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Penn State Worry Questionnaire: structure and psychometric properties of the Chinese version*

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Abstract: The Penn State Worry Questionnaire (PSWQ) is a measure of worry phenomena and has been demonstrated valid in cross-cultural populations. The present study examined the factor structure and psychometric properties of the Chinese version of PSWQ (Ch-PSWQ) in a Chinese college sample (n=1243). Exploratory factor analysis of the Ch-PSWQ revealed a two-factor solution (engagement of worry and absence of worry). Confirmatory factor analysis and model comparison supported that the model of one factor with method effect provided the best fit to the data. The Ch-PSWQ and its factors evidenced good internal consistency and both convergent and discriminate validity. The present study supports the opinion that the second factor of PSWQ not only contains the component of evaluating pathological worry, but also might represent other traits.

Key words: Worry, Penn State Worry Questionnaire (PSWQ), Construct, Reliability, Validity
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INTRODUCTION

Worry, as the central feature of generalized anxiety disorder (GAD), is regarded as an apprehensive expectation about real-life concerns such as finances, relations, work, school, household chores, and so on (Barlow, 2002; Roemer *et al*., 1997). Borkovec (1994) defined worry as a negative effect characterized by uncontrollable fear, thoughts, and images and focused on negative outcomes. As an important emotion in the spectrum of anxiety and fear, worry is considered by some to exist in various anxiety disorders, such as obsessive compulsive disorder (OCD), social anxiety, and panic disorder (Barlow, 1988; Dugas *et al*., 1998). Worry also appears to be a common phenomenon in depression (Molina *et al.*, 1998) and has been conceptualized as a cognitive component of anxiety that involves attentional vigilance and distorted information processing (Barlow, 2002; Craske, 1999). However, a clear understanding of worry remains elusive.

Given the importance of the construct of worry, a reliable and valid assessment is essential. One of the most widely used measures of worry, developed by Meyer *et al*.(1990), is the Penn State Worry Questionnaire (PSWQ). The PSWQ was designed to capture the generality, excessiveness, and uncontrollability dimensions of pathological worry. Since 1990, the PSWQ has been widely used as a self-report measure of worry and GAD. The PSWQ has also been used in most treatment outcome studies of GAD (Barlow *et al*., 1992; Borkovec and Costello, 1993; Ladouceur *et al*., 2000), laboratory investigations (Butler *et al*., 1995), and GAD psychopathology studies (Beck *et al*., 1996).

PSWQ has 16 items and each item is rated on a scale from 1 (‘not at all typical of me’) to 5 (‘very typical of me’). Eleven items are worded in the direction of pathological worry, with higher numbers indicating more worry (e.g., ‘Once I start worrying, I

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cannot stop'), while the remaining five items are worded to indicate that worry is not a problem, with higher numbers indicating less worry (e.g., 'I never worry about anything'). Total score is calculated by summing the first 11 items and the reverse-scores of the latter 5 items, with higher PSWQ scores reflecting greater levels of pathological worry.

The structure of the PSWQ has been examined in many studies. In the development of the PSWQ, Meyer *et al*.(1990) firstly reported that, with a predominantly non-patient sample, its items were loaded onto a single factor. This result, which has come to be known as the one-factor model of PSWQ, was repeated by Brown *et al*.(1992) with clinical samples. However, after Meyer *et al*.(1990) and Brown *et al*. (1992), other researchers have consistently reported a two-factor model (Beck *et al*., 1995; Fresco *et al*., 2002; van Rijsoort *et al*., 1999; Stöber, 1995). These later researchers found that the first factor, which they termed general worry or engagement of worry, consists of 11 items phrased in the symptomatic direction, and the second factor, termed absence of worry, consists of 5 reverse-worded items.

Considering that the exploratory factor analysis (EFA) does not allow for clarifying the reason of two factors consisting of positive and negative items of the PSWQ (Beck *et al*., 1995; Brown, 2003), the confirmatory factor analysis (CFA), as an alternative approach, has been used to address such issues (Brown, 2003; Fresco *et al*., 2002). Unlike EFA, CFA can evaluate different competing structure models and place restrictions on various parameter estimates such as factor loadings and variances, thereby resulting in a more parsimonious model (Wang, 1999; Zhong *et al*., 2008). The CFA model can be identified when the number of measured variables exceeds the number of freely estimated parameters, and the correlation of errors can be calculated and specified among the indicator residuals to reflect the method effects due to the similarity of items outside of factor loading, such as overlapped content, similar phrasings, and other susceptibilities to demand characteristics (Brown, 2003; Hau, 1995).

In their CFA-based evaluation of the PSWQ, Fresco *et al*.(2002) statistically compared the fit of one- and two-factor solutions in a large college student sample and found that the two-factor model, comprised of positively and negatively worded items, provided a superior fit to the data. They also offered a high-order worry factor (one-factor model) solution, based on the assumption that the correlation between engagement of worry and absence of worry was constrained to zero. However, this high-order solution was ultimately rejected in favor of the two-factor model, per Wang (1999)'s suggestion, as the latter fits the data just as well and is also more parsimonious.

In contrast, using CFA to evaluate the latent structure of PSWQ in a sample of outpatients with anxiety and mood disorders, Brown (2003) demonstrated the superiority of the one-factor model with method effect. He asserted that the second factor (absence of worry) is distinct from the first factor only due to the reversed score method and does not represent a separate latent construct. Later, Hazlett-Stevens *et al*.(2004) found that the five reverse-direction PSWQ items do not make up a separate worry construct, but rather, contain an underlying factor of negative wording method. This result has recently been replicated in a sample of Korean college students (Lim *et al*., 2008). However, a flaw in the aforementioned studies (Brown, 2003; Hazlett-Stevens *et al*., 2004; Lim *et al*., 2008) is that the two-factor model and one-factor model with method effect have indistinguishable goodness of fit. The decision to accept the one-factor model with method effect over the two-factor model was made without due consideration of the statistical result of model comparison.

In general, the PSWQ is a psychometrically sound instrument, exhibits psychometric specificity in that elevated scores are more typically associated with GAD than other anxiety disorder groups or non-anxious controls, and is often used as an indicator of treatment change (Stöber and Bittencout, 1998). The data from the extant literature, however, are based predominantly on non-Chinese samples. The aim of the present study was to evaluate the latent structure and psychometric properties of the PSWQ in Chinese university students.

MATERIALS AND METHODS

Preparation procedure of the Chinese version of the PSWQ (Ch-PSWQ)

We first translated the PSWQ into its Chinese version, and then, according to the cross-cultural research method (Ember and Ember, 2001), the translation was given to two English language professors in the English Language Department of Peking University for back-translation. The original and back-translated versions were then compared, and revisions were made to minimize discrepancies. Ch-PSWQ was finalized after several discussions among the authors. Two important guiding principles were followed in finalizing the text of the Ch-PSWQ: (1) the veracity of the translation; (2) the cultural acceptance of the translation, especially the Chinese meaning of worry. In order to both capture the emotional valence of "worry" and follow Chinese linguistic conventions, we translated worry in the Ch-PSWQ using two Chinese words, Danxin (items 1, 5, 6, 7, 9, 10, 11, 13, and 16) and Fachou (items 4, 12, 14, and 15). Both of these two words can be translated into English as worry.

Subjects

Sample 1 consisted of 1243 undergraduates (749 males, 467 females, and 27 gender unspecified; mean age (20.19±4.95) years, ranging from 16 to 30 years) from different schools in Peking University. Sample 2, for collecting the test-retest reliability, was comprised of 40 undergraduates (26 males and 14 females; mean age (19.3±0.69) years, ranging from 18 to 21 years) from Peking University, independently from Sample 1.

Assessment

The state-trait anxiety inventory (STAI) consists of two 20-item scales that aim to measure state and trait anxiety (Jacobs *et al*., 1988). The STAI state subscale asks respondents to rate on a 4-point scale how they feel "right now…at this moment" in response to a series of self-descriptive statements. Each of the items is rated from 1 (not at all) to 4 (very much so). In contrast, the STAI trait subscale asks respondents to rate how they feel "generally" on a 4-point scale, from 1 (almost never) to 4 (almost always). The Chinese version of STAI has good psychometric properties in the Chinese population, and factor analytic validation of the state-trait distinction has been demonstrated (Fu, 1997).

The Beck depression inventory (BDI) (Beck and Beamesderfer, 1974), which has 21 items, is one of the most widely used self-report instruments to study depression symptoms. The BDI instructs individuals to select one statement that best corresponds to their situation out of four. Each of the 21 items from the inventory reflects a distinct aspect of depression. Using BDI, Zhang *et al*.(1990) examined 268 subjects and found that 38 showed depression or depressive neurosis symptoms, and 29 showed other neurosis symptoms, the split-half coefficient and Cronbach's α of the Chinese version of BDI being 0.879 and 0.890, respectively. The results also suggested that the Chinese version of the BDI has good construct and concurrent validity, in terms of scale and included items (Zhang *et al*., 1990).

The Padua inventory (PI) (Sanavio, 1988) is a 60-item measurement for obsession and compulsion symptoms. Each PI item, rated on a 5-point scale, tests the severity of obsession and compulsion from 0 (not at all) to 4 (very much). The PI has 4 factors: impaired control over mental activities (Factor 1), urges and worries of losing control over motor behaviors (Factor 2), becoming contaminated (Factor 3), and checking (Factor 4). The Chinese version of PI has been shown to have good reliability (Zhong *et al*., 2006).

Procedure

The participants in Sample 1 took part in the study anonymously and voluntarily. They completed the packet of self-report measures including Ch-PSWQ, STAI, BDI and PI, in a classroom setting during class time. Each packet contained the measures in a pre-determined random order. The participants in Sample 2 also took part in the study voluntarily and individually and completed the Ch-PSWQ only. Subjects in Sample 2 did not remain anonymous, as they had to be contacted for retest data of Ch-PSWQ after an 8-week interval. All the participants in Samples 1 and 2 were informed of the confidentiality in this research. Approval for the conduct of this study was provided by the Ethical Committee at the Psychology Department of Peking University, and the procedures met the ethical standards of the Chinese Psychological Society (CPS, 2007).

Data analyses were conducted in several stages. First, Sample 1 was randomly divided into two parts, Sample 1a (n=622) and Sample 1b (n=621), with each part containing approximately half of the participants. For Sample 1a, an EFA was conducted at the item level of the PSWQ, while for Sample 1b, a CFA was conducted. Second, Cronbach's α and convergent/divergent validity were tested on Sample 1. Then, test-retest reliability was tested on Sample 2. EFA, correlation and reliability were conducted using SPSS 15.0. CFA was conducted using the AMOS structural equation-modeling program (Arbuckle and Wothke, 1999).

RESULTS

EFA

The subjects from Sample 1a were included in this factor analysis. The results show that there were 3 components with eigenvalue larger than 1, but a plot of eigenvalues (Scree test) and the pattern of factor loadings suggested a two-factor structure (Fig.1 and Table 1). Principal component analysis (PCA) was iteratively tested, followed by varimax rotation to investigate the two-factor structure of the PSWQ. The two factors accounted for 49.93% of variance. Three double-loading items remained because the difference between the loading coefficients was greater than 0.3. Table 1 presents the factor loading of each item after varimax rotation, as well as the Pearson correlations between each factor and included items. All the correlation coefficients were larger than 0.50 and statistically significant at $P<0.01$.

Factor 1 (11 items) had an eigenvalue of 5.47, representing 34.19% of the variance, and was termed "engagement of worry." Factor 2 (5 items) had an eigenvalue of 2.52, accounting for 15.74% of the variance, and was named "absence of worry." These results are congruent with previous two-factor structure results (Fresco *et al*., 2002; van Rijsoort *et al*., 1999).

CFA and model comparison

Using the data from Sample 1b, three models were tested and compared with CFA in the present study. Model 1 was the uni-factor solution (Brown *et al*., 1992; Meyer *et al*., 1990). Model 2 was the two-factor solution, with the 11 positively worded

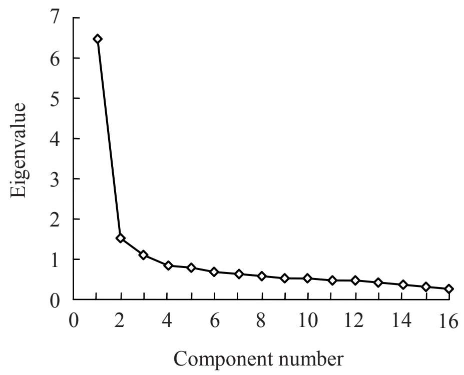

Fig.1 Principle component Scree plot of Ch-PSWQ

Table 1 Factors and factor loadings over 0.30 on the corresponding factor and correlations between each item and its belonging factor (two-factor model, *n*=622)

Item	Factor loading	r^{**}
Factor 1: engagement of worry		
15. I worry all the time	0.813	0.787
12. I have been a worrier all my life	0.779	0.766
14. Once I start worrying, I cannot stop	0.767	0.729
13. I notice that I have been worrying about things	0.765	0.804
7. I am always worrying about something	0.732	0.798
4. Many situations make me worry	0.700	0.751
2. My worries overwhelm me	0.662	0.669
5. I know I should not worry about things, but I just cannot help it	0.640	0.709
6. When I am under pressure, I worry a lot	0.610	0.709
16. I worry about projects until they are all done	0.562	0.626
9. As soon as I finish one task, I start to worry about everything, else I have to do	0.509	0.568
Factor 2: absence of worry		
10. I never worry about anything	0.666	0.646
3. I do not tend to worry about things	0.655	0.718
8. I find it easy to dismiss worrisome thoughts	0.646	0.704
1. If I do not have enough time to do everything, I do not worry about it	0.646	0.656
11. When there is nothing more I can do about a concern, I do not worry about it any more	0.591	0.630

$^{**}P<0.01$

items and the 5 negatively worded items representing the two indicators (Beck *et al*., 1995; Fresco *et al*., 2002; van Rijsoort *et al*., 1999; Stöber, 1995). Model 3 was the one factor with method effect solution suggested by Brown (2003), and subsequently repeated by Hazlett-Stevens *et al*.(2004) and Lim *et al*.(2008). As the goodness-of-fit indices shown in Table 2, Models 2 and 3 are superior to Model 1, and while both Models 2 and 3 are acceptable, Model 3 is slightly better.

Considering that Model 2 can be regarded as a nest model of Model 3, it is possible to use model comparison to test if Model 2, which is more parsimonious, is the better solution. In order to do the comparison, a likelihood ratio test was used to test the change of chi-squares (χ^2) and degree of freedom (*df*) of the two models. If the difference of chi-squares between the two models is not significant, then the more parsimonious model should be favored (Wang, 1999). The result of the likelihood ratio test showed that when degree of freedom (*df*) increased to 4, the change of chi-square (χ^2) of Model 2 was 45.67 ($P<0.001$) compared with Model 3. While somewhat less parsimonious, Model 3 was finally accepted because it is more accurate.

Reliability

Cronbach's α was calculated between each factor and the total score of the PSWQ. Table 3 shows the reliability of each factor in total and based on gender. All the results are satisfactory, confirming the internal consistency of the Ch-PSWQ in the Chinese samples. A Guttmann split-half test revealed the reliabilities of 0.88 and 0.65 for the two factors, respectively, once again verifying internal consistency of the Ch-PSWQ.

Table 3 also shows that the Cronbach's α of Factor 2 was lower than that of Factor 1. In order to test whether this difference was due to the smaller number of items included in Factor 2, 5 items in Factor 1 were randomly selected and the Cronbach's α was calculated. The result shows that the Cronbach's α of the 5 items in Factor 1 was 0.80, which is much higher than that in Factor 2.

The test-retest correlations in Sample 2 were calculated after an 8-week interval, resulting in correlations between total Ch-PSWQ score and individual factor scores of 0.87, 0.72, and 0.55, respectively. As coefficients between 0.6 and 0.9 were considered appropriate values for stability over time, the Ch-PSWQ, with the exception of Factor 2, showed good stability over 8 weeks.

Inner correlation

In order to examine the inner correlation of the Ch-PSWQ in the Chinese samples, correlation coefficients were calculated among individual factors and total score by using the data from Sample 1. The correlation coefficient between the two factors of the Ch-PSWQ is 0.47 ($P<0.01$). Factors 1 and 2 correlated with Ch-PSWQ total score at 0.95 and 0.74, respectively ($P<0.01$).

Convergent and divergent validities

Using the data obtained from Sample 1, we calculated the Pearson's correlation coefficients between the Ch-PSWQ score and STAI, BDI, and PI scores, respectively. Table 4 indicates that, as expected, the Ch-PSWQ total score and Factor 1 exhibited a moderate correlation with STAI-State, STAI-Trait, BDI, and PI Factor 1 (impaired control over mental activities) and Factor 4 (checking) ($P<0.01$). Meanwhile, Ch-PSWQ Factor 2 exhibited less than moderate correlation with the above assessments.

Table 2 Goodness-of-fit indices for Ch-PSWQ modes (n=621)

Model	χ^2	*df*	χ^2/df	*GFI*	*AGFI*	*NFI*	*TLI*	*CFI*	*RMSEA*	10%~90% *CI*
Model 1 (one factor)	580.440	104	5.581	0.872	0.832	0.862	0.865	0.883	0.087	0.080~0.094
Model 2 (two factor)	413.094	103	4.011	0.909	0.880	0.902	0.911	0.924	0.070	0.063~0.078
Model 3 (one factor with method effect)	367.428	99	3.711	0.917	0.885	0.912	0.920	0.934	0.067	0.060~0.074

χ^2: minimum fit function chi-square; *df*: degree of freedom; *GFI*: goodness-of-fit index; *AGFI*: adjusted goodness-of-fit index; *NFI*: Bentler-Bonett normed fit index; *TLI*: Tucker-Lewis index; *CFI*: comparative fit index; *RMSEA*: root mean square error of approximation; *CI*: confidence interval

Table 3 Cronbach's α coefficient for each factor and total according to gender (n=1243)

	Cronbach's α coefficient		
	Factor 1	Factor 2	Total
Total	0.91	0.68	0.89
Male	0.91	0.68	0.89
Female	0.91	0.67	0.90

Table 4 The correlation between Ch-PSWQ and other assessments (n=1243)

	Correlation coefficient		
	Factor 1	Factor 2	Total
STAI-State	0.533**	0.469**	0.579**
STAI-Trait	0.623**	0.512**	0.665**
PI-Factor1	0.647**	0.379**	0.638**
PI-Factor2	0.242**	0.091*	0.221**
PI-Factor3	0.267**	0.140**	0.258**
PI-Factor4	0.414**	0.245**	0.409**
BDI	0.568**	0.310**	0.552**

*P<0.05; **P<0.01

DISCUSSION

The present study examined the factor structure and psychometric properties of the Ch-PSWQ in a Chinese nonclinical sample. The EFA revealed a two-factor structure, suggesting the cross-culture stability and consistency of the PSWQ. We found that the 11 positively worded items formed the first factor, engagement of worry, accounting for 34.24% of total variance and exhibiting both good internal consistency and test-retest reliability. The 5 negatively worded items formed the second factor, representing 15.74% of total variance. The reliability of Factor 2 was lower than that of Factor 1, even after the item number in the two factors was balanced. This suggests that the lower α of Factor 2 is more than just a function of the smaller number of items included in this factor. Furthermore, unlike Brown (2003)'s study, which found a high correlation between the two factors, the correlation coefficient between Factor 1 and Factor 2 was found to be 0.468 in the present study, suggesting relatively good discriminate validity of the two factors. Hazlett-Stevens *et al.*(2004) demonstrated a weak correlation between the five-revised-item factor and GAD, which was measured by a self-reported questionnaire. However, Pestle *et al.* (2008) found that, in the study of the PSWQ for children, the reverse-scored items can predict the variability in clinician-reported ratings of generalized anxiety, but not self-reported anxiety. This implies that the revised items, Factor 2, may have an independent role, distinct from Factor 1 of the PSWQ.

The present study finds that the method-effect model (Model 3) was superior to both the one-factor solution (Model 1) and the two-factor solution (Model 2). This is consistent with some previous studies, which found that the one-factor-with-method-effect model provided a better fit than the two-factor structure (Brown, 2003; Hazlett-Stevens *et al.*, 2004; Lim *et al.*, 2008). In the method-effect model, the covariance of the 5 reversed items is assumed to be due to substantively irrelevant method effects, not some latent factors. Although this assumption of method effect has been proven in prior studies (Brown, 2003; Hazlett-Stevens *et al.*, 2004; Lim *et al.*, 2008), the strategy of using model comparison as a way to evaluate the best acceptable model is rather novel. Our finding supports that, in a Chinese non-clinical sample, it is not necessary to split the Ch-PSWQ into two distinct factors named "engagement of worry" and "absence of worry." In fact, the division into two dimensions is tricky and misleading, as they are better considered as two ends of a single construction. First, model comparison in the present study suggests that the method effect is confounded with the so-called factor "absence of worry." Controlling the method effect leads to the more accurate one-factor model. Second, the two-factor model will lead to confused clinical application. According to the two-factor model, a patient with a high score on engagement-of-worry responses and a lower score (revised) on the so-called absence-of-worry factor would be considered both worried and not worried. This contradiction leads to an important question about the PSWQ: What does the so-called absence-of-worry factor really mean? While previous studies tended to refer to the five reversed items as "absence of worry" (Fresco *et al.*, 2002; Stöber, 1995; van Rijsoort *et al.*, 1999), we argue that other latent variables might be responsible for or related to their co-variations. To further explore this assumption, it would be necessary to correlate the latent variable indicated by the five reversed items with other variables, such as socially desirable responses (Fresco *et* *al*., 2002), acquiescence, context effect, and so on.

With regard to the reliability and validity of the Ch-PSWQ, the correlations among the factors of Ch-PSWQ and other measures of depression and anxiety symptoms, such as STAI, PI and BDI, indicated that Factor 1 (engagement of worry) shared the largest unique similarity to these symptom measures, a result congruent with prior studies (Fresco *et al*., 2002). This finding means that using the 11-item worry engagement scale is better than using the 16-item total score. The test-retest reliability of the total score and Factor 1 was larger than 0.7, suggesting excellent consistency. In contrast, the test-retest reliability of Factor 2 was somewhat less than satisfactory. This might be attributed to the possibility that Factor 2 contains some items that evaluate traits which vary with time, rather than worry itself. Thus, it is a caution to say that the absence of worry is a new aspect of worry or other characteristics related with worry rather than just "no worry." When designing scales for questionnaires, it is customary to include negatively worded items to "reduce the effects of acquiescence" (Meyer *et al*., 1990), but some researchers suggested that "absence of worry" may represent a measure of social desirability (Fresco *et al*., 2002). Future research is clearly needed before this speculation can be addressed.

Although this study revealed the structure of Ch-PSWQ in a Chinese college sample, there are still some limitations. First, the sample consisted of relatively high functioning college students. Meyer *et al*. (1990) found that structures of the PSWQ in student and patient samples were different. Thus, further testing with a larger clinical sample in China would be necessary to confirm the psychometric adequacy of the Ch-PSWQ, especially the construct of the Ch-PSWQ in Chinese clinical samples. Second, the present data were acquired though self-report assessment, which can be biased by social desirability or the response styles of participants. Future studies would benefit from the inclusion of clinician-rated measures to check if the Ch-PSWQ demonstrates a similarly meaningful relationship to GAD in China. Third, the present study did not take into account the relationship between worry and related constructs such as "shame or executive shyness" in China. Zhong *et al*.(2008) found that shame is a mediator between the personality and social anxiety symptoms in a Chinese college sample, while shame did not play the same role in the American sample. Thus, the convergence and divergence between worry and shame should be investigated in a follow-up study in China.

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