole correlations and loadings on forced one-component solution for the PDI Y/N

Items	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21
<i>r</i>	0.42	0.47	0.36	0.45	0.57	0.50	0.58	0.53	0.40	0.46	0.35	0.44	0.44	0.35	0.36	0.57	0.43	0.51	0.60	0.59	0.51
Loading	0.42	0.47	0.31	0.45	0.59	0.54	0.58	0.52	0.36	0.44	0.32	0.42	0.41	0.32	0.35	0.58	0.44	0.53	0.63	0.63	0.55

Note.—PDI Y/N = Peters et al. Delusions Inventory; total of yes/no scores.

2. *Discriminant validity.* Correlations were also carried out between the PDI yes/no scores and the four O-LIFE factors, as well as with the STA (Claridge and Broks 1984) and extroversion (Eysenck and Eysenck 1975) for the subsample with data available on both scales. Only significance levels < 0.01 were considered because of the number of correlations performed. Three positive relationships were found between the PDI yes/no scores and the STA (Spearman's $r = 0.51$, $n = 47$, $p < 0.001$), the UnEx factor (Spearman's $r = 0.65$, $n = 47$, $p < 0.001$), and the ImpNon factor (Spearman's $r = 0.37$, $n = 47$, $p = 0.01$). None of the other correlations reached significance at the 0.01 level (extroversion: Spearman's $r = 0.35$, $n = 47$, $p > 0.01$; IntAn: Spearman's $r = -0.31$, $n = 47$, $p > 0.01$; CogDis: Spearman's $r = 0.21$, $n = 47$, $p > 0.1$).

Criterion validity. The Cronbach alpha coefficient of PDI yes/no in the deluded sample was 0.90, confirming that the internal consistency of the scale in this sample was even higher than in the healthy group. The criterion validity was investigated by comparing the scores of the healthy sample to those of the deluded group. The descriptive statistical data for both groups are given in table 3, including means, SDs, medians, ranges, and any significant differences between the two groups. There were no sex differences in the deluded sample on any of the scales apart from the distress dimension ($z = -2.7$, $p < 0.01$), where women scored higher. There were no relationships with age, unlike in the healthy sample.

All scales and ratings were significantly higher in the deluded group, although less so for the SD (EPQ). The average endorsement frequency for the 21 items was 53.2 percent. Of the 21 items, 16 were endorsed significantly more often in the deluded group (using Mann-Whitney tests). However, the range of scores between the two groups overlapped considerably, as illustrated in figure 1.

Comparisons were also made between the groups on the three dimensions, for each item selecting only individuals who had endorsed it. Eleven items were rated significantly higher on the distress ratings, plus a further 3 trends; 13 items on the preoccupation ratings; and 13 items on the conviction ratings.

Discussion

The aim of this study was to develop a version of the PDI (Peters et al. 1999b) that would be shorter but have the same psychometric properties. The results confirmed that the 21-item PDI remains a reliable and valid instrument to measure delusional ideation in the general population. As

Table 3. Comparisons between the healthy and deluded¹ groups on the PDI, DSSI, and SD (EPQ)

	Mean (SD)		Median (n)		Range	
	Healthy	Deluded	Healthy	Deluded	Healthy	Deluded
PDI Y/N	6.7 (4.4)	11.9*** (6.0)	6 (444)	11 (33)	0–21	0–21
D	15.5 (14.1)	36.7*** (23.6)	11 (435)	31 (33)	0–84	0–95
P	15.4 (14.1)	36.1*** (24.7)	12 (439)	29 (33)	0–93	0–98
C	20.4 (16.0)	44.5*** (27.4)	17 (423)	39 (33)	0–93	0–103
Total PDI	58.9 (48.0)	130.5*** (79.1)	49 (385)	123 (33)	0–291	0–317
DSSI	2.2 (3.3)	10.5*** (7.2)	1 (337)	10 (28)	0–16	0–24
SD (EPQ)	7.9 (4.8)	12.8* (4.4)	8 (331)	13 (11)	0–17	6–19

Note.—C = conviction rating scale; D = distress rating scale; DSSI = Delusions-Symptoms-State Inventory (Foulds and Bedford 1975); P = Preoccupation rating scale; PDI Y/N = Peters et al. Delusions Inventory, total of yes/no scores; SD = standard deviation; SD (EPQ) = Social Desirability scale of the Eysenck Personality Questionnaire (Eysenck and Eysenck 1975); total PDI = total of PDI Y/N + D + P + C.

¹ The means, SDs, and ranges of the deluded sample on the PDI, SD (EPQ), and DSSI are already reported in Peters et al. (1999a).

* $p < 0.01$ (Mann-Whitney tests between deluded and healthy samples; 2-tailed); *** $p < 0.001$ (Mann-Whitney tests between deluded and healthy samples; 2-tailed)

in the 40-item PDI, the internal consistency was more than adequate. The test-retest reliability was demonstrated by similar scores on two separate occasions up to 1 year apart. The convergent validity was established by its relationship with another delusions measure, the DSSI (Foulds and Bedford 1975). Although there was a significant inverse association between social desirability (Eysenck and Eysenck 1975) and PDI scores, the correlation was nevertheless of a very small value (–0.14) and is unlikely to be particularly meaningful or to invalidate the scale. The normal distribution of the 21-item PDI makes it a more appropriate instrument for use in population-based samples than the DSSI, which was highly skewed.

As predicted, a significant relationship was also found in a small subsample with the STA (Claridge and Broks 1984) and the UnEx, but not the CogDis or IntAn factors, of the O–LIFE (Mason et al. 1995), confirming that the PDI is related to positive, rather than negative or disorganization symptomatology, and establishing its discriminant validity. An unexpected relationship was also found with ImpNon, suggesting that delusional ideation may also be related to asocial or unconventional behavior. No relationship was found with extroversion (Eysenck and Eysenck 1975).

All other findings were consistent with the properties of the 40-item PDI. The average endorsement frequency in the healthy sample was 29.8 percent, only slightly higher than the 40-item average endorsement frequency of 25.2 percent, and similar to the prevalence rates found by Kendler et al. (1996) using the Composite International Diagnostic Interview (CIDI; WHO 1990). There was no sex difference on any of the scales, which parallels the absence of a female excess for psychotic illnesses. The only exception was in the deluded sample,

where women scored higher on the distress dimension. This is likely to reflect the gender bias commonly found for neurosis.

Inverse relationships were found between all PDI scales and age in the healthy sample, consistent with other psychosis-proneness scales (Claridge et al. 1996). As well as the potential slant toward higher IQ in our sample, this inverse relationship with age is likely to account for the slightly elevated PDI yes/no score obtained in the present study (PDI yes/no: 6.7; distress: 15.5; preoccupation: 15.4; conviction: 20.4), compared with two other sets of data. Verdoux et al. (1998a) gave the 21-item PDI to 790 GP practice attenders in the Aquitaine Sentinel Network in southwest France. The mean PDI yes/no score was 4.2, distress 9.4, preoccupation 9.8, and conviction 13.8. Linney et al. (2003) obtained complete data on the 21-item PDI from 2,120 twins from the Institute of Psychiatry Volunteer Twin Register. Similar to Verdoux et al., Linney et al. found that the mean PDI yes/no score was 4.1, distress 8.9, preoccupation 8.7, and conviction 12.6. Both of these studies also identified inverse relationships with age, and it is therefore likely that the differences in scores are due to age, because both their samples were older (mean of 52.1 years in the Verdoux et al. study, and mean of 47.9 years in the Linney et al. study, compared with 30.7 years in the present study).

Verdoux et al. (1998b) have made the intriguing claim that there is a striking parallel between the age-related decrease of schizotypy in nonpsychiatric patients, and the association between age and positive symptoms in functional and organic psychoses. Indeed, studies addressing the course of delusional symptoms have shown that they are less prominent in elderly psychotic patients (Ballenger et al. 1982; Weinberger and Lipska 1995;

Schultz et al. 1997). Verdoux et al. (1998b) suggest that late adolescence and early adulthood may be a neurodevelopmental stage favoring the expression of schizotypy in healthy subjects.

However, there are a number of possible alternative interpretations. First, the fact that individuals who score highly on schizotypal indexes are at higher risk of psychosis (Chapman et al. 1994; Kwapil et al. 1997) makes it possible that there are fewer older "high schizotypes" simply because by then they are likely to have already developed a psychotic disorder. Second, a cohort effect may be at play, because current youth culture is fascinated with all "unexplained" phenomena (e.g., the paranormal, UFO abductions, the X files, conspiracy theories) and actively encourages referential relationships with magazines, advertising, and so on (Peters 2001). Third, there may be something about aging that decreases one's tendency to exhibit schizotypal characteristics. For instance, there is a natural trend to become more conventional with increasing age, and accumulated experience may enable individuals to make more sober interpretations of their experiences and mental events. Verdoux et al.'s (1998b) findings that their older respondents scored higher on the religiosity items while scoring lower on the persecution, thought disturbance, grandiosity, and paranormal beliefs items would indeed seem to favor a psychological, rather than a neurodevelopmental, explanation. Nevertheless, longitudinal data are required to disentangle these issues.

As with the 40-item PDI, a deluded group scored significantly higher on all the 21-item PDI scales, establishing its criterion validity. The group's average endorsement frequency for each item was 53.2 percent, which was very close to the 51.6 percent average frequency found for the 40-item PDI. This finding also concurs with Verdoux et al. (1998a), who found that 21-item PDI scores were significantly higher in patients with a psychotic psychiatric history. Of interest in the Verdoux et al. study, although patients with a psychotic psychiatric history scored higher than those with other diagnoses, the latter also scored higher than the healthy sample. These results have since been replicated in a Dutch population (Hanssen et al. 2003). Such findings are comparable with the Netherlands Mental Health Survey and Incidence Study (NEMESIS) survey (van Os et al. 2000), where strong associations existed between all types of symptom ratings on the CIDI and all types of lifetime diagnoses, suggesting that the boundaries between diagnostic categories are blurred.

Although the deluded sample scored significantly higher overall, the range of PDI yes/no scores was identical for the two groups, with both groups ranging from the minimum to the maximum (0–21). Again, these findings mirror those from the 40-item PDI. While 10 percent of the healthy sample scored higher than the mean of the

deluded group on the 40-item PDI, 11 percent of the present healthy sample scored higher than the mean of the deluded group on the 21-item PDI. The consistency between the two samples, on two different versions of the PDI, intimates that this is a robust finding. Although Verdoux and her colleagues do not report the percentage of healthy respondents who scored higher than the mean of their psychotic patients, they also found a range of scores between 0 and 21 in their sample, and the range of individual item endorsement varied between 5 and 70 percent.

When selecting only those individuals who had endorsed specific items, deluded respondents scored significantly higher than their healthy counterparts on the distress dimension of 11 of the items (plus a further 3 trends), and on the preoccupation and conviction dimensions of 13 of the items. For example, item 3 ("Do you ever feel as if some people are not what they seem to be?") was endorsed equally often in the healthy and deluded samples. However, the deluded patients who answered "yes" to this item were significantly more distressed about it, spent more of their time thinking about it, and were more convinced of its veracity than were the healthy individuals who answered "yes." This pattern is again consistent with our previous findings with the 40-item PDI. Therefore, whether or not one becomes overtly deluded is determined not just by the content of mental events but also by the extent to which they are believed, how much they interfere with one's life, and their emotional impact.

We should point out that the PDI is not designed to identify full-blown psychotic delusions in the community; other scales (e.g., the DSSI) are available for this purpose. Rather, it was designed as a schizotypal scale for the measurement of delusional ideation in the general population, with each PSE item specifically toned down with the insertion of "as if" to ensure some endorsement in the general population. As such, the high endorsement rate of individual PDI items (29.8%) does not mean that delusions are frequent in the general population but rather that the themes found in delusions are reflected in the beliefs held in the general population. The claims that our data support the continuum view of psychosis rest on the normal distribution of PDI scores and the overlapping of distributions between the deluded and general samples, and not on the high endorsement rates of individual items, or the claim that delusions are frequent in the general population. The present study further implies that healthy individuals are best differentiated from their deluded counterparts by their conviction, preoccupation, and distress scores: it's not *what* you think, it's *how* you think about it.

Taken together, these findings imply that the divisions between normal and delusional thinking, or between

delusions and other types of pathological thinking, may be rather blurred. Furthermore, they support our previous claims (Peters et al. 1999a, 1999b) that the analysis of the dimensions of distress, preoccupation, and conviction may be more revealing than the content of belief alone for placing an individual on the continuum from health to psychopathology.

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Appendix

P.D.I.-21

This questionnaire is designed to measure beliefs and vivid mental experiences. We believe that they are much more common than has previously been supposed, and that most people have had some such experiences during their lives. Please answer the following questions as honestly as you can. There are no right or wrong answers, and there are no trick questions.

Please note that we are NOT interested in experiences people may have had when under the influence of drugs.

IT IS IMPORTANT THAT YOU ANSWER ALL QUESTIONS.

For the questions you answer YES to, we are interested in:

- (a) how distressing these beliefs or experiences are
- (b) how often you think about them; and
- (c) how true you believe them to be.

On the right hand side of the page we would like you to circle the number which corresponds most closely to how distressing this belief is, how often you think about it, and how much you believe that it is true.

If you answer NO please move on to the next question.

Example

Do you ever feel as if people are reading your mind ?

NO YES
 (please circle)

Not at all distressing	1	2	3	4	5	Very distressing
Hardly ever think about it	1	2	3	4	5	Think about it all the time
Don't believe it's true	1	2	3	4	5	Believe it is absolutely true

Do you ever feel as if you could read other people's minds ?

NO YES
 (please circle)

Not at all distressing	1	<input checked="" type="radio"/> 2	3	4	5	Very distressing
Hardly ever think about it	1	2	<input checked="" type="radio"/> 3	4	5	Think about it all the time
Don't believe it's true	1	2	<input checked="" type="radio"/> 3	4	5	Believe it is absolutely true

1) Do you ever feel as if people seem to drop hints about you or say things with a double meaning ?

NO YES
(please circle)

Not at all distressing					Very distressing
1	2	3	4	5	
Hardly ever think about it					Think about it all the time
1	2	3	4	5	
Don't believe it's true					Believe it is absolutely true
1	2	3	4	5	

2) Do you ever feel as if things in magazines or on TV were written especially for you ?

NO YES
(please circle)

Not at all distressing					Very distressing
1	2	3	4	5	
Hardly ever think about it					Think about it all the time
1	2	3	4	5	
Don't believe it's true					Believe it is absolutely true
1	2	3	4	5	

3) Do you ever feel as if some people are not what they seem to be ?

NO YES
(please circle)

Not at all distressing					Very distressing
1	2	3	4	5	
Hardly ever think about it					Think about it all the time
1	2	3	4	5	
Don't believe it's true					Believe it is absolutely true
1	2	3	4	5	

4) Do you ever feel as if you are being persecuted in some way ?

NO YES
(please circle)

Not at all distressing					Very distressing
1	2	3	4	5	
Hardly ever think about it					Think about it all the time
1	2	3	4	5	
Don't believe it's true					Believe it is absolutely true
1	2	3	4	5	

5) Do you ever feel as if there is a conspiracy against you ?

NO YES
(please circle)

Not at all distressing					Very distressing
1	2	3	4	5	
Hardly ever think about it					Think about it all the time
1	2	3	4	5	
Don't believe it's true					Believe it is absolutely true
1	2	3	4	5	

6) Do you ever feel as if you are, or destined to be someone very important ?

NO YES
(please circle)

Not at all distressing 1	2	3	4	Very distressing 5
Hardly ever think about it 1	2	3	4	Think about it all the time 5
Don't believe it's true 1	2	3	4	Believe it is absolutely true 5

7) Do you ever feel that you are a very special or unusual person ?

NO YES
(please circle)

Not at all distressing 1	2	3	4	Very distressing 5
Hardly ever think about it 1	2	3	4	Think about it all the time 5
Don't believe it's true 1	2	3	4	Believe it is absolutely true 5

8) Do you ever feel that you are especially close to God ?

NO YES
(please circle)

Not at all distressing 1	2	3	4	Very distressing 5
Hardly ever think about it 1	2	3	4	Think about it all the time 5
Don't believe it's true 1	2	3	4	Believe it is absolutely true 5

9) Do you ever think people can communicate telepathically ?

NO YES
(please circle)

Not at all distressing 1	2	3	4	Very distressing 5
Hardly ever think about it 1	2	3	4	Think about it all the time 5
Don't believe it's true 1	2	3	4	Believe it is absolutely true 5

10) Do you ever feel as if electrical devices such as computers can influence the way you think ?

NO YES
(please circle)

Not at all distressing 1	2	3	4	Very distressing 5
Hardly ever think about it 1	2	3	4	Think about it all the time 5
Don't believe it's true 1	2	3	4	Believe it is absolutely true 5

11) Do you ever feel as if you have been chosen by God in some way ?

NO YES
(please circle)

Not at all distressing 1	2	3	4	Very distressing 5
Hardly ever think about it 1	2	3	4	Think about it all the time 5
Don't believe it's true 1	2	3	4	Believe it is absolutely true 5

12) Do you believe in the power of witchcraft, voodoo or the occult ?

NO YES
(please circle)

Not at all distressing 1	2	3	4	Very distressing 5
Hardly ever think about it 1	2	3	4	Think about it all the time 5
Don't believe it's true 1	2	3	4	Believe it is absolutely true 5

13) Are you often worried that your partner may be unfaithful ?

NO YES
(please circle)

Not at all distressing 1	2	3	4	Very distressing 5
Hardly ever think about it 1	2	3	4	Think about it all the time 5
Don't believe it's true 1	2	3	4	Believe it is absolutely true 5

14) Do you ever feel that you have sinned more than the average person ?

NO YES
(please circle)

Not at all distressing 1	2	3	4	Very distressing 5
Hardly ever think about it 1	2	3	4	Think about it all the time 5
Don't believe it's true 1	2	3	4	Believe it is absolutely true 5

15) Do you ever feel that people look at you oddly because of your appearance ?

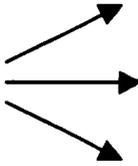
NO YES
(please circle)

Not at all distressing 1	2	3	4	Very distressing 5
Hardly ever think about it 1	2	3	4	Think about it all the time 5
Don't believe it's true 1	2	3	4	Believe it is absolutely true 5

<p>16) Do you ever feel as if you had no thoughts in your head at all ?</p> <p>NO YES</p> <p>(please circle)</p>	<p>Not at all distressing</p> <p>1 2 3 4 5</p>	<p>Very distressing</p>
	<p>Hardly ever think about it</p> <p>1 2 3 4 5</p>	<p>Think about it all the time</p>
	<p>Don't believe it's true</p> <p>1 2 3 4 5</p>	<p>Believe it is absolutely true</p>
<p>17) Do you ever feel as if the world is about to end ?</p> <p>NO YES</p> <p>(please circle)</p>	<p>Not at all distressing</p> <p>1 2 3 4 5</p>	<p>Very distressing</p>
	<p>Hardly ever think about it</p> <p>1 2 3 4 5</p>	<p>Think about it all the time</p>
	<p>Don't believe it's true</p> <p>1 2 3 4 5</p>	<p>Believe it is absolutely true</p>
<p>18) Do your thoughts ever feel alien to you in some way ?</p> <p>NO YES</p> <p>(please circle)</p>	<p>Not at all distressing</p> <p>1 2 3 4 5</p>	<p>Very distressing</p>
	<p>Hardly ever think about it</p> <p>1 2 3 4 5</p>	<p>Think about it all the time</p>
	<p>Don't believe it's true</p> <p>1 2 3 4 5</p>	<p>Believe it is absolutely true</p>
<p>19) Have your thoughts ever been so vivid that you were worried other people would hear them ?</p> <p>NO YES</p> <p>(please circle)</p>	<p>Not at all distressing</p> <p>1 2 3 4 5</p>	<p>Very distressing</p>
	<p>Hardly ever think about it</p> <p>1 2 3 4 5</p>	<p>Think about it all the time</p>
	<p>Don't believe it's true</p> <p>1 2 3 4 5</p>	<p>Believe it is absolutely true</p>
<p>20) Do you ever feel as if your own thoughts were being echoed back to you ?</p> <p>NO YES</p> <p>(please circle)</p>	<p>Not at all distressing</p> <p>1 2 3 4 5</p>	<p>Very distressing</p>
	<p>Hardly ever think about it</p> <p>1 2 3 4 5</p>	<p>Think about it all the time</p>
	<p>Don't believe it's true</p> <p>1 2 3 4 5</p>	<p>Believe it is absolutely true</p>

21) Do you ever feel as if you are a robot or zombie without a will of your own ?

NO YES
(please circle)



Not at all distressing					Very distressing
1	2	3	4	5	
Hardly ever think about it					Think about it all the time
1	2	3	4	5	
Don't believe it's true					Believe it is absolutely true
1	2	3	4	5	