


Development and initial validation of a short three-dimensional inventory of character strengths

Wenjie Duan¹  · He Bu¹

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Abstract

Purpose Character strength is described as a positive and organized pattern of emotions, thoughts, and behaviors. It serves as a schema that organizes categories of information toward the self, others, and the world, and provides the self-aware knowledge that facilitates the pursuit of goals, values, and ethical principles. Recent research has suggested that three reliable factors emerge from the measures of character strengths: caring, inquisitiveness, and self-control. The goal of this paper is to develop a psychometrically sound short measure of character strength.

Methods The questions were addressed in two studies using two independent samples: a cross-cultural (i.e., 518 Asians and 556 Westerners) sample, and a cross-population (i.e., 175 community participants and 171 inpatients) sample in China. **Results** Findings from the exploratory and confirmatory factor analysis suggested a cross-cultural three-factor model of character strength that could be measured by the Three-dimensional Inventory of Character Strengths (TICS). A multigroup confirmatory factor analysis further indicated that the number of factors and factor loadings was invariant in the medical and community samples. This result indicated that the brief inventory could be applied to a medical context. Internal reliability, content validity, and predictive validity were good, although the predictive validity of the three character strengths for psychological symptoms in the medical sample was more modest than that in the community sample.

Conclusions TICS is expected to be used for screening populations at risk, and a tool to aid mental health professionals in group-based treatment/intervention planning. It also should be noted that this short inventory should be used with caution for individual decision making.

Keywords Strength assessment · Psychometrics · Cross-culture · Positive psychiatry · Positive psychology · Wellbeing

Introduction

Character strength is described as a positive and organized pattern of emotions, thoughts, and behaviors [1]. It serves as a schema that organizes categories of information toward the self, others, and the world [2], and provides the self-aware knowledge that facilitates the pursuit of goals, values, and ethical principles [3]. Researchers have proposed that positive psychological concepts, such as resilience, character strengths, and mindfulness, could and should be integrated into clinical practice to help clients alleviate suffering and increase wellbeing [4] rather than emphasizing the negative. Character strength has attracted the attention of scientists in different health-promotion areas [5]; however, it has not been well studied in medical settings [6]. Bird et al. [7] reviewed seven qualitative and five quantitative strength assessment measures, and concluded that none of them met the needs of clinical populations. The existing measures are compromised by a variety of issues, such as problems with content validity, variations in factor structure, ecological validity of translated versions, and length [7–10]. The current study attempted to address these issues by developing a brief inventory with cross-cultural (western vs. eastern) and

✉ Wenjie Duan
duan.w@whu.edu.cn; duan.w@outlook.com

¹ Department of Sociology, Wuhan University, 299 Bayi Road, Wuchang District, Wuhan, Hubei, People's Republic of China

cross-population (medical vs. community) utility for measuring character strengths.

The VIA classification of strengths and virtues [11] provides a framework for studying character strengths from both psychological and cross-cultural perspectives. The VIA classification is a theory-driven framework comprising 24 character strengths (e.g., hope, gratitude, curiosity, self-regulation, and prudence) and 6 virtues that are recognized and valued across cultures around the world [11, 12]. An important argument on character strengths is the degree to which these constructs represent the distinct elements of personality compared with the constructs contained in the Big Five model of personality (i.e., openness, conscientiousness, extraversion, agreeableness, and neuroticism) [13]. For example, conscientiousness in the Big Five model overlaps with the self-regulation factor [14]. However, the meta-cognitive properties of character strength have a relatively weak correlation with the dimensions of the Big Five model [14]. In addition, although kindness and fairness factors partly overlap with agreeableness, the moral implications of caring are neglected by the Big Five model.

Existing literature using the VIA inventory of strengths (VIA-IS) [11] suggests that the factor structure of the 24 character strengths varies, as shown in the five-factor models [11, 15–18]. The four-factor models [14, 19], three-factor models [20, 21], and two-factor models [22] have been identified in different countries and cultures. These inconsistent findings imply the possibility of differences in latent structure across cultures. Kristjánsson [23] argued that the distinction between the character strengths involved in the VIA classification is insufficiently clear because of the existing cultural and social norm differences. Previous researchers have been aware of the cultural and social norm issue of character strength assessment [9, 24]. The combined emic–etic approach has been recommended to control the cultural and psychological factors for developing universal constructs and their corresponding assessments [25, 26]. The emic approach indicates that individuals' cognition and behavior is culturally dependent, whereas the etic approach implies that the models and theories developed in Western cultures are generalizable or culturally independent [25]. Duan et al. [27] adopted this approach in China to reveal a three-factor structure (i.e., interpersonal, vitality, and cautiousness) [28]. Another study revealed how the data split into different dimensions to decompose the factors from the top unrotated principal component (i.e., an overall strength factor) and found that the most appropriate solution was the three-factor model [21]. The authors called these components interpersonal, intellectual, and temperance strength.

McGrath [9] recent study found a three-component solution called caring, inquisitiveness, and self-control

based on psychological and cultural perspectives. The similar results speculated that the three-factor solution of VIA could be a universal structure across cultures. McGrath [9] adopted a variety of personality and character measures in other studies, such as Signature Strengths Inventory, Perceptions of Personal Qualities, HEXACO Personality Inventory, and Cattell's 16 Personality Factor Questionnaire Fifth Edition, to explore the factor solution of good characters. The results demonstrated a replicable three-factor structure of good characters across all measures. "Interpersonal" proposed by Duan et al. [27] and "Caring" by McGrath [9] indicate the character strength involved in maintaining agreeable relations toward others; "Vitality" by Duan et al. [27] and "Inquisitiveness" by McGrath [9] indicate the character strength that describes the curiosity and creativity to associate oneself with all life in the whole world; and "Cautiousness" proposed by Duan et al. [27] and "self-control" by McGrath [9] indicate the character strength that reflects the regulation and adoption ability in achieving values and goals. Hypothesizing that the current three-character strengths model (i.e., caring, inquisitiveness, and self-control) is a universal structure of character strengths across cultures is reasonable and warrants further examination.

The three character strengths involved in the three-strength model can be measured by the 240-item VIA-IS [11] and the 96-item Chinese Virtues Questionnaire (CVQ) [28]. Although the three-factor model has now emerged to be reliable across multiple cultures and measurement devices, other issues have been interfering with their use in clinical and non-clinical settings [7]. The existing VIA-IS and CVQ inventories may be excessively long for medical patients or individuals with significant mental health issues. A semi-structured interview about the VIA-IS among 21 psychotic patients revealed that 38% of them considered the questionnaire difficult and excessively long [29]. Moreover, the length of the questionnaires also causes inconvenience for large-scale investigations in community populations. Ziegler et al. [30] suggested that a well-developed short scale would be more suitable for community and clinical research and practice.

Moreover, the relationship between character strengths and mental wellbeing has been explored in many studies in normal populations from various countries (e.g., college students, adolescents, and adults). An individual with a high level of character strength shows a high level of mental wellbeing (e.g., happiness and flourishing) and a low level of psychological symptoms (e.g., depression and anxiety). For instance, character strength has a significant positive relationship with life satisfaction [31, 32], wellbeing [33], positive emotions [34], quality of life [35], less perceived stress [36, 37], and life meaning [38]. Character strength-based interventions have also been conducted to

reveal the positive role of using character strength in increasing mental wellbeing [39–41]. Nevertheless, only a few studies have explored the relationship between character strengths and mental illness. Few studies on the general population have indicated that character strengths have a negative association with psychological distress [37] and posttraumatic stress disorders [42]. Limited medical and clinical studies have found that physical illnesses and particular disorders (e.g., gelotophobia) could have a slightly negative relationship with some character strengths, such as Hope, Curiosity, and Gratitude [43, 44]. Moreover, a replication study of Seligman et al. [39] found that using character strengths did not significantly decrease depression among medical patients with depression disorders [45]. Sims et al. [29] found that strengths-based intervention only improved the positive affect and not the negative affect of participants with clinical psychosis. The general finding that the evaluation of character strengths provides a useful contribution to understanding clinical phenomena has an exception [45]; the overall findings suggest the usefulness of having a measure of strengths that is equally applicable to medical and community general populations, with the goal of evaluating whether or not strengths are equally useful for alleviating suffering and increasing wellbeing in both populations.

These findings raise three issues: (a) whether or not the three-factor model can describe the theoretical structure of character strengths in the VIA classification, (b) whether or not character strengths can be equally measured in ordinary and medical populations, and (c) whether the roles or the functions of these character strengths (i.e., alleviating suffering and increasing wellbeing) are identical between these two populations. An important contributor to develop such a measure is the demonstration of measurement invariance (i.e., metric equivalence and scalar equivalence) across populations.

The present study

The preceding discussion highlights three significant goals addressed in this study: replication of the three-character strengths model (i.e., caring, inquisitiveness, and self-control), development of a brief character strengths inventory that is relevant to both medical and community settings, and establishing the metric and the scalar equivalence of the new inventory across different populations.

Two studies were conducted to develop a brief inventory to measure the three character strengths and evaluate its cross-cultural and cross-population validity. Study 1 used a Chinese undergraduate sample to develop the Three-dimensional Inventory of Character Strengths (TICS). The

factor structure of the instrument was then tested among Western students. Study 2 used a community sample and an inpatient sample in China to examine the measurement invariance of the inventory across populations and explore the ability of the TICS to predict the mental health criteria four weeks later.

Study 1: inventory development and cross-cultural validation

Method

Participants and procedures

Participants included 1074 college students who were studying in China. The Asian sample consisted of 518 (48.14%; 229 males and 289 females) Chinese students, and the Western sample comprised 556 (51.76%; 231 males and 325 females) students from the United States, Italy, France, Canada, Switzerland, and the United Kingdom. The age of the participants ranged from 18 to 25 years ($M = 20.17$, $SD = 1.47$). The Asian sample was used for inventory development, such as item selection and exploratory factor analysis (EFA), and the Western sample was used for cross-cultural validation, such as confirmatory factor analysis (CFA), because of the limited sample size of the Asian sample. Using Asian and Western sample also examines the stability of the model in students with cross-cultural backgrounds. The invitation was distributed through the university email system. An online survey system was used. Participants were invited to visit the provided URL to complete the anonymous questionnaire and provide demographic information. The snowball sampling method was adopted. Students with Western cultural backgrounds were encouraged to invite their classmates to participate in this study. At the beginning of the questionnaire, participants were instructed to click the “Agree” button to indicate their willingness. Participants with serious physical and/or mental illness were excluded. Data were collected from October 2013 to May 2015.

Item pool and selection criteria

A total of 96 items of the CVQ [27, 28], which were originally drawn from the items comprising the VIA-IS, were adopted as the initial item pool for the exploratory factor analysis. The combined emic–etic approach [25] adopted by the authors improved the likelihood of equivalence. All these items conform to social norms relevant in Western and Eastern societies [8, 27]. Moreover, the items of the original VIA-IS have cross-cultural relevance [46].

Participants were required to rate each item from 1 (“very much unlike me”) to 5 (“very much like me”). The adapted guideline for developing the brief inventory proposed by Marsh et al. [47] was adopted to construct the short scale. The criteria applied in the current case were as follows: (a) retain the structure of three subscales to describe three character strengths (i.e., caring, inquisitiveness, and self-control subscales), (b) retain as much content coverage as possible of the 24 strengths in VIA while being concise by keeping only one item representing each strength, (c) include at least four items in each of the three subscales, (d) choose items to achieve acceptable internal reliabilities for each subscale, (e) choose items with item-total correlations of at least 0.40, and (f) demonstrate an acceptable item-level CFA model fit with factor loadings on the parent scale higher than 0.50 and minimal cross-loadings. Constructing short scales based on optimization statistics (e.g., reliability and internal consistency) may result in scales with a narrow bandwidth. Thus, we developed the above criteria (b) to cover the hypothesized attributes well.

Results

EFA

Following the procedure suggested by [47], EFA was conducted using the 96 items of CVQ in the Asian sample. Principal axis factoring with oblimin rotation was used to generate three factors. The KMO value (0.93) and Bartlett’s test ($p < 0.001$) were acceptable. The results indicated that (a) the three factors explained only 29.51% of the total variance; (b) the items showed low factor loadings (i.e., 93 items with a factor loading of less than 0.60 and 48 items with a factor loading of less than 0.50); (c) some items cross-loaded on multiple latent factors; and (d) some items loaded on theoretically unexpected factors (e.g., the items of caring loaded highly on the self-control factor). These statistics are consistent with the argument that the character strengths in the VIA classification are insufficiently distinct [23]. Total variance explained, Cronbach’s alphas, and item-to-total correlations were used in the item selection to prove a reliable factor structure. After the item selection process, items with low factor loadings, substantial cross-loadings, and theoretically unexpected maximum loadings were removed sequentially. 15 items retained (5 items per factor), and this outcome explained 50.94% of the total. Moreover, 14 of the 15 items had factor loadings higher than 0.51, with the exception of one item with a factor loading of 0.49. The item-total correlations were higher than 0.42. The internal reliabilities (Cronbach’s alpha) of the three scales were higher than 0.74. The results are shown in Table 1.

CFA

The Western sample was used to examine the cross-cultural structural validity of the three-character strengths model. Confirmatory factor analysis was conducted using Mplus 7.0 [48]. The comparative fit index ($CFI > 0.95$), Tucker-Lewis index ($TLI > 0.95$), and root mean square error of approximation ($RMSEA < 0.05$ or 0.08) were adopted to evaluate the models [49]. Two models were tested: a single-factor model and a three-factor model. The single-factor model showed poor goodness-of-fit ($\chi^2 = 602.968$, $df = 90$, $\chi^2/df = 6.70$, $p < 0.001$, $CFI = 0.706$, $TLI = 0.657$, $RMSEA = 0.101$, 90% CI [0.094, 0.109]), whereas the three-factor model had acceptable fit ($\chi^2 = 213.246$, $df = 87$, $\chi^2/df = 2.45$, $p < 0.001$, $CFI = 0.928$, $TLI = 0.913$, $RMSEA = 0.051$, 90% CI [0.042, 0.060]). The standardized path coefficients, which are higher than 0.49, of the three-factor model and the correlations among the three character strengths are shown in Fig. 1.

Descriptive statistics and difference analysis

The mean and the standard deviation of each strength in the Asian and Western samples are presented in Table 2. The independent samples t test indicated no significant difference among the three strengths between Asian and Western populations.

Study 2: measurement invariance and predictive ability

Method

Participants and procedures

A total of 175 (50.60%) community participants and 171 (49.40%) general surgery inpatients were involved in Study 2. The participants were recruited from different communities and hospitals in Chongqing and Sichuan, China. Only the general surgery patients who were in the process of rehabilitation were invited to participate in the current study, and the critically ill, emergency, and psychiatric patients were excluded. Participants included 167 (48.30%) males and 179 (51.70%) females, and the age ranged from 22 to 54 years ($M = 40.21$, $SD = 8.44$). No difference in gender ($t = 0.74$, $p = 0.46$) or age ($t = -1.87$, $p = 0.06$) was found in the two samples. The paper-and-pencil method was used to collect data. Trained psychology students in communities and registered nurses in hospitals invited potential participants to join the study. Participants were required to complete the TICS immediately and

Table 1 Factor structure, internal reliability, and item-total correlation of the three-dimensional inventory of character strengths (Asian sample)

Item no.	Strengths in VIA	Items	Factor loadings			Item-total correlation
			Inquisitiveness	Caring	Self-control	
54	Curiosity	I can find something of interest in any situation [在任何情形下我都能找到乐趣]	0.71	0.23	-0.21	0.56
51	Humor	I never allow a gloomy situation to take away my sense of humor [我从不让沮丧的境遇带走我的幽默感]	0.64	0.25	-0.29	0.54
32	Creativity	I am always coming up with new ways to do things [我总能想出新方法去做事情]	0.61	0.30	-0.47	0.47
20	Social intelligence	I have the ability to make other people feel interesting [我有能力令其他人对一些事物产生兴趣]	0.56	0.21	-0.30	0.47
52	Zest	I have lots of energy [我精力充沛]	0.51	0.34	-0.35	0.42
79	Fairness	I believe that everyone should have a say [我认为每个人都应该有发言权]	0.28	0.81	-0.27	0.56
80	Leadership	As a leader, I believe that everyone in the group should have a say in what the group does [作为团体领导者,我认为每个成员都有对团体所做的事发表意见的权利]	0.19	0.68	-0.19	0.55
78	Teamwork	It is important to me to respect decisions made by my group [尊重团体的决定对我来说很重要]	0.21	0.53	-0.23	0.56
91	Authenticity	Others trust me to keep their secrets [别人相信我能帮他们保守秘密]	0.31	0.51	-0.43	0.55
66	Kindness	I enjoy being kind to others [我享受善待他人的感觉]	0.31	0.49	-0.25	0.563
16	Regulation	I am a highly disciplined person [我是一个高度自律的人]	0.22	0.25	-0.67	0.55
17	Prudence	I always think before I speak [我总是思考以后再讲话]	0.28	0.24	-0.63	0.51
56	Judgment	Thinking things through is part of who I am [深思熟虑是我的特点之一]	0.36	0.19	-0.62	0.53
44	Perseverance	I do not give up [我不言放弃]	0.34	0.41	-0.57	0.47
30	Love of learning	I am a true life-long learner [我是个真正的终身学习者]	0.45	0.27	-0.54	0.47
		Explained variance	29.87%	11.36%	9.71%	-
		Cronbach's alpha	0.74	0.74	0.74	-
		Ordinal alpha	0.87	0.82	0.86	-

invited to complete the depression anxiety stress scale (DASS) four weeks later. There was a four-week interval between administering the TICS and DASS, in order to explore the ability of the TICS to predict mental health outcomes. In the community sample, whether individual character strengths are protectors of mental health, in the absence of physical or emotional illness, was tested. In the inpatients, whether people with more character strengths are less likely to experience depression and anxiety after surgery was examined. Subsequently, the

relative roles of character strengths in the two different populations were compared. Participants who were willing to attend and complete the entire study received compensation (i.e., RMB 30). All participants provided a written informed consent. The Institutional Review Board of the First Hospital Affiliated with Chongqing Medical University and the Hospital (TCM) Affiliated with Southwest Medical University approved this study. The data were collected from March 2015 to October 2015.

Fig. 1 Confirmatory factor analysis of the three-character strengths model in the western sample with standardized path coefficients and standard errors. *inquis* inquisitiveness, *control* self-control

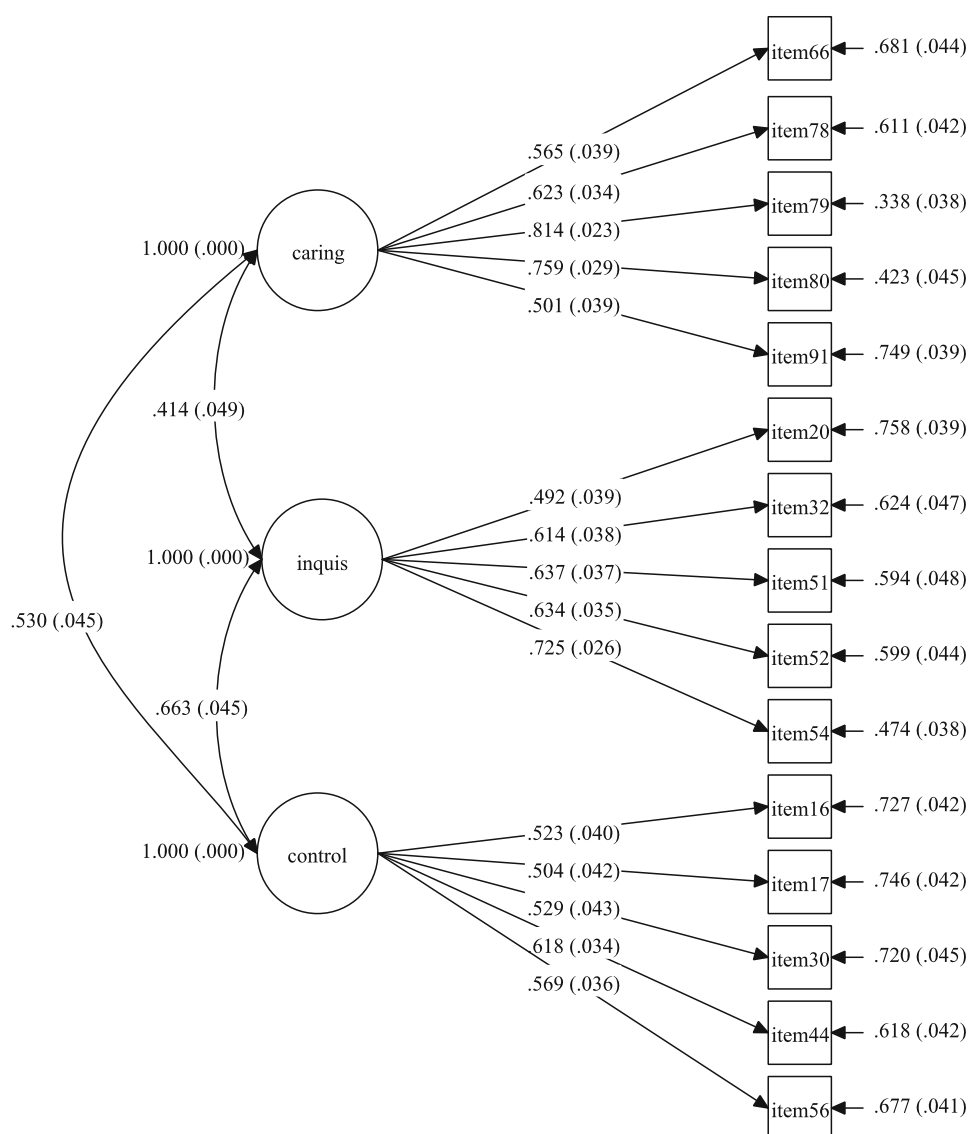


Table 2 Descriptive statistics and difference analysis of the three character strengths in Asian and Western populations

	Asian sample ($n = 518$)		Western sample ($n = 556$)		t -test	
	Mean	SD	Mean	SD	t	p
Caring	4.11	0.50	4.01	0.56	1.33	0.19
Inquisitiveness	3.42	0.65	3.45	0.64	-0.84	0.40
Self-control	3.50	0.68	3.47	0.63	0.61	0.54

Measures

TICS

TICS is a 15-item brief scale for measuring the three character strengths (i.e., caring, inquisitiveness, and self-control; five items per subscale) as described in the previous study. Participants were required to rate each item from 1 (“very much unlike me”) to 5 (“very much like me”). Subscale scores were obtained by averaging across

items on the scale. The Cronbach’s alpha in the community sample and in the medical sample of the Caring subscale were 0.82 and 0.86, that of the Inquisitiveness subscale were 0.79 and 0.80, and that of the Self-control subscale were 0.83 and 0.85, respectively.

DASS

DASS was adopted for assessing depression, anxiety, and stress in the past week. It is a 21-item self-report scale that

contains three subscales (seven items per subscale) [50]. Participants were asked to indicate their answers on a four-point scale based on the experiences of the past week from “did not apply to me at all” (0) to “applied to me very much, or most of the time” (3). None of the items were reverse coded. A previous study revealed that the Chinese version had good psychometric properties [51]. Only the depression and anxiety subscales were used in the current study. The Cronbach’s alpha in the community sample and in the medical sample for the depression subscale were 0.76 and 0.79 and that for the anxiety subscale were 0.72 and 0.73, respectively.

Results

Multigroup confirmatory factor analysis (MG-CFA)

MG-CFA was performed to examine the measurement invariance of the three-factor model between the medical and community samples. The three levels of equivalence from the weakest to the strongest (i.e., configural invariance, weak/metric factorial invariance, and strong/scalar factorial invariance) were examined [52, 53]. Change in CFI (Δ CFI) of less than 0.010 [54] and change in RMSEA (Δ RMSEA) of less than 0.015 [55] were adopted to determine whether or not equivalence was maintained between a more restricted model and a less restricted one. As the initial analysis, CFA was separately conducted in the two samples. The medical sample ($\chi^2 = 113.034$, $df = 87$, CFI = 0.925, TLI = 0.909, RMSEA = 0.042, 90% CI [0.013, 0.062]) and the community sample ($\chi^2 = 112.204$, $df = 87$, CFI = 0.926, TLI = 0.911, RMSEA = 0.041, 90% CI [0.011, 0.061]) produced acceptable indices values. The MG-CFA results are presented in Table 3, which shows acceptable changes in the CFI and RMSEA of the weak model. The results support the conclusion that the number of factors and the factor loadings of the items of TICS can be equal across the medical and community populations. Thus, the factor invariance of the three-strength model was partly achieved.

Descriptive statistics and difference analysis

The descriptive statistics, which includes the mean and the standard deviation, of the three character strengths in the

two samples are presented in Table 4. The independent samples t test indicated that the scores of the three character strengths in the community sample were significantly higher than those of the medical sample (in all cases $t > 2.37$, $p < 0.019$). Depression ($t = 4.61$, $p < 0.001$) and anxiety ($t = 10.50$, $p < 0.001$) in the medical sample were also significantly higher than those in the community sample.

Predictive validity

Table 5 shows the Pearson correlations among character strengths, depression, and anxiety in the two samples. The results showed that the three character strengths were positively correlated in both samples, with the coefficients ranging from 0.19 to 0.48 ($p < 0.05$), and negatively correlated with depression and anxiety ($r = -0.17$ to -0.39 , all $p < 0.001$). However, the correlations between character strengths and mental health variables in the medical sample were weaker than those in the community sample. In the community sample, the regression analysis indicated that the three character strengths predicted 29% of the variance of depression symptoms, and Inquisitiveness predicted 12% of the variance of anxiety symptoms (Table 6). Only self-control explained 6% of the variance of anxiety symptoms in the medical sample.

Discussion

The current study aimed to address three issues in the assessment area of character strengths: (a) whether or not the three-factor model can describe the theoretical structure of character strengths in the VIA classification, (b) whether or not a brief character strengths inventory can be developed to facilitate the application of these positive qualities to medical settings, and (c) whether or not the metric and functional equivalences achieved in different populations are unclear. This study developed a brief and psychometrically sound TICS to measure caring, inquisitiveness, and self-control (15 items, 5 items per strength). TICS demonstrates reasonable utility for both medical and community populations. The following discussion focuses on the above three issues.

Table 3 Examination of factor invariance across medical and community samples

	χ^2	df	CFI	Δ CFI	RMSEA	Δ RMSEA
Model one	229.213	174	0.917	–	0.043	–
Model two	244.232	186	0.912	0.005	0.043	0.000
Model three	309.707	198	0.831	0.081	0.057	0.014

Model one configural model, *Model two* equal loadings model, *Model three* equal loadings + intercepts model

Table 4 Descriptive statistics and difference analysis of the three character strengths in medical and community samples

	Community sample (<i>n</i> = 175)		Medical sample (<i>n</i> = 171)		<i>t</i> -test	
	Mean	SD	Mean	SD	<i>t</i>	<i>p</i>
Caring	4.13	0.39	3.85	0.57	5.10	<0.01
Inquisitiveness	3.42	0.45	3.29	0.56	2.37	<0.05
Self-control	3.52	0.49	3.36	0.69	2.39	<0.05
Depression	0.95	0.48	1.20	0.54	-4.61	<0.01
Anxiety	0.93	0.31	1.39	0.49	-10.50	<0.01

Table 5 Pearson correlations between the three character strengths, depression and anxiety in medical and community samples

	Community sample (<i>n</i> = 175)				Medical sample (<i>n</i> = 171)			
	1	2	3	4	1	2	3	4
1 caring	–				–			
2 inquisitiveness	0.19*	–			0.40**	–		
3 self-control	0.33**	0.35**	–		0.46**	0.48**	–	
4 depression	-0.36**	-0.39**	-0.41**	–	-0.26**	-0.25**	-0.26**	–
5 anxiety	-0.21**	-0.28**	-0.26**	0.31**	-0.17*	-0.13	-0.24**	0.68**

* $p < 0.05$, ** $p < 0.01$ **Table 6** Regressions of the three character strengths on depression and anxiety in medical and community samples

	Predictors	Outcome: depression		Outcome: anxiety	
		β	<i>t</i>	β	<i>t</i>
Community sample	Caring	-0.23	-3.36**	-0.13	-10.66
	Inquisitiveness	-0.26	-3.72**	-0.21	-2.69**
	Self-control	-0.25	-3.46**	-0.15	-1.85
	<i>F</i>		22.82**		8.01**
	<i>R</i> ²		0.29		0.12
Medical sample	Caring	-0.16	-1.83	-0.08	-0.90
	Inquisitiveness	-0.13	-1.54	0.00	-0.01
	Self-control	-0.12	-1.38	-0.20	-2.24*
	<i>F</i>		6.54**		3.66*
	<i>R</i> ²		0.11		0.06

* $p < 0.05$, ** $p < 0.01$

Three-factor solution of character strengths

The present study hypothesized a more reliable three-character strengths model (i.e., caring, inquisitiveness, and self-control) based on previous work [9, 27] and theoretical models [3, 11]. The caring component indicates the character strength devoted to maintain agreeable relations with others. The inquisitiveness component relates to the character strength that describes the curiosity and creativity that link the self to the outside world. The self-control component denotes the character strength that reflects the regulation and adaptation ability to achieve valuable goals. The three-strength model of character demonstrated its cross-cultural (Study 1, Asian vs. Westerner) and cross-

population (Study 2, medical and community) validities through CFAs.

Our findings are not unique though. Ho et al. [56] combined positive elements or qualities that show clinical efficacy in enhancing wellbeing and reducing ill-being in clinical studies, such as the ability to love and be loved, gratitude, curiosity, hope, and self-regulation, to further examine their underlying factor structures. Three similar factors (i.e., interpersonal strength, intellectual strength, and temperance strength) emerged from their sample, which comprised individuals with a history of psychiatric problems [56]. Further studies demonstrated the invariance across gender, age, education levels, and marriage status of the three-factor model of strengths [57]. Moreover, Bellier-

Teichmann and Pomini [58] developed another Q-sort-based self-assessment strengths profile for individuals suffering from mental disorders. Although the participants only included 21 patients suffering from mental disorders, such as schizophrenia, mood disorders, and personality disorders, the results were meaningful. This study suggested that 30 strengths could be classified into three categories: personal characteristics (e.g., curiosity and humor), hobbies and passions (e.g., reading/writing and doing sports), and environmental and social strengths (e.g., family and romantic relationship). The three-factor model of character strengths obtained after controlling for the psychological and cultural factors is in accordance with the temperament and character model based on the psychobiological perspective [59]. The temperament and character model is derived from the psychobiological perspective and involves the structure and organization of the brain and the effects of the external environment on the individual's emotion, thought, and behavior [3]. This model describes three general and broad dimensions of characters: (a) the character related to self-autonomy and fulfillment of oneself, (b) the character related to the engagement in relationships with others (e.g., facility members, close friends, and community partners), and (c) the character related to spirituality in the connection between life and the whole world [60, 61]. Thus, the three-character strengths model (i.e., caring, inquisitiveness, and self-control) may be a reliable solution of character strength structures.

Fifteen-item three-dimensional inventory of character strengths

The internal reliability of the three subscales was higher than 0.70, which is good for scales with items less than 20 items [62]. The standard VIA classification contains 24 character strengths, while this 15 items of the TICS only covered 15 different components of the VIA, as listed in Table 1. A previous study claimed that the distinction among the components involved in the VIA classification was insufficiently clear [23]. Hence, due to the ambiguous boundaries and overlapping concepts in the VIA classification, less than 24 components retained in the final item pool was fairly predictable. Moreover, another study developed a 24-item character strengths rating form (CSRFB) to assess character strengths with a single item for each strength [63]. The results of testing CSRFB yielded good convergence with the original VIA classification [11], showing that the short instrument can also have characteristics similar to the standard measure. Therefore, the covered bandwidth of the brief TICS is acceptable. The correlations between the three character strengths and psychological symptoms (i.e., depression and anxiety) were significantly negative in the medical and community

samples, consistent with previous studies [27, 33]. These results suggest that the TICS have good internal reliability and predictive validity. Moreover, the configural model and weak invariances of the three-dimensional model of character strength was achieved in the medical and community samples. This result suggests that the same indicators (i.e., items) load on similar factors (i.e., three characters) with equal factor loadings across the different groups [64]. That is, the 15-item TICS measures the same concepts across the medical and community samples, and the results between the two groups can be compared.

Functional equivalences of three character strengths between the community and medical populations

Character strength-based interventions have been demonstrated to increase wellbeing and ameliorate depression symptoms in non-clinical populations in different countries [39, 40, 65]. Using cognitive behavioral terms, decreased suffering and increased wellbeing can be achieved through the exploration, clarification, and cultivation of the three character strengths [66]. Although the psychometric characteristics of TICS are positive in different cultures and populations, the predictive ability should be further discussed. The three character strengths (i.e., caring, inquisitiveness, and self-control) explained 29% of the variance of depression symptoms in the community sample, but Self-control by itself accounted for only 6% of the variance of anxiety in the medical sample. Moreover, the correlations between strengths and psychological symptoms in the medical sample are more modest than those in the community sample. The result has two possible explanations. One is that, the low scores of strengths indicate ill-being, and the high scores indicate wellbeing. This is because the construct of character strengths may represent a continuum from ill-being (low level) to wellbeing (high level) [10]. Another reason is that, according to the continuum approach of character strengths proposed by Seligman [67], having mental illnesses is the low level or the failure of personal character strengths. In accordance with the temperament and character model [59], at least two strengths with low scores (i.e., caring and self-control in this study) were recurrent among individuals with mental health problems, such as depression and anxiety. Table 5 shows that the medical sample had higher correlations between depression and anxiety and closer associations among the three character strengths compared to the community sample. Thus, the negative associations between character strengths and psychological distress in the medical sample with significant psychological symptoms are expected to be modest.

However, the differences in the character strengths of the relationships between the medical and community

samples may imply that character strengths could have functional in-equivalence in different populations. Duan et al. [42] examined the role of strengths in affecting posttraumatic growth in a sample of trauma sufferers. The results indicated that strengths could not significantly predict posttraumatic growth among individuals with posttraumatic stress disorder. Moreover, as we mentioned in the introduction, the strength-based intervention did not produce any significant change in decreasing depression among clinical patients with depression disorders [45]. Therefore, the present study suggests that character strengths may be more effective in reducing psychological symptoms in non-clinical populations than in somatic clinical populations. Moreover, the nature of character strengths should promote wellbeing through self-awareness and engagement, not cure the disease [11]. The clinical population discussed in the current research is primarily a somatic clinical sample. Whether or not character strength shows functional equivalence in enhancing wellbeing in somatic clinical population and mental illness patients remains unclear.

The TICS has three main advantages: (a) it is a simple and quick way to assess three key character strengths across diverse populations; (b) it covers a wide range of positive qualities identified in the evidence-based literature and clinical practice; and (c) it provides a general character strengths profile for planning and monitoring psychological and clinical interventions/treatments in practice.

Limitations and future directions

Although the advantages of using short scales have been discussed, there may be disadvantages or important limitations associated with that use. For example, Heene et al. [68] showed that the reduction of the number of items has no effect on criterion validity or differences between two samples, but the scale scores at the individual level are unreliable. Moreover, when the number of items is reduced, the measurement precision, which refers to the reliability of individual scores, deteriorates quicker than the total score reliability, which describes the total score reliability. Thus, shortened scales (e.g., State Scale of the State–Trait Anxiety Inventory) may be more feasible to provide results, which meet the minimum total score reliability requirements, for scientific research than for reliable individual decision making [69–71]. No study has suggested that the dimensional scores of the TICS at the individual level are unreliable. Future research is expected to investigate this issue. The classical test theory and generalizability theory should be combined to further evaluate the psychometric characteristics of the TICS [72]. Nevertheless, the shortened scale can also show screening

roles in identifying at-risk populations. Su et al. [73] developed a long 54-item comprehensive inventory of thriving (for research purposes), and a short version 10-item brief inventory of thriving (BIT) for large-scale and practical use. A recent study found the screening role of the BIT in mental health status was superior to other wellbeing measures, for the reason that the BIT measures the fullest range of mental, physical, and social wellbeing [74]. More studies are needed using appropriate estimators, reliability and validity calculations, and diverse populations [75], in order to enhance the psychometric properties of the TICS. In addition, Sandy et al. [76] recently compared the genetic algorithms approach (an automatic search algorithm to find solutions in a compact problem space) to the traditional approach (internal consistency and various validities, namely rational methods), in evaluating the psychometric characteristics of the abbreviated scales. Results implied that both of the methods produced similar psychometric qualities. Thus, future studies adopting the genetic algorithms method can be conducted to identify the accuracy of psychometric properties of the TICS.

A number of other limitations should be noted in light of the above findings. First, the findings are generalizable only to college students, normal community individuals, and general surgery inpatients. The participants were Chinese community adults and inpatients who could not reflect the full background of parallel participants in other countries. Thus, future studies are recommended to further validate the TICS in other populations. Second, none of the medical participants involved in the study were diagnosed with mental disorders. Therefore, the generalizability of the findings in this study to individuals with mental issues is unknown. Future research can explore the screening role of the TICS, especially on the individual level, among participants with depression, anxiety, personality, or other disorders. Third, only limited psychometric properties were reported in the current study. The test–retest reliability and measurement invariance should be further examined. The MG-CFA between Asian and Western students was not conducted, as the Asian student sample was used for EFA. Therefore, independent samples should be collected for further examination of cross-cultural invariance. Moreover, the overlap between the TICS and other character strengths measures, such as the VIA-IS [11], CVQ [27, 28], Brief Strengths Scale [56], and Temperament and Character Inventory [77], are worthy of exploration. The comparison among these measures may also shed light on the content validity and the discriminant and incremental validity of the newly developed TICS. Finally, the associations of the three strengths with other psychological variables (e.g., positive and negative emotions, happiness, and psychological distress) should be investigated.

Implications

This study has three important implications for scientific research and clinical practice. First, the findings suggest that the inferences made based on the scores of the TICS are valid. College students, medical inpatients, and community populations can use this inventory for assessing personal strengths, and this inventory is brief enough to be efficient in medical and community use. Second, character strengths-based intervention can be developed in normal populations, such as college students, office workers, and communities, to increase wellbeing and decrease psychological symptoms. Finally, character strength is suggested to be a supplementary component that can be integrated into traditional therapies in a clinical setting. With the increasing number of studies, the TICS is expected to be a means of screening populations at risk, a tool to aid mental health professionals in group-based treatment/intervention planning.

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Compliance with ethical standards

Conflict of interest The author, Wenjie Duan, declares no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

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