Routledge
Taylor & Francis Group

Australian Psychologist

ISSN: 0005-0067 (Print) 1742-9544 (Online) Journal homepage: www.tandfonline.com/journals/rapy20

Psychometric properties of the DSM-5 Panic Disorder Dimensional Scale in an Australian community sample

Siobhan Plunkett, Bethany M. Wootton & Karen Moses

To cite this article: Siobhan Plunkett, Bethany M. Wootton & Karen Moses (2025) Psychometric properties of the DSM-5 Panic Disorder Dimensional Scale in an Australian community sample, Australian Psychologist, 60:2, 152-161, DOI: 10.1080/00050067.2024.2357280

To link to this article: https://doi.org/10.1080/00050067.2024.2357280

Published online: 30 May 2024.

AUSTRALIAN PSYCHOLOGIST
2025, VOL. 60, NO. 2, 152–161
https://doi.org/10.1080/00050067.2024.2357280

ORIGINAL ARTICLE

OPEN ACCESS Check for updates

Psychometric properties of the DSM-5 Panic Disorder Dimensional Scale in an Australian community sample

Siobhan Plunkett[a], Bethany M. Wootton[b] and Karen Moses[a]

[a]School of Psychology, Western Sydney University, Penrith, New South Wales, Australia; [b]Discipline of Psychology, Graduate School of Health, University of Technology Sydney, Ultimo, New South Wales, Australia

ABSTRACT

Objective: The Panic Disorder Dimensional Scale (PD-D) was developed to provide a dimensional rating of panic disorder (PD) symptom severity alongside the traditional categorical Diagnostic and Statistical Manual of Mental Disorders (DSM) diagnosis. The aim of the present study was to evaluate the psychometric properties of the PD-D in an Australian community sample.

Method: Two-hundred and eighty-eight participants (72.9% female) aged 18–76 years (M = 28.28; SD = 12.08) completed the study.

Results: Confirmatory factor analysis indicated that PD-D demonstrates a unidimensional factor (comparative fit index [CFI] = 0.95; Tucker-Lewis index (TLI) = 0.94; standardised root mean square residual [SRMR] = 0.04). The scale also demonstrated excellent internal consistency [α = .96 (95% CI: .95–.97); ω = 0.96 (95% CI: .95–.97)], and evidence of convergent and divergent validity. A good test–retest reliability was evident for the total PD-D score (ICC = .76, p < .001).

Conclusions: The PD-D appears to be a reliable and valid measure which can be used to support diagnosis of PD in Australia. Limitations are discussed, including the use of a predominantly female sample and lack of clinician-informed data regarding current diagnoses.

KEY POINTS

What is already known about this topic:

(1) Panic disorder is a chronic disorder with high symptomatic variability over time.
(2) A dimensional approach to the assessment of panic disorder has the benefit of capturing changes in severity and symptomology over time.
(3) The Panic Disorder Dimensional Scale (PD-D) was developed by the DSM-5 Anxiety, Obsessive-Compulsive Spectrum, Posttraumatic and Dissociative Disorder workgroup to aid in the dimensional assessment of panic disorder.

What this topic adds:

(1) The current study offers support for the psychometric properties of the Panic Disorder Dimensional Scale (PD-D) in an Australian sample.
(2) The scale demonstrates a unidimensional factor structure, convergent and divergent validity, excellent internal consistency and good total score test-retest reliability.
(3) The PD-D holds promise for both clinical practice and future research into the dimensional conceptualisation of anxiety disorder symptoms.

ARTICLE HISTORY
Received 1 February 2023
Accepted 12 May 2024

KEYWORDS
Dimensional Scale; DSM-5; panic disorder; PD-D; psychometric properties; self-report

Panic disorder (PD) is characterised by recurrent unexpected panic attacks with ongoing anticipatory anxiety or maladaptive changes in behaviour (American Psychiatric Association [APA], 2022). The onset of PD usually occurs in early adulthood (de Lijster et al., 2017; Solmi et al., 2022). The median age of onset in Australia is 30 years (McEvoy et al., 2011), which is consistent with the onset of 32 years found in international samples (de Jonge et al., 2016). It is estimated that between 1.7% and 3.8% of the population experience PD during their lifetime (de Jonge et al., 2016; Kessler et al., 2012). In Australia, the 12-month prevalence rate for PD is estimated at 3.7% (5% for females and 2.3% for males; Australian Bureau of Statistics, 2022).

PD frequently occurs with other mental disorders, with up to 80% experiencing a comorbid mental disorder in their lifetime (de Jonge et al., 2016). Mood and anxiety-related disorders are the most common comorbid conditions, followed by drug or alcohol abuse disorders (Rachman & De Silva,

CONTACT Karen Moses K.Moses@westernsydney.edu.au

2010; Tilli et al., 2012). Longitudinal studies suggest PD has a chronic course, with some waxing and waning of symptoms over time (Nay et al., 2013). It is associated with high levels of disability, impairment and impacts on quality of life (Barrera & Norton, 2009; Kim et al., 2021; Olatunji et al., 2007). Individuals experiencing PD frequently present to medical settings, including emergency departments as well as primary care physicians (Horenstein & Heimberg, 2020). This results in significant costs to the individual and society (Shirneshan et al., 2013).

There is good evidence for the use of Cognitive-Behavioural Therapy in the treatment of anxiety disorders, including PD (Roberge et al., 2020). Such evidence-based treatment is best informed by a comprehensive clinical assessment, which involves a multimodal approach. Sources of assessment information include the clinical interview, functional behavioural analysis, semi-structured diagnostic interview, self-report or clinician administered rating scales, self-monitoring, and direct observation (Moses et al., 2020). Rating scales are an important part of evidence-based assessment and are frequently used as part of initial and ongoing assessment as they can quickly identify and measure symptoms and elicit information which may not have been forthcoming from the clinical interview (Moses et al., 2020). Rating scales have the advantage of being typically free or low cost and can be relatively brief, making them an effective means of measuring symptom change at multiple time points.

Since its inception, the DSM has been primarily concerned with defining discreet disorders rather than capturing the heterogeneity of presentations. This has been important in the development of evidence-based treatment approaches for a wide range of presentations (Barlow, 2002). However, in recent decades, research into the mood and anxiety-related disorders has increasingly highlighted common traits and underlying psychopathological processes, particularly for PD, where research highlights the similarities between different anxiety presentations (Barlow et al., 2014) and similarities in their developmental pathways (Kossowsky et al., 2013). A dimensional approach to the assessment and treatment of PD is increasingly seen as more parsimonious with the literature and has the benefit of capturing information such as disorder severity and sub-clinical presentations which may be important to the clinical formulation (Kraemer, 2007). Dimensional anxiety measures with a common template may also simplify comparison of symptoms across disorders which are frequently comorbid or show a developmental trajectory (Kossowsky et al., 2013; Shear et al., 2007; Silove et al., 1996).

Acknowledging the benefits of dimensional approaches, the Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-5) Anxiety, Obsessive-Compulsive Spectrum, Posttraumatic and Dissociative Disorder workgroup were tasked with the development of a set of brief measures with a common template designed to correspond with DSM-5 diagnostic criteria (LeBeau et al., 2012). The Dimensional Anxiety Scales, developed by this workgroup, assess symptoms of immediate fear and future-oriented anxiety, which are manifested in cognitive, physiological and behavioural symptoms such as danger-related thoughts, increased physiological arousal, and escape or avoidance behaviours. These core symptoms are assessed using 10 items for each anxiety diagnosis and differ according to the focus of anxiety in different disorders (e.g., bodily sensations in PD or negative social evaluation in social anxiety disorder). Used alongside categorical diagnoses, the scales can provide a measure of disorder severity, including sub-clinical presentations. Due to their brevity, they are suitable for use at regular intervals, assisting clinicians to assess symptom changes over time. An additional benefit is the inclusion of direct questions related to avoidance behaviours. These are often central to the development and maintenance of anxiety disorders but are not always reported during the clinical interview without detailed questioning (Shear et al., 2007).

Initial validation of the Panic Disorder Dimensional Scale (PD-D) in North American university and clinical samples indicated promising psychometric properties, including excellent internal consistency ($\alpha > 0.90$), convergent and divergent validity, clinical sensitivity and test–retest reliability (ICC = 0.84; LeBeau et al., 2012). The psychometric properties of the PD-D have also been examined in a German treatment seeking sample (Beesdo-Baum et al., 2012), Dutch parents of elementary school children (Moller & Bogels, 2016), German university students (Knappe et al., 2014) and a Brazilian community sample (DeSousa et al., 2017). Research to date on the German, Dutch, and Portuguese-Brazilian versions of the PD-D has demonstrated a single-factor structure (Beesdo-Baum et al., 2012; DeSousa et al., 2017; Knappe et al., 2014), good to excellent internal consistency and test–retest reliability (DeSousa et al., 2017; Knappe et al., 2014; LeBeau et al., 2012), and evidence of convergent and divergent validity (Beesdo-Baum et al., 2012; DeSousa et al., 2017; Knappe et al., 2014; LeBeau et al., 2012). The English version of the PD-D has since been evaluated in a sample of Australian adults, demonstrating high

internal consistency, convergent validity and evidence of unidimensional factor structure (Sunderland et al., 2020). Item response analysis was also conducted, suggesting that PD-D shows greatest accuracy in individuals with elevated symptoms.

Firstly, although existing research has shown the PD-D to be a valid and reliable measure of PD severity, further research is required to support generalisability across broader populations. Most notably, research to date has largely utilised samples restricted in age, gender and education level. Where clinical samples have been utilised, these have tended to be small. Secondly, research using the English version of the PD-D is sparse, and to date, there is no data on test–retest reliability in the Australian population. Given that cultural variables can have a substantial influence on the reporting of PD symptoms and the expression and prevalence of PD vary across cultures (Barlow, 2002), further validation in a broad range of cultures is important to inform the use of the PD-D in evidence-based assessment and treatment (LeBeau et al., 2012).

The current study aims to address some limitations and expand on the existing literature by examining the psychometric properties of the PD-D in an Australian community sample, particularly the increased diversity of sampled population and absence of test–retest reliability. Specifically, the study will examine the scale's (1) factor structure; (2) internal consistency; (3) test–retest reliability and (4) convergent and divergent validity. In line with existing research, it is hypothesised that the PD-D will show a unidimensional factor structure, excellent internal consistency, good test–retest reliability, and convergent and divergent validity.

Method

Participants

A total of 413 participants commenced the study. For inclusion in this study, participants were required to be at least 18 years of age and living in Australia. Individuals were excluded from this study if they lived outside of Australia or were younger than 18. A total of 288 participants were included in the study after the removal of incomplete data and participants that did not meet inclusion criteria. The final sample was predominantly female ($N = 209$, 72.6%; Male $N = 72$, 25%; Other/prefer not to say $N = 2$ .7%), with a mean age of 28.28 years ($SD = 12.08$, range = 18–76). Further sample characteristics are outlined in Table 1. The study was approved by the Human Research and Ethics Committee of Western Sydney University (approval number: H13180) in April 2019. Data collection commenced in April 2019. The study was not pre-registered.

Table 1. Participant demographics ($N = 288$).

Variable	N	%
Gender		
Female	210	72.6
Male	72	25.0
Other/prefer not to say	2	0.7
Marital status		
Single	83	63.5
Married	53	18.4
De facto	36	18.4
Divorced	11	3.8
Separated	3	1.0
Widowed	1	0.3
Employment status		
Working part time	82	28.5
Working full time	79	27.4
Unemployed	12	4.2
Studying	99	34.4
Retired	2	0.7
Full time carer	2	0.7
Other	11	3.8
Education level		
School certificate	29	10.1
Trade certificate	17	5.9
Higher school certificate	138	47.9
Bachelor's degree	55	19.1
Postgraduate degree	41	14.2
Doctorate	8	2.8
Country of origin		
Australia	224	77.8
New Zealand	2	0.7
Asia	24	8.3
Europe	4	1.4
United Kingdom	6	2.1
North America	4	1.4
South America	3	1.0
Middle east	11	3.8
Africa	5	1.7
Other	5	1.7

Procedure

This study was part of a larger body of research seeking to evaluate all dimensional anxiety measures developed by the Anxiety, Obsessive-Compulsive Spectrum, Posttraumatic and Dissociative Disorder workgroup. To date, two manuscripts have been published from this dataset (Binasis et al., 2022; Groves et al., 2023). Participants were recruited through posts on social media, community noticeboards, and via email. Participants were also invited to share the study with their networks in order to support efforts to obtain a heterogeneous sample. Recruitment source was not monitored. Potential participants received a link to the online questionnaire. In Time 1, participants reviewed an information sheet and consent form, followed by a demographic questionnaire. The PD-D and additional study questionnaires were completed in fixed order as follows: PD-D, Panic Disorder Severity Scale (PDSS: Shear et al., 1997), Short-Form Social Interaction Anxiety and

Social Phobia Scale (SIAS-6 and SPS-6: Peters et al., 2012). Upon completion, participants were invited to participate in Time 2, involving completion of the PD-D a second time to investigate test–retest reliability. Interested participants created a unique identification code to anonymously link responses from Time 1 and Time 2. The link to complete the PD-D again was provided 2 weeks later via email. Forty-nine individuals participated in Time 2. Of these, 26 were able to be matched with complete data from Time 1.

Measures

Panic Disorder Dimensional Scale (PD-D; Le Beau et al., 2012)

The PD-D is a 10-item self-report measure which examines the frequency of panic disorder symptoms over the past month. Items are rated on a 5-point Likert scale ranging from 0 ("never") to 4 ("all of the time"). A total score is created by summing responses across the 10 items, with higher scores representing greater severity. The first five items examine the cognitive, subjective-emotional, and physiological experience of fear or anxiety (e.g., "felt anxious, worried, or nervous about having more panic attacks"), while the next five items examine behavioural or cognitive avoidance related to the fear or anxiety (e.g., "avoided situations in which panic attacks might occur"). The PD-D has demonstrated good to excellent internal consistency (α between .88 and .96; DeSousa et al., 2017; Knappe et al., 2014; Moller & Bogels, 2016).

Panic Disorder Severity Scale – Self Report Form (PDSS-SR; Houck et al., 2002; Shear et al., 1997)

The PDSS-SR is a seven-item scale used to assess the severity of PD symptomology. Items are rated on a 5-point Likert scale from 0 ("none") to 4 ("extreme"). Responses are summed to create a total score from 0 to 28, with higher scores representing greater severity. The PDSS-SR has been shown to have good internal consistency (α = .92; Houck et al., 2002).

The Social Interaction Anxiety Scale-6 (SIAS-6) and Social Phobia Scale-6 (SPS-6; Mattick & Clarke, 1998; Peters et al., 2012)

The SIAS-6 and SPS-6 are six-item self-report companion measures designed to assess two distinct aspects of social anxiety. The SIAS-6 assesses fears related to social interaction, including initiation and maintenance (e.g., eye contact). The SPS-6 assesses fears of being scrutinised during everyday activities (e.g., worry about shaking or trembling). Across both measures, items are rated on a 5-point Likert scale ranging from 0 ("not at all characteristic or true of me") to 4 ("extremely characteristic or true of me"), resulting in total scores between 0 and 24 for each scale, with higher scores representing greater severity. The SIAS-6 and SPS-6 have been shown to retain the construct validity of the longer SIAS and SPS forms (Peters et al., 2012) and demonstrate acceptable to good internal consistency in clinical and non-clinical samples (α = .75–79 for the SIAS-6 and α = .85–.87 for the SPS-6; Le Blanc et al., 2014).

Statistical analyses

Analyses were conducted using IBM SPSS Statistics Version 28 and IBM SPSS Amos Version 28. Assumption testing revealed non-normal data with a positive skew (1.29) and light-tailed kurtosis (.80), therefore non-parametric tests were used where appropriate. Outliers were examined for total scores (operationalised as >3.29 standard deviations above the mean), revealing three for the PDSS-SR, SIAS-6 and SPS-6, and one for the PD-D. These were retained as there was no evidence these responses were not an accurate reflection of the population under investigation.

Confirmatory factor analysis (CFA) using maximum likelihood estimation was used to determine the factor structure of the PD-D from data collected in Time 1. Data showed strong evidence of multivariate non-normality with positive kurtosis (C.R. = 68.98), therefore maximum likelihood (ML) estimation with bootstrapping (500) was used to estimate model parameters (Byrne, 2016). ML was used due to evidence that ordinal data with five or more categories can be treated as approximately continuous (Rhemtulla et al., 2012). The comparative fit index (CFI), TLI, standardised root mean square residual (SRMR) and the Root Mean Square Error of Approximation (RMSEA) with 90% confidence interval (CI) were chosen to assess goodness of fit, as recommended by Hu and Bentler (1998). Maydeu-Olivares et al. (2018) also suggest that the SRMR is an appropriate choice for non-normal data. CFI and TLI values greater than or equal to 0.90 were taken to indicate acceptable fit to the model, and values greater than 0.95 to indicate good fit. SRMR and RMSEA values less than 0.08 were taken to indicate acceptable fit, and values less than or equal to 0.05 to indicate good fit (Brown, 2006; Hu & Bentler, 1999). The power analysis indicated that with a medium effect size, alpha of .05 and power of .08, 181 participants were required to assess factor analysis (Faul et al., 2007), which was exceeded in the current study.

Internal consistency of PD-D responses in Time 1 and Time 2 was assessed using Cronbach's α and

McDonald's Omega with 95% CI. Test–retest reliability was examined by calculating Intraclass Correlational Coefficients (ICCs) between PD-D scores from Time 1 and Time 2. This was calculated using a two-way mixed effect model and absolute agreement type, with confidence interval set to 95%. ICCs above 0.50, 0.75, and 0.90 were considered to indicate moderate, good or excellent reliability, respectively (Koo & Li, 2016). Given an ICC of at least .80 was expected based on the existing literature (LeBeau et al., 2012) with two administrations, confidence interval of .20, 50% assurance probability, a total sample size of 55 was required for these analyses (Borg et al., 2022). A paired-samples *t*-test was also used to compare the mean scores from the Time 1 and Time 2 administration.

Due to nonnormal data, convergent and divergent validity were examined using Spearman's ρ to obtain correlations between the PD-D and PDSS, PD-D and SIAS-6, and PD-D and SPS-6. Visual inspection of scatterplots indicated a monotonic relationship between variables. The study was adequately powered to assess the expected large relationship between the PD-D and convergent measures (alpha = .05; power = .80; r = .50; N = 29), however was underpowered to assess the expected small relationship between the PD-D and divergent measures (alpha = .05; power = .80; r = .10; N = 783; Hulley et al., 2013).

Results

Descriptive statistics

Descriptive statistics for the sample are represented in Table 2. Of participants who completed the PD-D in Time 1, 72.2% had a total score between 0–10, 14.6% scored 11–20, 9.7% scored 21–30 and 3.5% scored 31–40. 63/288 (21.9%) of the sample reported symptoms potentially indicative of panic disorder, considering a cut-point of 15 (Beesdo-Baum et al., 2012).

Factor structure

Initial CFA results showed evidence of adequate model fit according to the CFI and TLI, ($\chi2(35) = 246.08$, $p < .001$, CFI = 0.93, TLI = 0.91), good fit according to the SRMR (SRMR = 0.04), but unacceptable RMSEA (RMSEA = .15, 90% CI .13 to .16). Post hoc review of modification indices indicated high local covariance between items 4 and 5 (examining physiological symptoms), items 6 and 7 (examining avoidance and escape behaviours) and items 8 and 9 (examining behavioural and cognitive avoidance behaviours). In line with the methodology of DeSousa et al. (2017), another CFA was conducted including correlations between the error terms of these items. The adjusted model showed improved fit to the data ($\chi2(32) = 164.37$, $p < .001$, CFI = .95, TLI = .94, and SRMR = 0.04), with the exception of RMSEA (RMSEA = .12, 90% CI .10 to .14). Moderate correlation coefficients were found for the local dependency estimates between the errors of items added to the model, with .32 for items 4 and 5, .35 for items 6 and 7, and .32 for items 8 and 9 (all $p < .001$). Squared multiple correlations and unstandardised and standardised regression weights in the best-fit model are shown in Table 3. All items loaded significantly on the single factor [range = 0.76 (Item 10) – 0.89 (Item 2)]. Correlation coefficients between PD-D items are provided in Table 4.

Validity

There was a strong positive correlation between the PD-D and the PDSS-SR ($r_s = 0.77$, $p < .001$) and weaker positive correlations between the PD-D and

Table 2. Descriptive statistics for measures in time 1 (N = 288).

Measure	Cronbach's alpha (95% CI)	McDonald's Omega (95% CI)	*M (SD)*	Median	Range	Possible range
PD-D total	0.96 (.95–.97)	0.96 (.95–.97)	7.55 (9.34)	3.5	0–40	0–40
Item 1	–	–	0.73 (1.00)	0.00	0–4	0–4
Item 2	–	–	0.75 (1.05)	0.00	0–4	0–4
Item 3	–	–	0.67 (1.05)	0.00	0–4	0–4
Item 4	–	–	0.82 (1.09)	0.00	0–4	0–4
Item 5	–	–	1.03 (1.17)	1.00	0–4	0–4
Item 6	–	–	0.75 (1.06)	0.00	0–4	0–4
Item 7	–	–	0.65 (1.04)	0.00	0–4	0–4
Item 8	–	–	0.80 (1.19)	0.00	0–4	0–4
Item 9	–	–	0.83 (1.18)	0.00	0–4	0–4
Item 10	–	–	0.53 (1.06)	0.00	0–4	0–4
PDSS-SR total	0.92 (.90–.93)	.92 (.89–.93)	3.74 (4.61)	2	0–24	0–28
SIAS-6 total	0.88 (.86–.90)	.88 (.85–.90)	5.91 (5.36)	5	0–24	0–24
SPS-6 total	0.91 (.90–.93)	.91 (.89–.93)	5.85 (5.93)	4	0–24	0–24

Abbreviations: PD-D, Panic Disorder Dimensional Scale; PDSS-SR, Panic Disorder Severity Scale – Self Report Form; Social Anxiety Interaction Anxiety Scale-6, SIAS-6; Social Phobia Scale-6, SPS-6.

Table 3. Factor loadings and squared multiple correlations for the PD-D ($N = 288$).

Item	Unstandardised	Standardised	Squared multiple correlations
Item 1	1.00	0.88	0.75
Item 2	1.08	0.89	0.79
Item 3	1.07	0.88	0.78
Item 4	1.11	0.88	0.78
Item 5	1.07	0.79	0.63
Item 6	1.01	0.82	0.68
Item 7	1.01	0.84	0.70
Item 8	1.11	0.81	0.65
Item 9	1.14	0.83	0.69
Item 10	0.92	0.76	0.57

Abbreviation: PD-D, Panic Disorder Dimensional Scale.
All unstandardised and standardised factor loadings were significant at < .001.

Table 4. Spearman rank order correlations between PD-D items ($N = 288$).

Item	1	2	3	4	5	6	7	8	9	10
1	–									
2	.79	–								
3	.73	.79	–							
4	.80	.79	.76	–						
5	.68	.72	.68	.78	–					
6	.68	.70	.70	.70	.64	–				
7	.72	.71	.69	.69	.66	.81	–			
8	.71	.71	.70	.71	.66	.80	.75	–		
9	.67	.71	.73	.69	.67	.80	.75	.79	–	
10	.64	.65	.67	.62	.59	.68	.67	.71	.68	–

All correlations significant at $p < .001$.
Abbreviation: PD-D, Panic Disorder Dimensional Scale.

SIAS-6 ($r_s = .59$, $p < .001$) and SPS-6 ($r_s = .40$, $p < .001$), providing evidence of convergent and divergent validity.

Reliability

Cronbach's α for the PD-D in Time 1 was 0.96 (95% CI: .95–.97). McDonalds ω for the PD-D in Time 1 was also 0.96 (95% CI: .95–.97). Good test–retest reliability was evident for the total PD-D score (ICC = .76, $p < .001$); however, mixed results were seen for individual items. When comparing only participants who completed the PD-D at both Time 1 ($M = 6.89$; $SD = 9.53$) and Time 2 ($M = 6.19$; $SD = 6.67$) ($N = 26$) the mean scores were not significantly different ($t_{(25)} = .611$ $p = .273$; $d = 0.12$).

Discussion

The PD-D is a brief self-report scale designed to provide a dimensional rating of panic disorder severity alongside DSM-5-TR categorical diagnoses. The aim of the present study was to examine the psychometric properties of the PD-D in an Australian community sample. It was hypothesised that the results would be consistent with previous findings, showing that the PD-D exhibits a unidimensional factor structure, good to excellent internal reliability, good test–retest reliability and evidence of convergent and divergent validity. In the present study, all hypotheses were supported.

Factor structure

As expected, the results of the present study suggest that the PD-D has a unidimensional factor structure. This is consistent with previous evaluations of the English, German and Portuguese-Brazilian versions of the scale (Beesdo-Baum et al., 2012; DeSousa et al., 2017; Knappe et al., 2014; Sunderland et al., 2020). While model fit was adequate in the initial CFA, review of modification indices suggested improved fit with inclusion of correlations between the errors of items 4 and 5 (examining physiological symptoms), items 6 and 7 (examining avoidance and escape behaviours) and items 8 and 9 (examining behavioural and cognitive avoidance behaviours). There were also strong correlations between these items, suggesting a close relationship between these symptoms. Similarly, DeSousa et al. (2017) also found adequate fit, with inclusion of error correlations for items 6 and 7, however, did not find evidence for inclusion of correlations between other error terms. In summary, the present findings add to the weight of evidence suggesting the PD-D exhibits a unidimensional factor structure, with items measuring the construct of PD severity.

Reliability

The present study demonstrated that the PD-D has excellent internal reliability, consistent with previous studies utilising both clinical and non-clinical samples (DeSousa et al., 2017; Knappe et al., 2014; LeBeau et al., 2012; Moller & Bogels, 2016; Sunderland et al., 2020). Test–retest reliability was also examined, showing good test–retest reliability for the total PD-D score. This is consistent with previous studies examining test–retest reliability in non-clinical samples (DeSousa et al., 2017; Knappe et al., 2014; LeBeau et al., 2012). The present study was the first to examine test–retest within an Australian population.

Validity

Convergent validity of the PD-D was demonstrated in the present study with a strong correlation with the PDSS-SR (Houck et al., 2002; Shear et al., 1997). Previous comparisons with the PDSS-SR yielded similar results (DeSousa

et al., 2017; Sunderland et al., 2020). Evidence for divergent validity was seen in weaker correlations between the PD-D and SPS-6 and SIAS-6 (Mattick & Clarke, 1998; Peters et al., 2012). Sunderland et al. (2020) found a similar pattern of results to the present study, with a stronger correlation between the PD-D and SPS compared with the SIAS. Individuals who experience PD also commonly have fears related to the perception of others, and SAD is frequently comorbid (Rachman & De Silva, 2010); therefore, reasonably high correlations between PD and SAD symptoms are unsurprising. Future studies may wish to consider comparisons with measures of less frequently comorbid conditions such as the eating disorders or obsessive-compulsive disorder.

Strengths

The present study provides an important investigation of the psychometric properties of the PD-D, adding to the growing literature demonstrating the psychometric properties of the DSM-5 dimensional scales in the Australian population (Binasis et al., 2022; Carey et al., 2019; Cheyne et al., 2018; Macfarlane et al., 2020; Sunderland et al., 2020). Importantly, this is the first study to provide data on test–retest reliability in an Australian sample. Results highlight the utility of not only examining change in total scale scores but also change in individual symptom data (Fried & Nesse, 2015). As one of the several dimensional anxiety scales developed with a common template, the PD-D may be particularly useful in comparing individual symptoms across disorders and the effects of external factors on symptoms of several comorbid presentations. Treatment focusing on symptoms of one disorder may also have flow on effects to those of a co-occurring disorder (Barlow et al., 2014), and in this regard, the dimensional anxiety scales may be particularly well suited to measuring treatment response.

Limitations

Notwithstanding these important findings, there are several limitations to this study that should be considered. Firstly, although the present study included a diverse sample similar to the general Australian population in terms of educational level and employment (Australian Bureau of Statistics, 2021b), and country of birth (Australian Bureau of Statistics, 2021a), the majority of participants were female and under 25 years of age. This limits the generalisability of our results to the Australian population as a whole. The high proportion of female respondents in the present study is similar to other studies of clinical and non-clinical samples (Beesdo-Baum et al., 2012; DeSousa et al., 2017; Knappe et al., 2013; LeBeau et al., 2012; Moller & Bogels, 2016; Sunderland et al., 2020) and may reflect the greater proportion of Australian females who experience anxiety disorders compared to males (Australian Bureau of Statistics, 2022). This could result in a greater female interest in participation in a study related to anxiety disorders.

Secondly, the proportion of participants who completed the PD-D across Time 1 and Time 2 was relatively small, and these participants could represent a sub-population with a particular interest in the study topic. Inclusion of a monetary incentive in future studies may result in a more gender-balanced sample of participants and increase motivation to participate over multiple time points.

Thirdly, although review of responses indicated that most participants who completed the PD-D in Time 2 did so within approximately 2 weeks of Time 1, the time period between responses was not closely monitored. Future studies may wish to constrain responding to a set time period in order to assess symptom changes within a precise time frame and reduce sources of variability.

Finally, the present study did not gather information regarding clinical diagnoses, with data regarding participant symptom severity gathered from self-report measures alone. Although clinical sensitivity has been established in the German and Dutch translations of the PD-D (Beesdo-Baum et al., 2012; Knappe et al., 2013, 2014; Moller & Bogels, 2016), data using the English version are limited (LeBeau et al., 2012). Future studies may wish to use more comprehensive assessment methods to determine how PD-D scores relate to the likelihood of DSM-5-TR categorical diagnoses.

Conclusion

In conclusion, the present study provides further support for use of the PD-D as a valid and reliable self-report measure of PD symptom severity. The scale holds promise for both clinical practice and future research into the dimensional conceptualisation of anxiety disorder symptoms. The PD-D is both brief and thorough, capturing subjective-emotional, physiological, and behavioural expressions of fear and anxiety experienced in PD. Future research investigating potential differences between the “7 day” and “past month” versions of the PD-D in clinical samples would provide further information to support their use in clinical settings. Additional studies examining test–retest reliability in larger samples with elevated symptoms are also warranted to provide

clinicians with further information about the interpretation of total and individual item scores.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

ORCID

Bethany M. Wootton http://orcid.org/0000-0001-9036-0699
Karen Moses http://orcid.org/0000-0003-0968-5432

Data availability statement

The data of the present study are available upon request from the corresponding author.

References

American Psychiatric Association. (2022). *Diagnostic and statistical manual of mental disorders* (5th ed., text rev). https://doi.org/10.1176/appi.books.9780890425787

Australian Bureau of Statistics. (2021a). *Cultural diversity: Census*. https://www.abs.gov.au/statistics/people/people-and-communities/cultural-diversity-census/2021

Australian Bureau of Statistics. (2021b). *Education and work, Australia*. https://www.abs.gov.au/statistics/people/education/education-and-work-australia/may-2021

Australian Bureau of Statistics. (2022). *National survey of mental health and wellbeing*. https://www.abs.gov.au/statistics/health/mental-health/national-survey-mental-health-and-wellbeing-summary-results/latest-release

Barlow, D. H. (2002). *Anxiety and its disorders: The nature and treatment of anxiety and panic*. Guilford Press.

Barlow, D. H., Sauer-Zavala, S., Carl, J. R., Bullis, J. R., & Ellard, K. K. (2014). The nature, diagnosis, and treatment of neuroticism: Back to the future. *Clinical Psychological Science*, *2*(3), 344–365. https://doi.org/10.1177/2167702613505532

Barrera, T. L., & Norton, P. J. (2009). Quality of life impairment in generalized anxiety disorder, social phobia, and panic disorder. *Journal of Anxiety Disorders*, *23*(8), 1086–1090. https://doi.org/10.1016/j.janxdis.2009.07.011

Beesdo-Baum, K., Klotsche, J., Knappe, S., Craske, M. G., LeBeau, R. T., Hoyer, J., Strobel, A., Pieper, L., & Wittchen, H. U. (2012). Psychometric properties of the dimensional anxiety scales for DSM-V in an unselected sample of German treatment seeking patients. *Depression and Anxiety*, *29*(12), 1014–1024. https://doi.org/10.1002/da.21994

Binasis, T., Groves, D., Wootton, B. M., & Moses, K. (2022). Psychometric properties of the DSM-5 social anxiety disorder dimensional scale in an Australian community sample. *Journal of Clinical Psychology*, *78*(5), 938–950. https://doi.org/10.1002/jclp.23262

Borg, D. N., Bach, A. J. E., O'Brien, J. L., & Sainani, K. L. (2022). Calculating sample size for reliability studies [Article]. *PM and R*, *14*(8), 1018–1025. https://doi.org/10.1002/pmrj.12850

Brown, T. A. (2006). *Confirmatory factor analysis for applied research*. Guilford Press.

Byrne, B. M. (2016). *Structural equation modeling with AMOS: Basic concepts, applications, and programming* (3rd ed.). Routledge.

Carey, E. A., Del Pozo de Bolger, A., & Wootton, B. M. (2019). Psychometric properties of the hoarding disorder-dimensional scale. *Journal of Obsessive-Compulsive and Related Disorders*, *21*, 91–96. https://doi.org/10.1016/j.jocrd.2019.01.001

Cheyne, J. E., Del Pozo de Bolger, A., & Wootton, B. M. (2018). Reliability and validity of the Trichotillomania Dimensional Scale (TTM-D). *Journal of Obsessive-Compulsive and Related Disorders*, *19*, 61–65. https://doi.org/10.1016/j.jocrd.2018.08.004

de Jonge, P., Roest, A. M., Lim, C. C. W., Florescu, S. E., Bromet, E. J., Stein, D. J., Harris, M., Nakov, V., Caldas de Almeida, J. M., Levinson, D., Al-Hamzawi, A. O., Haro, J. M., Viana, M. C., Borges, G., O'Neill, S., de Girolamo, G., Demyttenaere, K., Gureje, O., Iwata, N., … Scott, K. M. (2016). Cross-national epidemiology of panic disorder and panic attacks in the world mental health surveys. *Depression and Anxiety*, *33*(12), 1155–1177. https://doi.org/10.1002/da.22572

de Lijster, J. M., Dierckx, B., Utens, E. M., Verhulst, F. C., Zieldorff, C., Dieleman, G. C., & Legerstee, J. S. (2017). The age of onset of anxiety disorders. *The Canadian Journal of Psychiatry*, *62*(4), 237–246. https://doi.org/10.1177/0706743716640757

DeSousa, D. A., Moreno, A. L., Osório, F. L., Crippa, J. A. S., LeBeau, R., Manfro, G. G., Salum, G. A., & Koller, S. H. (2017). Psychometric properties of the dimensional anxiety scales for DSM-5 in a Brazilian community sample. *International Journal of Methods in Psychiatric Research*, *26*(3). https://doi.org/10.1002/mpr.1531

Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G* power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, *39*(2), 175–191. https://doi.org/10.3758/BF03193146

Fried, E. I., & Nesse, R. M. (2015). Depression sum-scores don't add up: Why analysing specific depression symptoms is essential. *BMC Medicine*, *13*(1), 72–72. https://doi.org/10.1186/s12916-015-0325-4

Groves, D., Binasis, T., Wootton, B., Moses, K., & Vega-Muñoz, A. (2023). Psychometric properties of the generalised anxiety disorder dimensional scale in an Australian sample. *PLOS ONE*, *18*(6), e0286634. https://doi.org/10.1371/journal.pone.0286634

Horenstein, A., & Heimberg, R. G. (2020). Anxiety disorders and healthcare utilization: A systematic review. *Clinical Psychology Review*, *81*, 101894. https://doi.org/10.1016/j.cpr.2020.101894

Houck, P. R., Spiegel, D. A., Shear, M. K., & Rucci, P. (2002). Reliability of the self-report version of the panic disorder

severity scale. *Depression and Anxiety*, *15*(4), 183–185. https://doi.org/10.1002/da.10049

Hu, L. T., & Bentler, P. M. (1998). Fit indices in covariance structure modelling: Sensitivity to underparameterized model misspecification. *Psychological Methods*, *3*(4), 424–453. https://doi.org/10.1037/1082-989X.3.4.424

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, *6*(1), 1–55. https://doi.org/10.1080/10705519909540118

Hulley, S. B., Cummings, S. R., Browner, W. S., Grady, D., & Newman, T. B. (2013). *Designing clinical research : An epidemiologic approach*. Lippincott Williams & Wilkins.

Kessler, R. C., Petukhova, M., Sampson, N. A., Zaslavsky, A. M., & Wittchen, H. U. (2012). Twelve-month and lifetime prevalence and lifetime morbid risk of anxiety and mood disorders in the United States. *International Journal of Methods in Psychiatric Research*, *21*(3), 169–184. https://doi.org/10.1002/mpr.1359

Kim, H. J., Kim, J. E., & Lee, S. H. (2021). Functional impairment in patients with panic disorder. *Psychiatry Investigation*, *18*(5), 434–442. https://doi.org/10.30773/pi.2020.0425

Knappe, S., Klotsche, J., Heyde, F., Hiob, S., Siegert, J., Hoyer, J., Strobel, A., LeBeau, R. T., Craske, M. G., Wittchen, H. U., & Beesdo-Baum, K. (2014). Test–retest reliability and sensitivity to change of the dimensional anxiety scales for DSM-5. *CNS Spectrums*, *19*(3), 256–267. https://doi.org/10.1017/S1092852913000710

Knappe, S., Klotsche, J., Strobel, A., LeBeau, R. T., Craske, M. G., Wittchen, H. U., & Beesdo-Baum, K. (2013). Dimensional anxiety scales for DSM-5: Sensitivity to clinical severity. *European Psychiatry*, *28*(7), 448–456. https://doi.org/10.1016/j.eurpsy.2013.02.001

Koo, T. K., & Li, M. Y. (2016). A guideline of selecting and reporting intraclass correlation coefficients for reliability research. *Journal of Chiropractic Medicine*, *15*(2), 155–163. https://doi.org/10.1016/j.jcm.2016.02.012

Kossowsky, J., Pfaltz, M. C., Schneider, S., Taeymans, J., Locher, C., & Gaab, J. (2013). The separation anxiety hypothesis of panic disorder revisited: A meta-analysis. *American Journal of Psychiatry*, *170*(7), 768–781. https://doi.org/10.1176/appi.ajp.2012.12070893

Kraemer, H. C. (2007). DSM categories and dimensions in clinical and research contexts. *International Journal of Methods in Psychiatric Research*, *16*(S1), S8–S15. https://doi.org/10.1002/mpr.211

LeBeau, R. T., Glenn, D. E., Hanover, L. N., Beesdo-Baum, K., Wittchen, H. U., & Craske, M. G. (2012). A dimensional approach to measuring anxiety for DSM-5. *International Journal of Methods in Psychiatric Research*, *21*(4), 258–272. https://doi.org/10.1002/mpr.1369

Le Blanc, A. L., Bruce, L. C., Heimberg, R. G., Hope, D. A., Blanco, C., Schneier, F. R., & Liebowitz, M. R. (2014). Evaluation of the psychometric properties of two short forms of the social interaction anxiety scale and the social phobia scale. *Assessment*, *21*(3), 312–323. https://doi.org/10.1177/1073191114521279

Macfarlane, F., Luo, A., Moses, K., Russell, A., Cheyne, J., Bolger, A. D. P., & Wootton, B. M. (2020). Psychometric properties of the body dysmorphic disorder-dimensional scale. *Clinical Psychologist*, *24*(2), 114–122. https://doi.org/10.1111/cp.12200

Mattick, R. P., & Clarke, J. C. (1998). Development and validation of measures of social phobia scrutiny fear and social interaction anxiety. *Behaviour Research and Therapy*, *36*(4), 455–470. https://doi.org/10.1016/S0005-7967(97)10031-6

Maydeu-Olivares, A., Shi, D., & Rosseel, Y. (2018). Assessing fit in structural equation models: A monte-carlo evaluation of RMSEA versus SRMR confidence intervals and tests of close fit. *Structural Equation Modeling: A Multidisciplinary Journal*, *25*(3), 389–402. https://doi.org/10.1080/10705511.2017.1389611

McEvoy, P. M., Grove, R., & Slade, T. (2011). Epidemiology of anxiety disorders in the Australian general population: Findings of the 2007 Australian national survey of mental health and wellbeing. *Australasian Psychiatry: Bulletin of the Royal Australian & New Zealand College of Psychiatrists*, *45*(11), 957–967. https://doi.org/10.3109/00048674.2011.624083

Moller, E. L., & Bogels, S. M. (2016). The DSM-5 dimensional anxiety scales in a Dutch non-clinical sample: Psychometric properties including the adult separation anxiety disorder scale. *International Journal of Methods in Psychiatric Research*, *25*(3), 232–239. https://doi.org/10.1002/mpr.1515

Moses, K., Gayed, M., Chuah, S., & Wootton, B. M. (2020). The use of evidence-based assessment for anxiety disorders in an Australian sample. *Journal of Anxiety Disorders*, *75*, 102279–102279. https://doi.org/10.1016/j.janxdis.2020.102279

Nay, W., Brown, R., & Roberson-Nay, R. (2013). Longitudinal course of panic disorder with and without agoraphobia using the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC). *Psychiatry Research*, *208*(1), 54–61. https://doi.org/10.1016/j.psychres.2013.03.006

Olatunji, B. O., Cisler, J. M., & Tolin, D. F. (2007). Quality of life in the anxiety disorders: A meta-analytic review. *Clinical Psychology Review*, *27*(5), 572–581. https://doi.org/10.1016/j.cpr.2007.01.015

Peters, L., Rapee, R. M., Sunderland, M., Andrews, G., & Mattick, R. P. (2012). Development of a short form Social Interaction Anxiety (SIAS) and Social Phobia Scale (SPS) using nonparametric item response theory: The SIAS-6 and the SPS-6. *Psychological Assessment*, *24*(1), 66–76. https://doi.org/10.1037/a0024544

Rachman, S., & De Silva, P. (2010). *Panic disorder* (3rd ed.). Oxford University Press.

Rhemtulla, M., Brosseau-Liard, P. É., & Savalei, V. (2012). When can categorical variables be treated as continuous? A comparison of robust continuous and categorical SEM estimation methods under suboptimal conditions. *Psychological Methods*, *17*(3), 354–373. https://doi.org/10.1037/a0029315

Roberge, P., Provencher, M. D., Gaboury, I., Gosselin, P., Vasiliadis, H.-M., Benoît, A., Carrier, N., Antony, M. M., Chaillet, N., Houle, J., Hudon, C., & Norton, P. J. (2020). Group transdiagnostic cognitive-behavior therapy for anxiety disorders: A pragmatic randomized clinical trial. *Psychological Medicine*, *52*(13), 1–11. https://doi.org/10.1017/S0033291720004316

Shear, M. K., Bjelland, I., Beesdo, K., Gloster, A. T., & Wittchen, H. U. (2007). Supplementary dimensional assessment in anxiety disorders. *International Journal of Methods*

in Psychiatric Research, *16*(S1), S52–S64. https://doi.org/10.1002/mpr.215

Shear, M. K., Brown, T. A., Barlow, D. H., Money, R., Sholomskas, D. E., Woods, S. W., Gorman, J. M., & Papp, L. A. (1997). Multicenter collaborative panic disorder severity scale. *The American Journal of Psychiatry*, *154*(11), 1571–1575. https://doi.org/10.1176/ajp.154.11.1571

Shirneshan, E., Bailey, J., Relyea, G., Franklin, B. E., Solomon, D. K., & Brown, L. M. (2013). Incremental direct medical expenditures associated with anxiety disorders for the U.S. adult population: Evidence from the medical expenditure panel survey. *Journal of Anxiety Disorders*, *27*(7), 720–727. https://doi.org/10.1016/j.janxdis.2013.09.009

Silove, D., Manicavasagar, V., Curtis, J., & Blaszczynski, A. (1996). Is early separation anxiety a risk factor for adult panic disorder?: A critical review. *Comprehensive Psychiatry*, *37*(3), 167–179. https://doi.org/10.1016/S0010-440X(96)90033-4

Solmi, M., Radua, J., Olivola, M., Croce, E., Soardo, L., Salazar de Pablo, G., Il Shin, J., Kirkbride, J. B., Jones, P., Kim, J. H., Kim, J. Y., Carvalho, A. F., Seeman, M. V., Correll, C. U., & Fusar-Poli, P. (2022). Age at onset of mental disorders worldwide: Large-scale meta-analysis of 192 epidemiological studies. *Molecular Psychiatry*, *27*(1), 281–295. https://doi.org/10.1038/s41380-021-01161-7

Sunderland, M., Batterham, P. J., Calear, A. L., Carragher, N., & Slade, T. (2020). The psychometric properties of 30-day versions of the DSM-5 dimensional severity scales for social anxiety disorder and panic disorder. *Psychiatry Research*, *291*, 113229. https://doi.org/10.1016/j.psychres.2020.113229

Tilli, V., Suominen, K., & Karlsson, H. (2012). Panic disorder in primary care: Comorbid psychiatric disorders and their persistence. *Scandinavian Journal of Primary Health Care*, *30*(4), 247–253. https://doi.org/10.3109/02813432.2012.732471