


Cross-cultural adaptation and clinical application of the Perth Empathy Scale

Qingying Ye¹ | Yang Liu¹ | Siyu Zhang² | Ke Ni³ |
Sufen Fu² | Wenjie Dou¹ | Wei Wei^{4,5,6} | Bao-Ming Li^{1,7} |
David A. Preece^{8,9} | Xin-Lu Cai^{1,7,10,11} 

¹Institute of Brain Science and Department of Physiology, School of Basic Medical Sciences, Hangzhou Normal University, Hangzhou, China

²Department of Psychology, Jing Hengyi School of Education, Hangzhou Normal University, Hangzhou, China

³Qiqihar Mental Health Center, Qiqihar, China

⁴Department of Neurobiology, Affiliated Mental Health Center & Hangzhou Seventh People's Hospital, Zhejiang University School of Medicine, Hangzhou, China

⁵Liangzhu Laboratory, MOE Frontier Science Center for Brain Science and Brain-machine Integration, State Key Laboratory of Brain-machine Intelligence, Zhejiang University, Hangzhou, China

⁶NHC and CAMS Key Laboratory of Medical Neurobiology, Zhejiang University, Hangzhou, China

⁷Zhejiang Philosophy and Social Science Laboratory for Research in Early Development and Childcare, Hangzhou Normal University, Hangzhou, China

⁸School of Population Health and Curtin enAble Institute, Curtin University, Perth, Australia

⁹School of Psychological Science, The University of Western Australia, Perth, Australia

¹⁰Zhejiang Key Laboratory for Research in Assessment of Cognitive Impairments, Hangzhou, China

¹¹Shanghai Key Laboratory of Mental Health and Psychological Crisis Intervention, East China Normal University, Shanghai, China

Correspondence

David A. Preece, School of Population Health and Curtin enAble Institute, Curtin University, Perth 6102, Australia.

Email: david.preece@curtin.edu.au

Xin-Lu Cai, Institute of Brain Science and Department of Physiology, School of Basic Medical Sciences, Hangzhou Normal University, Hangzhou 311121, China.

Email: caixinlu@hznu.edu.cn

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Abstract

Objective: Alterations of empathy have been observed in patients with various mental disorders. The Perth Empathy Scale (PES) was recently developed to measure a multidimensional construct of empathy across positive and negative emotions. However, its psychometric properties and clinical applications have not been examined in the Chinese context.

Methods: The Chinese version of the PES was developed and administered to a large Chinese sample ($n = 1090$). Factor structure, internal consistency, test-retest reliability, and convergent, discriminant, as well as concurrent validity were examined. Moreover, 50 patients with

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major depressive disorder (MDD) and 50 healthy controls were recruited to explore the clinical utility of the PES.

Results: Confirmatory factor analyses supported a theoretically congruent three-factor structure of empathy, namely Cognitive Empathy, Negative Affective Empathy and Positive Affective Empathy. The PES showed good to excellent internal consistency reliability, good convergent and discriminant validity, acceptable concurrent validity, and moderate to high test-retest reliability. Patients with MDD had significantly lower PES scores compared to healthy controls. Linear discriminant function comprised of the three factors correctly differentiated 71% of participants, which further verified the clinical utility of the PES.

Conclusions: Our findings indicated that the Chinese version of the PES is a reliable and valid instrument to measure cognitive and affective empathy across negative and positive emotions, and could therefore be used in both research and clinical practice.

KEYWORDS

depression, empathy, factor structure, Perth Empathy Scale, psychometric

1 | INTRODUCTION

Empathy is broadly defined as the ability to understand and experience the emotional state of others (Cuff et al., 2016; Reniers et al., 2011). It has been well established that empathy encompasses two core components, cognitive empathy and affective empathy. Cognitive empathy refers to the ability to recognize or understand others' emotional experience, while affective empathy refers to the capacity to respond to others' emotional states (Cuff et al., 2016). Empathic function plays an important role in social functioning and mental health (Cox et al., 2012; Maliske et al., 2023). Moreover, deficits of empathy have been found in various mental disorders (Thoma et al., 2013), such as major depressive disorder (MDD) (Rutgen et al., 2021) and schizophrenia spectrum disorders (Bonfils et al., 2017).

1.1 | Existing measures of empathy

Several measures have been developed to assess empathy, including the Empathic Quotient (EQ; Baron-Cohen & Wheelwright, 2004), the Basic Empathy Scale (Jolliffe & Farrington, 2006), the Interpersonal Reactive Index (IRI; Davis, 1980), and the Questionnaire of Cognitive and Affective Empathy (QCAE; Reniers et al., 2011). Among them, the IRI and the QCAE have been used widely. The IRI contains four subscales, including Empathic Concern,

Perspective Taking, Fantasy, and Personal Distress. Perspective Taking assesses cognitive empathy, while Empathic Concern taps into affective empathy. The QCAE measures cognitive empathy by the Online Simulation and Perspective Taking subscales, and affective empathy by the Emotional Contagion, Proximal Responsivity, as well as Peripheral Responsivity subscales. Although the abovementioned questionnaires have been shown to have good psychometric properties (Gilet et al., 2013; Liang et al., 2020), several limitations should be noted. First, contemporary models of empathy have proposed that cognitive and affective empathy would interact with each other to form an overall reflect of empathic response (general empathy) (Håkansson Eklund & Summer Meranius, 2021; Leiberg & Anders, 2006; Preston & de Waal, 2002; Schurz et al., 2021). Previous studies using the above two questionnaires, however, have not empirically verified the theoretically multidimensional construct of empathy that integrates both the facet levels (cognitive and affective empathy), and the broader level (general empathy) (Lima & Osório, 2021). Second, the IRI and the QCAE do not assess cognitive and affective empathy across negative and positive valences, which are essential for understanding emotional functioning. Third, the IRI and the QCAE have been reported to have problematic structural validities (Lima & Osório, 2021; Murphy et al., 2020). Therefore, a psychometrically sound instrument to assess the multidimensional construct of empathy, especially encompassing positive and negative valences, is in dire need.

1.2 | Perth Empathy Scale (PES)

To address this need, Brett et al. (2022) recently developed a novel 20-item scale, namely the PES, to assess cognitive and affective empathy across both negative and positive valences (Brett et al., 2022). Four subscales were designed to measure the various subcomponents of empathy for either negative or positive emotions: Negative Cognitive Empathy (e.g., *Just by seeing or hearing someone, I know if they are feeling angry*), Positive Cognitive Empathy (e.g., *Just by seeing or hearing someone, I know if they are feeling amused*), Negative Affective Empathy (e.g., *When I see or hear someone who is angry, it makes me feel angry too*), and Positive Affective Empathy (e.g., *When I see or hear someone who is amused, it makes me feel amused too*). Furthermore, the subscale scores can be combined into composite scores for Cognitive Empathy and Affective Empathy, capturing these domains across both valences. Lastly, all subscale scores can be summed into a general empathy score as an overall indicator of empathy.

In the study by Brett et al. (2022), the original PES was found to have good reliability and validity. Results from factor analyses discovered a three-factor structure of the PES, whereby there was a unitary Cognitive Empathy factor, along with the valence-specific Negative Affective Empathy and Positive Affective Empathy factors (see Supporting Information: Figure 1). The hierarchical and bifactorial models also supported the above factors, suggesting that they served as coherent components of a broader “general empathy” factor (see Supporting Information: Figure 1). All subscales and composite scores showed acceptable-to-good internal consistency reliability, good convergent validity, and sufficient discriminant validity (Brett et al., 2022).

1.3 | Cross-cultural and clinical studies of empathy

Previous research has documented cross-cultural differences in emotional functions, among which empathy was especially prominent (Aival-Naveh et al., 2019; Deng et al., 2019; Laukka & Efenbein, 2021). For example, Atkins et al. (2016) found East Asian participants to report reduced affective empathy but greater cognitive empathy than their British counterparts. In contrast, a large-scale study revealed that individuals from collectivistic cultures exhibited greater levels of affective empathy than those from individualistic cultures (Chopik et al., 2017). The heterogeneity of methodologies used in these studies might be one potential factor contributing to the inconsistent findings (Stosic et al., 2022). Therefore, a comprehensive and psychometrically sound instrument for assessing empathy has great implication for cross-cultural research (Rogler, 1989). Since the original PES was developed

solely by data of adults from Australia, and only available in English, the generalizability of these results across other cultures remains unclear.

Using various empathic measures, impairments in empathy have been found in patients with various mental conditions (Bonfils et al., 2017; Pittelkow et al., 2021; Schreier et al., 2013). For example, depression was found to be related with deficits in both cognitive and affective empathy (Paz et al., 2022). Compared with healthy controls, patients with MDD reported decreased levels of perspective taking and empathic concern (Cusi et al., 2011), higher levels of personal distress, and lower levels of affective responses (Guhn et al., 2020). Importantly, impairments in cognitive and affective empathy were found to be associated with higher levels of alexithymia (i.e., a trait involving difficulties identifying, describing, and focusing attention on one's own emotions) in patients with MDD (Banzhaf et al., 2018; Preece et al., 2017). Furthermore, a key symptom of depression is increased sensitivity to negative information, which was termed as negative bias (LeMoult & Gotlib, 2019). Previous studies in negative bias have revealed that patients with MDD tend to approach negative but avoid positive information (Bourke et al., 2010; Duque & Vázquez, 2015). Therefore, it is of clinical importance to measure empathy across different valences in depression. However, no measures have specifically examined empathy across negative and positive valences in patients with MDD. As the original PES was initially designed to assess empathy across both negative and positive valences and can be applied to both general and clinical populations, it is suitable to utilize the PES to investigate empathy in patients with MDD.

1.4 | The present study

Therefore, the present study aimed to introduce the first Chinese version of the PES and examine its psychometric properties and clinical utility. First, we investigated the factor structure, reliability, and validity of the PES in a large neurotypical sample recruited from mainland China. Second, the clinical utility of the PES was evaluated among a group of patients with MDD and a matched healthy control group. Based on findings from the original PES study and previous validation studies for other empathy measures (Brett et al., 2022; Liang et al., 2019; Melchers et al., 2016), we hypothesized that the three-factor structure (with a general Cognitive Empathy factor, and splitting affective empathy by valence into Negative Affective Empathy and Positive Affective Empathy) would be the best-fitting model in the Chinese context and it would demonstrate good reliability and validity. Moreover, given that patients with MDD have previously shown empathic deficits (Bora & Berk, 2016), we expected that patients with MDD would report lower PES scores than the healthy controls.

2 | METHODS

2.1 | Participants

One thousand and ninety participants (mean age = 20.64 years, SD = 2.96 years; 317 males; mean length of education = 14.12 years, SD = 1.87 years) were recruited from Hangzhou, Beijing, and Qiqihar through online advertisements. The majority of these participants were of Han ethnicity (95.23%), and the remaining were from ethnic minorities. Of these participants, 335 completed the PES again after a 4-week interval to assess test-retest reliability. All participants completed a set of self-reported questionnaires at an online platform named Wenjuanxing (<https://www.wjx.cn/>). To ensure the validity of our data, 10 pairs of lie-detection items were included in the series of questionnaires. An example pair was as followed: (a) I prefer being with others rather than being alone; and (b) I Prefer being alone (see Supporting Information: Materials). Moreover, we conducted a Beck Depression Inventory (BDI; Beck et al., 1987; Chan, 1991) to screen their depressive levels. For the nonclinical sample, the exclusion criteria were (1) having more than three conflicting responses in lie-detection items; (2) having

personal or family history of psychiatric or neurological disorder; and (3) having a history of substance abuse, alcohol dependence, or severe head trauma.

To examine the clinical utility of the PES, 50 patients with MDD (mean age = 32.96 years, SD = 8.89 years; 13 males; mean education duration = 12.98 years, SD = 2.97 years) were recruited from Qiqihar Mental Health Center in Heilongjiang Province. All of these participants were Han Chinese. Patients with MDD were diagnosed according to the Structured Clinical Interview for DSM-IV Axis I disorders (First & Gibbon, 2004). Their depressive symptoms were evaluated by a qualified psychiatrist using the 24-item Hamilton Rating Scale (HAM-D; Hamilton, 1960). The scores of the HAM-D ranged from 10 to 33 (mean = 22.80, SD = 5.04). The average daily doses of antidepressant were assessed by fluoxetine equivalents (29.96 ± 15.89 mg/d). Fifty healthy controls were recruited from local neighboring communities (mean age = 30.28 years, SD = 5.98 years; 16 males; mean education duration = 15.32 years, SD = 1.85 years). Most of these participants were Han Chinese (95.00%) and others were from ethnic minorities.

All participants were recruited from June to October 2022. Informed consents were acquired from every participant, and each received 25 RMB as compensation for their time.

2.2 | Measures

2.2.1 | PES

The English version of the PES (Brett et al., 2022) is a 20-item, self-rating measure designed to assess cognitive and affective empathy across negative and positive emotions. Each item is answered on a 5-point Likert scale, ranging from 1 ("almost never") to 5 ("almost always"), with higher scores indicating higher levels of empathy. Four subscales can be derived: Negative Cognitive Empathy (e.g., *Just by seeing or hearing someone, I know if they are feeling disgusted*), Positive Cognitive Empathy (e.g., *Just by seeing or hearing someone, I know if they are feeling enthusiastic*), Negative Affective Empathy (e.g., *When I see or hear someone who is disgusted, it makes me feel disgusted too*), and Positive Affective Empathy (e.g., *When I see or hear someone who is enthusiastic, it makes me feel enthusiastic too*). These subscale scores can be summed into two meaningful composite scores for Cognitive Empathy and Affective Empathy. A total scale score can also be extracted as an overall marker of empathy (Brett et al., 2022).

The original English version of the PES was translated into Chinese by two bilingual translators. One is a psychology expert and another is a psychology postgraduate student. Then, the two draft versions were compared, and discrepancies were discussed and reconciled to reach a consensus. The revised version was then back-translated into English by a bilingual psychology expert who had no knowledge of the original scale. The back-translated version of PES was compared with the original English version. Further modifications were made until the two versions achieved the highest possible interchangeability, resulting in the final version of the Chinese PES. We also test this final version PES in a pilot study and the participants all reported this scale was clear and readable. The Chinese adaption of the PES is provided in Supporting Information: Materials.

2.2.2 | IRI

The 28-item IRI consists of four components of empathy, including Perspective Taking (e.g., *I try to look at everybody's side of a disagreement before I make a decision*), Empathic Concern (e.g., *I would describe myself as a pretty soft-hearted person*), Personal Distress (e.g., *I tend to lose control during emergencies*), and Fantasy (e.g., *When I watch a good movie, I can very easily put myself in the place of a leading character*) (Davis, 1980).

Cognitive and affective empathy are measured by the Perspective Taking subscale and the Empathic Concern subscale, respectively. Each item is scored on a 5-point Likert scale ranging from 0 (“does not describe me well”) to 4 (“describes me very well”). Higher scores reflect the better ability to empathize. The Chinese version of the IRI has been reported to have good reliability (Wang et al., 2013; Zhao et al., 2019). The Cronbach's α coefficient for the Perspective Taking subscale and the Empathic Concern subscale scores was .62 and .68 in our nonclinical sample, was .48 and .56 in patients with MDD, and was .64 and .69 in healthy controls (see Table 1).

TABLE 1 Descriptive statistics and reliability for the administered measures.

	Large sample (n = 1090)			MDD (n = 50)			HC (n = 50)			F/ χ^2	p
	M	SD	α	M	SD	α	M	SD	α		
Gender (Male/Female)	317/773			13/37			16/34			.44	.66
Age	20.64	2.96		32.96	8.89		30.28	5.98		1.77	.08
Education duration	14.12	1.87		12.98	2.97		15.32	1.85		-4.73	<.001***
PES											
PES-NCE	17.54	4.08	.88	13.88	4.14	.89	17.70	4.53	.93	13.90	<.001***
PES-PCE	17.71	3.97	.88	14.52	3.55	.79	18.22	4.56	.94	14.36	<.001***
PES-NAE	14.26	4.03	.78	12.20	3.61	.83	13.06	4.10	.84	4.87	.03*
PES-PAE	15.23	4.19	.84	13.60	3.94	.84	16.76	4.04	.84	12.40	.001**
PES-CE	35.25	7.76	.93	28.40	7.38	.92	35.92	8.95	.97	14.90	<.001***
PES-AE	29.49	7.41	.87	25.80	5.60	.78	29.82	7.02	.87	12.61	.001**
PES-Empathy	64.73	13.05	.92	54.20	11.21	.89	65.74	13.91	.94	18.22	<.001***
IRI											
IRI-PT	16.56	3.66	.62	15.06	3.00	.48	17.20	3.76	.64	6.87	.01*
IRI-EC	17.97	3.81	.68	16.36	3.12	.56	19.56	3.56	.69	21.14	<.001***
QCAE											
QCAE-CE	57.49	8.55	.91	53.32	7.33	.87	60.66	9.01	.95	15.17	<.001***
QCAE-AE	30.52	4.30	.73	28.60	3.51	.65	29.76	4.74	.78	3.65	.06
TAS-20											
TAS-DIF	17.14	6.23	.90	20.16	5.67	.91	12.64	5.18	.89	35.35	<.001***
TAS-DDF	13.57	3.70	.65	15.06	3.01	.63	10.94	3.81	.70	26.18	<.001***
TAS-EOT	20.76	3.75	.39	23.04	3.40	.54	18.88	4.32	.57	25.54	<.001***
TAS-Alexithymia	51.47	11.21	.85	58.26	10.57	.89	42.46	11.48	.88	38.80	<.001***

Note: Bonferroni corrections to correct for multiple testing with adjusted $p < (.05/N)$, where N indicates the number of correlations.

Abbreviations: AE, affective empathy; CE, cognitive empathy; DDF, difficulty describing feelings; DIF, difficulty identifying feelings; EC, empathic concern; EOT, externally oriented thinking; HC, healthy controls; IRI, Interpersonal Reactive Index; MDD, major depressive disorders; NAE, negative affective empathy; NCE, negative cognitive empathy; PAE, positive affective empathy; PCE, positive cognitive empathy; PES, Perth Empathy Scale; PT, perspective-taking; QCAE, Questionnaire of Cognitive and Affective Empathy; TAS, Toronto Alexithymia Scale.

* $p < .05$; ** $p < .01$; *** $p < .001$.

2.2.3 | QCAE

The QCAE is another 31-item self-report questionnaire to assess one's capacity for empathy (Reniers et al., 2011). The QCAE comprises questions capturing cognitive empathy (20 items) and affective empathy (11 items). Participants answer each item by using a 4-point Likert scale ranging from 1 ("strongly disagree") to 4 ("strongly agree"). Higher scores indicate greater ability to empathize. The Chinese version of the QCAE has been demonstrated to have good validity and reliability (Liang et al., 2019, 2020). The Cronbach's α coefficient for the Cognitive Empathy and Affective Empathy scores was .91 and .73 in our nonclinical sample, was .87 and .65 in the MDD group, and was .95 and .78 in healthy controls (see Table 1).

2.2.4 | 20-Item Toronto Alexithymia Scale (TAS-20)

The TAS-20 is a self-report measure of alexithymia (Bagby et al., 1994). It was designed to assess three components of alexithymia: Difficulty in Identifying Feelings, Difficulty in Describing Feelings, and Externally-oriented Thinking. Participants respond to each item on a 5-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"), with higher scores indicating higher levels of alexithymia. The Chinese version of the TAS-20 has been demonstrated to possess good reliability and validity, though the Externally-oriented Thinking facet score usually has low reliability (Ling et al., 2016; Zhu et al., 2007). The Cronbach's α coefficients for the TAS-20 subscales and total scale scores ranged from .39 to .90 in our nonclinical sample (see Table 1). As for patients with MDD and its healthy controls, the Cronbach's α coefficients for the TAS-20 subscales and total scale scores ranged from .54 to .91 and from .57 to .89, respectively (see Table 1).

2.3 | Data analyses

2.3.1 | Factor structure

Statistical analyses were carried out using SPSS version 26.0 and AMOS 21.0. We tested all the candidate models using confirmatory factor analysis (CFA; maximum likelihood estimation based on a Pearson covariance matrix), following the same model validation procedure as in the original PES development study (Brett et al., 2022). Seven theoretically informed models based on increasing complexity were assessed (see Supporting Information: Figure 1). First, we examined a one-factor model (model 1) comprised of a general factor, then a two-factor model (model 2) generally distinguishing between cognitive and affective components of empathy (Cuff et al., 2016), and a three-factor model (model 3) that distinguished valences in cognitive empathy (Rueda et al., 2015; Zhang et al., 2021). Second, another three-factor model (model 4) was constructed that distinguished between negative and positive valences in affective empathy (Löchner et al., 2022; Yan et al., 2021). Additionally, its bifactor version (model 4b, three narrow factors and one general factor) (Xu et al., 2021) and a hierarchical version (model 4h, three first-order factors and one higher-order factor) (Cliffordson, 2002) were examined. Finally, a four-factor model (model 5) which made a distinguish between negative and positive emotions in both cognitive and affective empathy was also examined (Ziaei et al., 2021).

Model goodness-of-fit was judged based on the following four indices: the comparative fit index (CFI), the Tucker Lewis index (TLI), the root mean square error of approximation (RMSEA), and the standardized root mean residual (SRMR). The evaluation criteria for acceptable model fit were: CFI \geq .90, TLI \geq .90, RMSEA \leq .08, and SRMR \leq .08 (Cheung & Rensvold, 2002; Hu & Bentler, 1999; Marsh et al., 2004). The Akaike's Information Criteria (AIC) values were used to compare different CFA models, with a lower AIC value indicating a better fitting model (Byrne, 2013).

2.3.2 | Reliability

The Cronbach's α coefficients of the PES total scale, subscales, and composite scores were calculated to examine the scale's internal consistency reliability for each group. Values $\geq .70$ were considered acceptable, $\geq .80$ good, and $\geq .90$ excellent. Test-retest reliability was examined using the intraclass correlation coefficient (ICC) function (Shrout & Fleiss, 1979) in SPSS. The ICCs were interpreted as follows: ICCs $\geq .50$ were considered as moderate, $\geq .75$ as good, and $\geq .90$ as excellent (Koo & Li, 2016).

2.3.3 | Convergent/discriminant/concurrent validity and clinical utility

Convergent validity was determined by correlations between the PES scores with the IRI and the QCAE scores. We investigated discriminant validity by a second-order exploratory factor analysis (EFA; principal axis factoring using direct oblimin rotation) of PES and TAS subscale scores (Brett et al., 2022). As empathy and alexithymia focus on different aspects of self-other distinctions, in which empathy focusing on others' emotions while alexithymia focusing on one's own emotions, we hypothesized that the PES and the TAS would load on two separable latent variables. To further explore the concurrent validity of the PES, we conducted correlation analyses between the PES scores with the BDI score in the large nonclinical sample, and with the HAMD score in patients with MDD.

In terms of the clinical utility of the PES, we calculated the group differences on the scores of the PES total scale and subscales between patients with MDD and healthy controls. As healthy controls had significantly longer duration of education than patients with MDD, analysis of covariance (ANCOVA) was performed to compare PES total scores with duration of education as a covariate. Multivariate analysis of covariance (MANCOVA) was used to compare the scores of the intended factors across the groups, with education levels similarly controlled as a covariate. We used a Bonferroni correction ($.05/4 = .0125$) to control for multiple testing. Furthermore, a discriminant analysis was conducted to examine the extent to which the PES scores of the intended factors could be used to discriminate and classify the two groups.

3 | RESULTS

3.1 | Profile of the participants

Demographic information was summarized in Table 1. There were no significant differences between patients with MDD and healthy controls in terms of age and gender distribution (age: $t_{98} = 1.77, p = .08$; gender distribution: $\chi^2 = 0.44, p = .66$). However, significantly longer education level was discovered among healthy controls than patients with MDD ($t_{98} = -4.73, p < .001$).

3.2 | Factor structure

Fit indices for each tested factor model of the PES are presented in Table 2. Results showed that a three-factor model (model 4) fit the data best, as compared with the other models (CFI = .880, TLI = .864, RMSEA = .090). Moreover, a hierarchical version of the model 4 (model 4 h) showed the same results as the model 4. We conducted the model modification for both models and the modification indices (MI) remained the same. For parsimony, we only included the modification results of model 4. The results of the MI showed that allowing for correlated error terms between Item 4 and Item 8, Item 11 and Item 12, as well as Item 17 and Item 18 could improve the model fit significantly (CFI = .915, TLI = .902, RMSEA = .076). These items are parallel-worded in referencing same emotion

TABLE 2 Goodness-of-fit index values from confirmatory factor analyses of the PES.

Model	χ^2	df	χ^2/df	RMSEA	SRMR	CFI	TLI	AIC
1-factor model (model 1)	4206.512	170	24.744	.148	.130	.669	.631	4286.512
2-factor model (model 2)	1974.902	169	11.686	.099	.065	.852	.834	2056.902
3-factor-cognitive valenced model (model 3)	1947.681	167	11.663	.099	.064	.854	.834	2033.681
3-factor-affective valenced model (model 4)	1631.847	167	9.772	.090	.063	.880	.864	1717.847
3-factor-hierarchical model (model 4h)	1631.847	167	9.772	.092	.063	.880	.864	1717.847
3-factor-bifactor model (model 4b)	1080.235	149	7.250	.076	.140	.924	.903	1202.235
4-factor model (model 5)	1484.679	164	9.053	.086	.060	.892	.875	1576.679
3-factor-affective valenced-MI model (model 4i)	1199.091	164	7.312	.076	.056	.915	.902	1291.091

Abbreviations: AIC, Akaike information criterion; CFI, comparative fit index; MI, modification indices; RMSEA, root mean square error of approximation; SRMR, standardized root mean residual; TLI, Tucker Lewis index.

respectively (i.e., happiness, amusement, calmness, and embarrassment), thus providing theoretical justification for these correlated error terms being in the model. Therefore, model 4 was refined based on the MI. A graphic representation of the modified three-factor model (model 4i) is shown in Figure 1. In model 4i, all items loaded well on their intended factor and these three factors were significantly positively correlated.

3.3 | Reliability

As shown in Table 1, the Cronbach's α for the general empathy score was .92 in the large nonclinical sample, suggesting excellent internal consistency reliability. All subscales and composite scores of the PES demonstrated good to excellent internal reliability, with the α values ranging from .78 to .93. For patients with MDD, the Cronbach's α values for the PES total scale, subscales, and composite scores ranged from .78 to .92. As for healthy controls, the Cronbach's α values for the PES total scale, subscales, and composite scores ranged from .84 to .97.

In terms of the 4-week test-retest reliability, ICC was .73, .77, and .76 for the intended Negative Affective Empathy, Positive Affective Empathy, and Cognitive Empathy subscale, respectively. We also evaluated the Cronbach's α values and ICCs for all subscales, composite, and total scale scores (see Supporting Information: Table 1).

3.4 | Validity

The scores of the PES total scale, subscales and composite scales were positively and significantly correlated with both the cognitive and affective empathy subscale scores of the QCAE and the IRI (see Table 3), suggesting good convergent validity. Regarding discriminant validity, the second-order EFA extracted two separable factors, with all the PES subscales loading on the one factor "general empathy" (loadings ranging from .56 to .81) and all the TAS subscales on another factor "general alexithymia" (loadings ranging from .40 to .87). Therefore, the results of the EFA suggested that the PES and the TAS-20 measured separate latent structures (see Table 4). In terms of the concurrent validity of the PES, total scores of the BDI were positively correlated with scores of the Negative Affective Empathy subscale ($r = .17, p < .001$), while negatively correlated with scores of the Positive Affective Empathy subscale ($r = -.09, p < .05$) in the neurotypical sample. However, in patients with MDD, no significant correlations were found between the scores of the PES and the HAM-D.

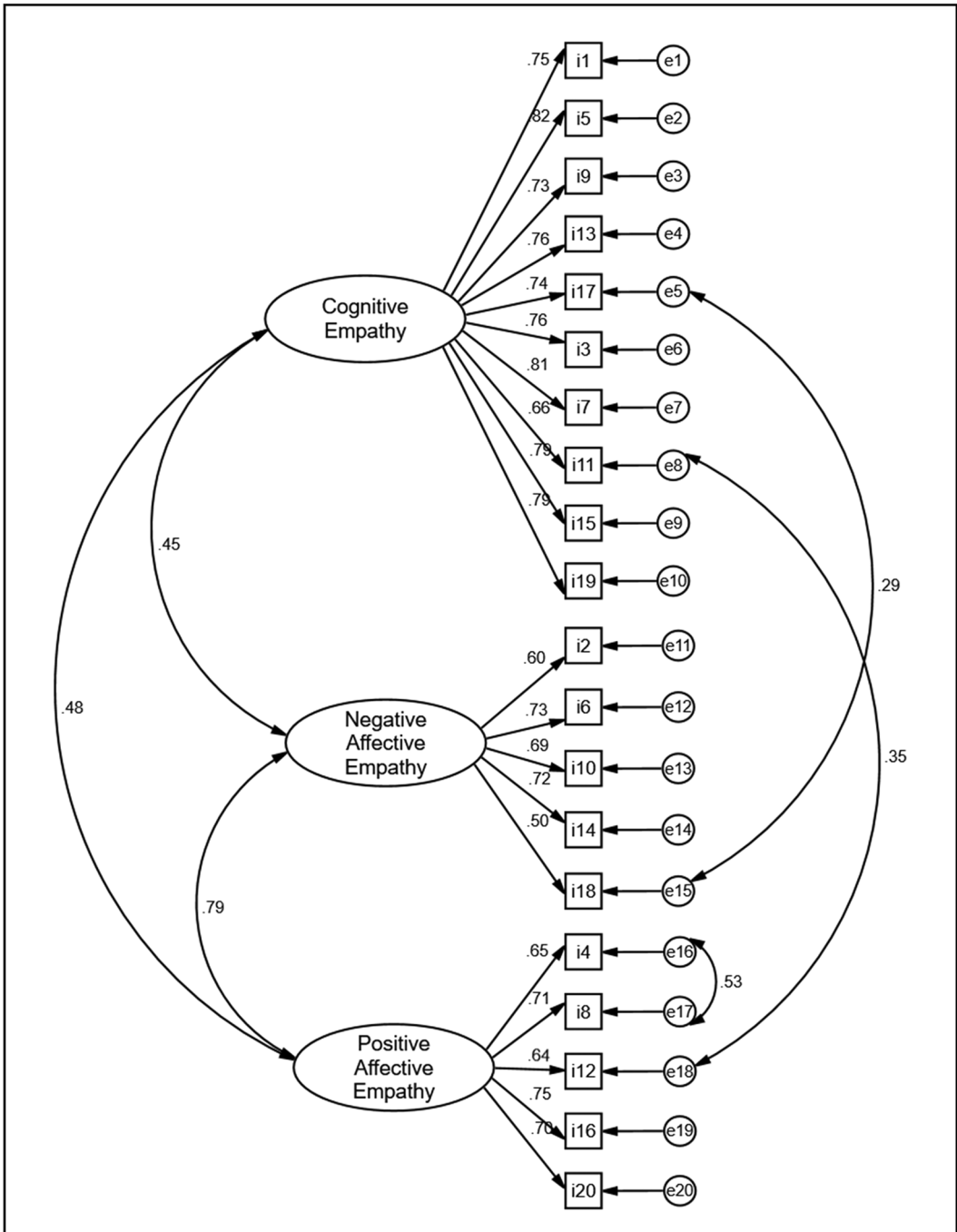


FIGURE 1 Graphical representations of modified three-factor model (model 4i) with factor loadings.

3.5 | Clinical utility

As shown in Table 1 and Supporting Information: Figure 2, patients with MDD had significantly lower PES total scores than healthy controls ($F(1,97) = 18.22, p < .001, \text{partial } \eta^2 = 0.16$). MANCOVA showed that the score of each PES subscale was significantly lower in patients with MDD than in healthy controls (Negative Cognitive Empathy: F

TABLE 3 Pearson correlations between the PES with the IRI and QCAE.

	IRI-PT	IRI-EC	QCAE-CE	QCAE-AE
PES-CE	.18**	.15**	.48**	.20**
PES-NAE	.19**	.13**	.29**	.37**
PES-PAE	.33**	.26**	.40**	.31**
PES-AE	.29**	.22**	.38**	.38**
PES-Empathy	.27**	.21**	.51**	.33**

Abbreviations: AE, affective empathy; CE, cognitive empathy; EC, empathic concern; IRI, Interpersonal Reactive Index; NAE, negative affective empathy; PAE, positive affective empathy; PES, Perth Empathy Scale; PT, perspective-taking; QCAE, Questionnaire of Cognitive and Affective Empathy.

** $p < .01$.

TABLE 4 Factor loadings of the exploratory factor analysis with subscales from the PES and the TAS-20.

	Factor 1 "General alexithymia"	Factor 2 "General empathy"
TAS-20		
TAS-DIF	.86	.13
TAS-DDF	.87	.03
TAS-EOT	.40	-.10
PES		
PES-NAE	.21	.81
PES-PAE	-.07	.78
PES-CE	-.10	.56
% Variance accounted for	28.67	26.39

Note: Principal axis factoring with direct oblimin rotation was used.

Abbreviations: CE, cognitive empathy; DDF, difficulty describing feelings; DIF, difficulty identifying feelings; EOT, externally oriented thinking; NAE, negative affective empathy; PAE, positive affective empathy; PES, Perth Empathy Scale; TAS, Toronto Alexithymia Scale.

(1,97) = 13.90, $p < .001$, partial $\eta^2 = 0.13$; Positive Cognitive Empathy: $F(1,97) = 14.36$, $p < .001$, partial $\eta^2 = 0.13$; Negative Affective Empathy: $F(1,97) = 4.87$, $p = .03$, partial $\eta^2 = 0.05$; Positive Affective Empathy: $F(1,97) = 12.40$, $p = .001$, partial $\eta^2 = 0.11$).

Moreover, the discriminant function (Discriminant score = $0.087 \times$ Cognitive Empathy $- 0.029 \times$ Negative Cognitive Empathy $+ 0.114 \times$ Positive Cognitive Empathy $- 4.171$) significantly distinguished the two groups of participants ($\lambda = .80$, $\chi^2(3) = 21.591$, $p < .001$). Discriminant analysis found 71.00% of the original cases could be correctly classified (72.00% for patients with MDD, 70.00% for healthy controls).

4 | DISCUSSION

In this study, we introduced the Chinese version of the PES and examined its psychometric properties. The CFA suggested a three-factor affective valenced structure of the PES, concurring with the original study (Brett et al., 2022). Our findings also reported excellent internal consistency, good test-retest reliability, as well as high

convergent and discriminant validity of the PES. In addition, the PES was able to significantly distinguish patients with MDD from healthy controls. Overall, the Chinese version of PES appears to be a reliable and valid tool for assessing the multidimensional empathy construct in the Chinese settings.

For the factor structure, the results of CFA supported a three-factor model, in which the items meaningfully loaded on the Cognitive Empathy, Negative Affective Empathy and Positive Affective Empathy subscales. The three components could be effectively combined into a general empathy factor. This finding is consistent with the results in an English version of the PES (Brett et al., 2022), supporting a multifaceted construct of empathy across Eastern and Western culture. Furthermore, this three-factor structure highlighted the importance to distinguish negative and positive valences for affective empathy, but not cognitive empathy. Previous studies based on self-report, behavioral and functional neuroimaging methods have demonstrated that empathizing others' negative and positive affect was related to distinct patterns of social behavior, social emotion and brain networks (Andreychik & Migliaccio, 2015; Bernhardt & Singer, 2012; Lamm et al., 2015; Light et al., 2019). Therefore, our findings extend prior research by elucidating the valence-specificity in affective empathy rather than cognitive empathy, which may contribute to shedding light on the complexities of empathy.

The reliability and validity of the Chinese PES were comparable to those in the original English version (Brett et al., 2022), indicating good cross-cultural adaptation of the PES. Our findings were similar or even better to those reported in other empathic scale validation studies in China, such as the QCAE (Liang et al., 2019, 2020), the IRI (Wang et al., 2013; Zhao et al., 2019) and the EQ (Zhao et al., 2018; Zhou et al., 2022). We further extended the previous investigation of the PES by examining its test-retest reliability over a 4-week period and observed that empathic structure measured by the PES was a relatively stable trait. Evidence of concurrent validity was provided by significant correlations between Negative Affective Empathy and Positive Affective Empathy with depressive symptoms in nonclinical sample. This different correlated pattern further supported the necessity to distinguish negative and positive valences in affective empathy. However, we did not find significant correlations between scores of the PES and HAMD in patients with MDD, which was in line with previous studies using the QCAE or IRI (Cusi et al., 2011; Liang et al., 2020). Liang et al. (2020) reported nonsignificant correlations between QCAE and HAMD (Cognitive Empathy: $r = .03$; Affective Empathy: $r = -.07$). Cusi et al. (2011) found that neither cognitive nor affective empathy scores were significantly associated with the depressive symptoms measured by HAMD (Cusi et al., 2011). Such results might be explained by the limited sample size and medication effects. Future studies may benefit from recruiting a larger sample and including medication-naïve patients to explore the relationship between empathy and depressive symptoms in patients with MDD.

Impaired ability of empathy was commonly found in patients with MDD (Kupferberg et al., 2016). In our study, the significantly lower scores of the PES in patients with MDD indicated that patients had abnormal empathy, consistent with previous studies (Guhn et al., 2020; Kilian et al., 2022). Abnormal empathy has also been reported in chronic (Wilbertz et al., 2010), recurrent (Cusi et al., 2011), and remitted depression (Ladegaard et al., 2016), as well as in subclinical depression (Schreiter et al., 2013), suggesting that the deficits of empathy may be a potential risk factor for the development of depression, especially the affective empathy component (Yan et al., 2021). However, existing evidence was mainly based on other measures focusing on negatively valenced empathy. Our study found that patients with MDD seemed to have more difficulties in sharing others' positive emotions compared to negative emotions, in accordance with findings showing that lower positive empathy was associated with higher depression across different cultures (Cui et al., 2023; Light et al., 2019). Moreover, our results extended the previous findings by combining both negative and positive emotions for empathy and explored its clinical applications in the Chinese context. Taken together, our results indicated that the Chinese version of the PES was sensitive enough to detect atypical empathy in MDD, thus has the potentiality to be applied in clinical settings.

Several limitations of this study should be noted. First, the majority of the nonclinical participants were young adults, which might not be representative of the general Chinese population. Second, we only recruited patients with MDD as our clinical sample. Therefore, the generalization of our findings to other mental conditions remains unknown. Third, in some past studies not using the PES, differences between self-report measures and behavioral

measures of empathy have been found (Murphy et al., 2020). Future studies should combine the PES with behavioral performance and neurophysiological techniques, to investigate the concurrent validity of the PES against behavioral measures.

5 | CONCLUSION

In conclusion, our results suggest that the Chinese version of the PES has sound psychometric features. The PES is a promising measure for comprehensively assessing cognitive and affective empathy across negative and positive emotions in the Chinese-speaking sample. Use of the PES moving forward should therefore usefully enhance the comprehensiveness of empathy assessments.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ETHICS STATEMENT

This study's ethical procedures followed the Declaration of Helsinki and were approved by the Research Ethics Review Board of the School of Basic Medical Sciences, Hangzhou Normal University. Informed consent was obtained from each participant.

ORCID

Xin-Lu Cai  <https://orcid.org/0000-0003-2260-4772>

PEER REVIEW

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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