UCLA
UCLA Previously Published Works

Title
Psychometric testing of the Chinese version of the Medical Outcomes Study Social Support Survey among people living with HIV/AIDS in China

Permalink
https://escholarship.org/uc/item/8b17b0vt

Journal
Applied Nursing Research, 28(4)

ISSN
0897-1897

Authors
Yu, Yu
Yang, Joyce P
Shiu, Cheng-Shi
et al.

Publication Date
2015-11-01

DOI
10.1016/j.apnr.2015.03.006

Peer reviewed

Original Article

Psychometric testing of the Chinese version of the Medical Outcomes Study Social Support Survey among people living with HIV/AIDS in China

Yu Yu, MPH [a,b,1], Joyce P. Yang, M.S. [c,2], Cheng-Shi Shiu, MSW, PhD [d,3], Jane M. Simoni, PhD [c,4], Shuiyuan Xiao, MD [a,5], Wei-ti Chen, PhD [e,6], Deepa Rao, PhD [f,7], Mingjiong Wang, M.S. [g,*]

[a] Department of Social Medicine and Health Management, Public Health School, Central South University, Changsha, Hunan 410008, China
[b] Department of Global Health, University of Washington, Seattle, WA 98195-7765, USA
[c] Department of Psychology, University of Washington, Seattle, WA 98195-1525, USA
[d] School of Social Work, University of Washington, Seattle, WA 98105, USA
[e] Yale school of nursing, Yale University, Orange, CT 06477, USA
[f] Department of Global Health, University of Washington, Seattle, WA 98104, USA
[g] Department of Traditional Chinese Medicine, Changsha Medical School, Lei feng road nine kilometers, Traditional Chinese Medicine department of Changsha Medical School, Wangcheng, Changshang city, Hunan province 410219, China

ARTICLE INFO

ABSTRACT

Purpose: The aim of this study was to assess the psychometric properties of the Chinese (Mandarin) version of the Medical Outcomes Study Social Support Survey (MOS-SSS-CM) among people living with HIV/AIDS (PLWHA) in Mainland China.

Methods: A cross-sectional study was conducted with a convenience sample of 200 Chinese PLWHA. They completed the MOS-SSS-CM along with the Chinese version of the Beck Depression Inventory Revised (BDI-II) scale, the Zung Self-Rating Anxiety Scale (SAS), the Perceived Stress Scale (PSS-10), and the World Health Organization Quality of Life Brief (WHOQOL-BREF) scale.

Results: Internal consistency (Cronbach's α) was 0.97 for the overall MOS-SSS-CM and 0.82–0.91 for the five sub-scales originally proposed. However, 11 of the 19 items demonstrated unsatisfactory item discriminant validity. An exploratory factor analysis yielded a two-factor solution with tangible and social-emotional dimensions, which demonstrated satisfactory reliability and better discrimination between different subscales than did the original five-factor model. The concurrent validity of the two-factor scale was further confirmed by its significant negative correlations with the BDI-II ($r = -0.41$, $p < 0.01$); the SAS ($r = -0.27$, $p < 0.01$); and the PSS-10 ($r = -0.30$, $p < 0.01$), and significant positive correlation with the WHOQOL-BREF scale ($r = 0.61$, $p < 0.01$).

Conclusion: We found a two-factor solution for the MOS-SSS-CM, which demonstrated good reliability and validity when applied to Chinese PLWHA. This was consistent with results from a study of Taiwanese caregivers. Further validation in other populations and disease states is warranted.

© 2015 Elsevier Inc. All rights reserved.

1. Introduction

HIV has become one of the most serious infectious diseases in China. In 2011, there was an estimated 780,000 people living with HIV/AIDS (PLWHA) in China, with 48,000 new infections and 28,000 deaths annually (Ministry of Health of the People's Republic of China (MHPRC), 2012). Due to strong governmental intervention around treatment, the mortality of PLWHA has drastically decreased. Improving the quality of life among PLWHA however, has become a more recent prominent concern.

Social support has been shown to contribute both to mental and physical health among PLWHA and is especially effective in reducing psychological distress such as depression and anxiety (Arriola, Spaulding, Booker, et al., 2013; Lam, Naar-King, & Wright, 2007; Liu, Pang, Sun, et al., 2013; Mizuno, Purcell, Dawson-Rose, et al., 2003; Reich, Lounsbury, Zaid-Muhammad, et al., 2010). Furthermore, perceived social support has been associated with higher quality of life of PLWHA in both cross-sectional and longitudinal studies (Bastardo & Kimberlin, 2000; Bekele, Rourke, Tucker, et al., 2013; Jia, Uphold, Wu, et al., 2004; Jia, Uphold, Zheng, et al., 2007; Rao, Chen, Pearson, et al., 2012; Yadav, 2010). With increasing recognition of its positive health impact, social support has been incorporated into health care interventions for PLWHA (Horvath, Oakes, Rosser, et al., 2013; Huynh, Kinsler,

* Corresponding author. Tel.: +86 15274984256.
E-mail addresses: youxiang8864@163.com (Y. Yu), jpyang@u.washington.edu (J.P. Yang), sigontw@gmail.com (C.-S. Shiu), jsimoni@uw.edu (J.M. Simoni), xiaosy@csu.edu.cn (S. Xiao), wei-ti.chen@yale.edu (W. Chen), deeparao@uw.edu (D. Rao), 403616846@qq.com (M. Wang).
[1] Tel.: +86 15675857745.
[2] Tel.: +1 314 283 4154.
[3] Tel.: +1 773 454 9957.
[4] Tel.: +1 206 406 5521; fax: +1 206 685 3157.
[5] Tel.: +86 731 84805459.
[6] Tel.: +1 203 737 2416.
[7] Tel.: +1 206 685 3064.

Cunningham, et al., 2013; Remien, Stirratt, Dognin, et al., 2006). In order to better understand and evaluate the health-promoting effects of social support interventions in fighting HIV/AIDS, a psychometrically sound measurement tool of social support is needed.

In China, the most commonly used assessment tool for social support is the Social Support Rating Scale (SSRS) developed by Shuiyuan Xiao 肖水源 (1994). It is a ten-item scale including subjective support, objective support, and utilization of support, and has been broadly used to assess social support in various populations. However, with no specific target population, the application of SSRS to individuals living with chronic illness such as HIV may be limited.

The Medical Outcomes Study–Social Support Survey (MOS-SSS) is a brief, multidimensional, self-administered questionnaire developed by Sherbourne and Stewart (1991) to evaluate social support in patients with chronic illness. It was originally hypothesized to measure five dimensions of social support: (1) emotional support (expression of positive affect, empathetic understanding, and the encouragement of expressions of feelings); (2) informational support (offering of advice, information, guidance, or feedback); (3) tangible support (provision of material aid or behavioral assistance); (4) positive social interaction (availability of other persons with whom to engage in pleasurable activities); and (5) affectionate support (expressions of love and affection) (Sherbourne & Stewart, 1991). With well-established reliability and validity, the MOS-SSS has been translated into different languages including Portuguese (Griep, Chor, Faerstein, et al., 2005; Soares, Biasoli, Scheliga, et al., 2012), Spanish (Cohen & Wills, 1985; House, Robbins, & Metzner, 1982), French (Anderson, Bilodeau, Deshaies, et al., 2005; Robitaille, Orpana, & McIntosh, 2011), and Malay (Mahmud, Awang, & Mohamed, 2004) and has been well validated among different sub-populations in various countries (Anderson et al., 2005; Cohen & Wills, 1985; Griep et al., 2005; House et al., 1982; Mahmud et al., 2004; Robitaille et al., 2011; Soares et al., 2012).

In 2004, the MOS-SSS was first translated into Mandarin (Yu, Lee, & Woo, 2004a), the world's most common language with over 1.3 billion speakers. Subsequent psychometric testing has demonstrated good reliability and validity (Lee, Thompson, Yu, et al., 2005; Shyu, Tang, Liang, et al., 2006; Thompson, Ski, Watson, et al., 2014; Wang et al.; Yu, Lee, & Woo, 2004b). Since psychometric testing is sample dependent (McHorney, Ware, Lu, et al., 1994) and most of the previous studies focused on elderly people with coronary heart disease, little is known about the scale's applicability in other disease groups such as PLWHA. The primary purpose of this study was to describe the psychometric properties of the original 5-dimension MOS-SSS-CM in PLWHA in Mainland China.

2. Methods

2.1. Participants

This cross-sectional descriptive study was conducted at Beijing's Ditan Hospital, the premier treatment center for infectious diseases in China. A convenience sample of 200 HIV-positive patients were recruited in the clinic waiting room between June and July 2012. The N of 200 satisfies the sample size requirement of at least 5 participants for each item to conduct a factor analysis (Tamaka, 1987). Eligible participants were required to be Mandarin-speaking individuals receiving care at Ditan Hospital who were at least 18 years of age. Cognitively impaired or actively psychotic individuals were excluded. After providing written informed consent, participants were asked to complete an hour-long paper-and-pencil survey and were reimbursed RMB100 ($15) for their time. Ethics approval was granted by the Institutional Review Boards of the University of Washington and Ditan Hospital.

2.2. Measures

2.2.1. MOS-SSS-CM

The MOS-SSS is a 19-item survey originally designed to assess five different dimensions of social support (i.e., emotional, informational,

tangible, affectionate support, and positive social interaction). Respondents are asked to choose how often each kind of support is available to them on a 5-point Likert scale from 0 = "none of the time," 1 = "a little of the time," 2 = "some of the time," 3 = "most of the time," to 4 = "all of the time" (Sherbourne & Stewart, 1991). The MOS-SSS demonstrated good reliability and validity in a United States sample of nearly 3000 chronic patients, with Cronbach's α coefficients greater than 0.91 for all subscales (Sherbourne & Stewart, 1991). The Chinese (Mandarin) version of MOS-SSS (MOS-SSS-CM) has been validated among sub-groups in various parts of China and has shown acceptable internal consistency with Cronbach's α coefficients ranging from 0.91 to 0.98 for the overall scale and 2-week test–retest reliability as measured by intraclass correlation coefficients ranging from 0.74 to 0.84 (Shyu et al., 2006; Wang et al.; Yu et al., 2004b).

2.2.2. BDI-II

The Beck Depression Inventory Revised (BDI-II) (Beck, Steer, & Brown, 1996) is a 21-item self-report questionnaire revised from the original BDI (Beck, Ward, Mendelson, et al., 1961) developed by Beck et al. (1961) to assess clinical depression. It assesses the psychological (items 1–13) and somatic (items 14–21) manifestations of depressive symptoms during the preceding 2 weeks. Each item is rated from 0 to 3 to indicate least to most depressed mood. A total score is calculated by adding the scores of each item and ranges from 0 to 63. With high reliability and validity, the English version of BDI-II has been translated and popularized in various countries in Europe, the Middle East, Asia, and Latin America (Alansari, 2005; Corbière, Bonneville-Roussy, Franche, et al., 2011; Gomes-Oliveira, Gorenstein, Lotufo Neto, et al., 2012; Penley, Wiebe, & Nwosu, 2003; Wang & Gorenstein, 2013). In the present study, the Chinese version of BDI-II demonstrated good internal consistency, with a Cronbach's α coefficient of 0.92.

2.2.3. SAS

The Self-Rating Anxiety Scale (SAS) is a 20-item measure developed by Zung Zung (1971) to assess the frequency of anxiety symptoms. It was primarily used to assess the frequency of anxiety-related somatic symptoms (Olatunji, Deacon, Abramowitz, et al., 2006). Items are assessed on a 4-point Likert scale ranging from 1 = "none or a little of the time" to 4 = "most or all of the time". Items 5, 9, 13, 17, and 19 are reversed scored and a cumulative score is obtained by adding individual scores. The Chinese version of SAS used in the present study had satisfactory internal consistency (Cronbach's α coefficient was 0.82).

2.2.4. PSS-10

The Perceived Stress Scale (PSS-10) is a shortened version of the original 14-item English version Perceived Stress Scale (PSS-14) developed by Cohen et al. (1983) as a global measure of stress (Cohen, Kamarck, & Mermelstein, 1983). It captures the extent to which respondents' lives appear to be unpredictable, uncontrollable, or overloaded over the past month. The PSS-10 consists of six negative and four positive items, to which participants are asked to respond on a 5-point Likert scale ranging from 0 = "never" to 4 = "very often", with higher composite scores indicating greater perceived stress. The PSS-10 has been widely used in measuring stress of patients with chronic disease and has demonstrated high internal consistency and test–retest reliability (Cohen et al., 1983; Chaaya, Osman, Naassan, et al., 2010; Mitchell, Crane, & Kim, 2008). The Chinese version of PSS-10 used in the present study demonstrated satisfactory internal consistency, with a Cronbach's α coefficient of 0.80.

2.2.5. WHOQOL-BREF

The WHOQOL-BREF (Group, W, 1998) is a self-report questionnaire developed by the WHO as a broad and comprehensive tool to assess quality of life and is cross-culturally applicable. It contains 26 questions with the first 2 questions regarding the overall quality of life and health

status and the next 24 questions asking about specific facets under the 4 domains of physical health, psychological health, social relationships, and environment. Each item is rated on a 5-point scale ranging from 1 = "low, negative perception" to 5 = "high, positive perception". The WHOQOL-BREF is available in 19 different languages and has been used world-wide to assess life quality all over the world. The Chinese version of WHOQOL-BREF used in the present study demonstrated good internal consistency, with a Cronbach's α coefficient of 0.95.

3. Data analysis

Socio-demographic characteristics of the sample were examined using descriptive statistics. Internal consistency was tested by calculating Cronbach's α, with a recommended level of 0.8 or above indicating acceptable internal consistency (Kline, 1986). The scale's convergent validity was tested by calculating the Pearson correlation between each item and the remainder of its hypothesized subscale (item–own subscale correlation), while discriminant validity was tested by comparing the item–own subscale correlation with the item–other subscale correlations. According to the multi-trait scaling techniques suggested by Hay et al. Shih and Shih (1999), item–own subscale correlations greater than 0.3 suggest acceptable convergent validity, while an item–own subscale correlation more than two standard errors bigger than the corresponding item–other subscale correlation indicates acceptable discriminant validity.

Factorial structure was explored by explorative factor analysis (EFA). According to Kaiser's criterion for factor extraction, factors retained were those with an eigenvalue above 1(Nunnally & Bernstein, 1994). Considering the high correlation among the items of the MOS-SSS, we used oblique rotation for factor rotation. According to Nunnally and Bernstein (1994), factor loadings equal or greater than 0.4 were considered appropriate (Nunnally & Bernstein, 1994).

The concurrent validity of the MOS-SSS-CM was tested using Pearson product–moment correlations with expected significant negative correlations with the BDI-II, the SAS, and the PSS-10 (Arriola et al., 2013; Lam et al., 2007; Liu et al., 2013; Mizuno et al., 2003; Reich et al., 2010), and an expected significant positive correlation with the WHOQOL-BREF (Bastardo & Kimberlin, 2000; Bekele et al., 2013; Jia, Uphold, Wu, et al., 2004; Jia, Uphold, Zheng, et al., 2007; Rao et al., 2012; Yadav, 2010).

4. Results

4.1. Preliminary analyses

The demographic characteristics of our sample of $N = 200$ are summarized in Table 1. In general, this sample was young, mostly male, and well educated.

4.2. Psychometric testing of the five-dimension scale

Cronbach's α was 0.97 for the overall social support scale, ranging from 0.82 to 0.91 for the five subscales, indicating good internal consistency. Table 2 shows the item to subscale correlations of the original 5 dimension subscales (Sherbourne & Stewart, 1991). The correlations between each item and the remainder of its hypothesized subscale were all above 0.6, indicating good convergent validity. However, unsatisfactory item discriminant validity was found in 11 out of the 19 items, with the item–own subscale correlations (0.63–0.82) being lower than or equal to item–other subscale correlations (0.67–0.84), suggesting that the original five dimensions may not be appropriate in this sample.

4.3. Exploratory factor analysis

Exploratory factor analysis (EFA) is used primarily as a means of exploring the underlying factor structure of a scale without a prior

Table 1
Social-demographics of the sample ($N = 200$)[a].

		n	%
Gender	Male	162	81.00
	Female	38	19.00
Age	18–29	45	22.50
	30–49	133	66.50
	≥ 50	20	10.00
Ethnicity	Han	179	89.50
	Non-Han	21	10.50
Education	Primary or less	35	17.50
	Secondary or less	64	32.00
	College and above	98	49.00
Employment	Unemployed	78	39.00
	Employed part-time	22	11.00
	Employed full-time	96	48.00
Monthly income (RMB)	Less than 328	70	35.00
	328–656	67	33.50
	Greater than 656	49	24.50
Current marital status	Married	69	34.50
	Divorced/separated/widowed	47	23.50
	Never married	84	42.00
Sexual identity	Gay/homosexual	84	42.00
	Bisexual	11	5.50
	Heterosexual	67	33.50
	Unknown	38	19.00
Any children	No	86	43.00
	Yes	108	54.00

[a] Some percentages do not add up to 100 due to missing values.

hypothesis (Bollen, 1989). Because of the unsatisfactory item discriminant validity, EFA was used first to explore and interpret the underlying factors. The EFA produced two initial eigenvalues above 1 (11.92 and 1.13), thus yielding a two-factor solution that accounted for 93.63% of the variance (Table 3). After using an oblique rotation, two factor labels were determined by factor loadings across variables. Items originally hypothesized to be in the subscales of affectionate, emotional, informational support, and positive social interaction all loaded high on the first factor, which we named as the social–emotional support subscale. Items originally hypothesized to be in the subscale of tangible support loaded high on the second factor, which we kept the original name of tangible support subscale. The first factor (social–emotional support) accounted for 85.51% of the total variance, whereas the second factor (tangible support) accounted for 8.12%. Note item 18 ("There is someone to love and make you feel wanted") loaded almost equally low on factor 1 (0.44) and factor 2 (0.41). Although the factor loading of item 3 ("There is someone to take you to the doctor if you needed it") on factor 2 (0.49) was higher than on factor 1 (0.29), it was still relatively low compared to the factor loadings of other items on factor 2.

4.4. Psychometric testing of the two-dimension scale

Further analyses examined the psychometric properties of the two-dimension model. As evidence for the internal consistency of the two-factor solution, the Cronbach's α coefficient was found to be 0.96 for social–emotional support and 0.91 for tangible support (vs. 0.82–0.91 for the five-dimension scale). The item–own subscale correlations ranged from 0.66 to 0.86 (vs. 0.63–0.86), and item–other subscale correlations ranged from 0.53 to 0.69 (compared to 0.43–0.84), indicating better convergent and discriminate validity than the original hypothesized five dimensions.

As seen in Table 4, the concurrent construct validity for the MOS-SSS-CM was confirmed with significant negative correlations with the BDI-II ($r = -0.41$, $p < 0.01$); the SAS ($r = -0.27$, $p < 0.01$); and the PSS-10 ($r = -0.30$, $p < 0.01$) and significant positive correlations with the WHOQOL-BREF scale ($r = 0.61$, $p < 0.01$).

Table 2
Pearson item–subscale correlations between each item and the original hypothesized subscale (N = 200)[a].

Domain	Mean	SD	Five original dimensions [b]					Item-rest[c]	Alpha[d]
			A	E	I	P	T		
4.Show love and affection	1.98	1.13	**0.63**	0.60	0.62	0.67	0.53	0.67	0.97
8. Hug you	2.02	1.29	**0.74**	0.73	0.71	0.79	0.57	0.78	0.97
18. Love you	2.37	1.19	**0.66**	0.69	0.66	0.72	0.69	0.76	0.97
1. Listen to you	2.15	1.25	0.61	**0.75**	0.75	0.67	0.60	0.74	0.97
7. Confide in	2.32	1.19	0.74	**0.81**	0.83	0.78	0.60	0.83	0.97
14. Share worries with	2.16	1.27	0.71	**0.80**	0.79	0.76	0.67	0.83	0.97
17. Understand your problems	2.29	1.13	0.72	**0.77**	0.78	0.80	0.71	0.84	0.97
2. Give you good advice	2.39	1.13	0.64	0.77	**0.77**	0.68	0.58	0.76	0.97
6. Give you information	2.14	1.17	0.68	0.75	**0.76**	0.75	0.54	0.77	0.97
10. Give advice you really want	2.26	1.16	0.71	0.80	**0.82**	0.83	0.61	0.83	0.97
15. Turn to for suggestions	2.28	1.12	0.70	0.84	**0.80**	0.77	0.61	0.82	0.97
5. Have a good time with	2.23	1.08	0.74	0.65	0.68	**0.70**	0.54	0.72	0.97
9. Get together for relaxation	2.33	1.16	0.78	0.80	0.79	**0.84**	0.61	0.84	0.97
11. Help get mind off things	2.19	1.22	0.73	0.79	0.80	**0.79**	0.62	0.82	0.97
16. Do something enjoyable	2.23	1.13	0.77	0.78	0.79	**0.86**	0.65	0.84	0.97
3. Take to doctor	2.01	1.31	0.60	0.61	0.59	0.54	**0.66**	0.66	0.97
12. Help if confined to bed	2.48	1.15	0.62	0.68	0.61	0.65	**0.85**	0.75	0.97
13. Help with daily chores	2.38	1.27	0.60	0.64	0.58	0.61	**0.86**	0.72	0.97
19. Prepare meals	2.38	1.25	0.63	0.64	0.56	0.60	**0.80**	0.71	0.97

[a] Items in bold are corrected correlations between that item and its hypothesized subscale excluding that item.
[b] A = affectionate support, E = emotional support, I = informational support, P = positive social interaction, T = tangible support.
[c] Corrected item to total correlations.
[d] Alpha if item deleted.

5. Discussion

The development of a culturally sensitive and psychometrically sound social support scale for an HIV-positive population in mainland China will contribute to a more accurate evaluation and in-depth understanding of the role of social support in the lives of PLWHA. This may improve their health outcomes by contribution to the development of more effective intervention strategies. The MOS-SSS-CM is a brief and simple scale that is specifically developed for the chronically ill. However, no prior published studies have examined the MOS-SSS-CM with a Chinese population of PWLHA. The present study demonstrates the applicability of the scale in Chinese PLWHA with good general reliability and validity.

Specifically, psychometric testing of the original 5-dimension scale showed acceptable internal consistency and convergent validity.

Table 3
Rotated factor loadings for MOS-SSS-CM[a].

Items	Factor loadings	
	Factor 1 (social-emotional support)	Factor 2 (tangible)
4. Show love and affection	**0.71**	−0.02
8. Hug you	**0.83**	−0.01
18. Love you	**0.44**	0.41
1. Listen to you	**0.60**	0.22
7. Confide in	**0.86**	0.02
14. Share worries with	**0.61**	0.29
17. Understand your problems	**0.62**	0.31
2. Give you good advice	**0.73**	0.08
6. Give you information	**0.86**	−0.05
10. Give advice you really want	**0.81**	0.08
15. Turn to for suggestions	**0.79**	0.09
5. Have a good time with	**0.76**	−0.01
9. Get together for relaxation	**0.88**	0.00
11. Help you get your mind off things	**0.71**	0.18
16. Do something enjoyable with	**0.76**	0.15
3. Take to doctor	0.28	**0.49**
12. Help if confined to bed	0.03	**0.89**
13. Help with daily chores	−0.05	**0.95**
19. Prepare meals	0.03	**0.85**

[a] Items in bold are factor loadings above 0.40.

Cronbach's α of 0.97 for the overall scale and 0.82 to 0.91 for the five subscales demonstrated good internal consistency. The item–own subscale correlations were all above .60, indicating good convergent validity. However, unsatisfactory discriminate validity was found in 11 out of 19 items, suggesting the original factor structure may not be appropriate for the Chinese context.

An EFA was used to further explore the dimensions of the MOS-SSS-CM. Contrary to the widely confirmed 4-dimension structure using CFA (Thompson et al., 2014; Wang et al.; Yu et al., 2004b), and the 3-dimension structure using EFA (Griep et al., 2005; Soares et al., 2012; Cohen & Wills, 1985), EFA in this study yielded only two factors, aggregating the original hypothesized affectionate, emotional, informational support and positive social interaction into one dimension and simply dividing the whole scale into tangible and social–emotional sub-scales. Interestingly, this result is similar to the factorial analysis reported in a Taiwanese sample (Shyu et al., 2006), and a sample of African diabetic outpatients in South Africa (Westaway, Seager, et al., 2005) using the same analytic method. The two-dimension structure may be attributed to the high correlation among various social support dimensions making it difficult to distinguish between similar items, which has been pointed out in previous studies (Griep et al., 2005; Soares et al., 2012; Cohen & Wills, 1985; Robitaille et al., 2011; Yu et al., 2004b).

Table 4
Pearson correlations of the association between the MOS-SSS-CM and the BDI-II, SAS, PSS-10, and the WHOQOL-BREF scales (N = 200).

		MOS-SSS-CM		
	Alpha	Overall scale	Tangible	Social–emotional
BDI-II	0.92	−0.41**	−0.28**	−0.42**
SAS	0.82	−0.27**	−0.29**	−0.24**
PSS-10	0.80	−0.30**	−0.25**	−0.30**
QOL total	0.95	0.61**	0.50**	0.61**
Physical	0.81	0.43**	0.35**	0.43**
Psychological	0.87	0.55**	0.43**	0.55**
Social	0.73	0.53**	0.45**	0.53**
Environmental	0.88	0.63**	0.54**	0.62**

BDI-II—Beck Depression Inventory Revised, SAS—Self-Rating Anxiety Scale, PSS-10—Perceived Stress Scale.
** Significant at p < 0.01.

It is also worth mentioning that the equally low loadings of item 18 ("There is someone to love and make you feel wanted") on factor 1 and factor 2 suggest that this item may not be appropriate to measure social support in a Chinese cultural context. While expressing love and emotions openly and directly may be more normative in Western contexts, Chinese individuals seldom use the word "love" in their daily life and may feel embarrassed to acknowledge there is someone to love. In the comparatively more conservative Chinese cultural context, expressions of love are implicit and indirect, and are generally expressed tangibly (e.g., with acts of service) without references to emotional terms like "love". It is likely that item 18 may be difficult for Chinese participants to understand who may find it awkward to answer. A useful replacement for future applications of the MOS-SSS-CM may be "there is someone to care about you". Regarding the low loading of item 3 ("Take to a doctor") on factor 2, the likely reason may be the young age (mean age of 37 years) of the participants in this study. Compared to patients with heart problems or cancer in other studies, PLWHA in this study are much younger and thus currently healthier and stronger. Participants are usually not weak enough to be hospitalized, and thus their need for someone to take them to the doctor may be lower.

Psychometric testing of the two-factor scale showed improved internal consistency, convergent validity, and discriminant validity compared to the original five-factor scale. The concurrent validity of the two-factor MOS-SSS-CM was further confirmed using a series of validated mental health scales including the BDI-II, SAS, PSS-10, and WHOQOL-BREF. The significant negative correlations between the overall and subscales of the MOS-SSS-CM and the BDI-II, SAS, and PSS-10 scales support the idea that social support is associated with reduced psychological distress among PLWHA (Arriola et al., 2013; Lam et al., 2007; Liu et al., 2013; Mizuno et al., 2003; Reich et al., 2010). The significant positive correlations between the MOS-SSS-CM subscales and the WHOQOL-BREF subscales also indicate that PLWHA with better social support experience better quality of life, which is consistent with previous studies (Bastardo & Kimberlin, 2000; Bekele et al., 2013; Jia, Uphold, Wu, et al., 2004; Jia, Uphold, Zheng, et al., 2007; Rao et al., 2012; Yadav, 2010). The concurrent validity of MOS-SSS-CM in this study further substantiates the previous published validity data among various populations in different parts of China (Shyu et al., 2006; Wang et al.; Yu et al., 2004b).

There are several limitations in this study. First, no re-test has been done on this sample, so the test–retest reliability of the MOS-SSS-CM cannot be evaluated. However, as a classic scale that has been widely used and validated in various studies, the MOS-SSS has demonstrated good stability over time. Moreover, previous studies using the MOS-SSS-CM among sub-populations in different parts of China have shown acceptable test–retest reliability with intra-class correlation ranging from 0.74 to 0.84 (Wang et al.; Yu et al., 2004b), allowing us to assume that MOS-SSS-CM would have good test–retest reliability in this sample. Second, the data were collected with a convenience sample recruited from Beijing's Ditan Hospital. As Ditan Hospital is a premier treatment center in China, the generalizability of this study may be limited.

Despite the limitations, this is the first study proposing a two-dimensional structure of the MOS-SSS-CM among PLWHA in China, with both strong theoretical and analytic support. In conclusion, this study demonstrates that the two-dimension MOS-SSS-CM is a reliable and valid scale to measure social support for PLWHA in China. A change of item 18 (from "There is someone to love and make you feel wanted" to "There is someone to care about you") may make the scale more culturally appropriate. The MOS-SSS-CM can now be recommended for assessing social support and its association with psychological distress and quality of life in PLWHA. Modification and validation of the MOS-SSS-CM in more diverse samples are suggested for future studies.

6. Ethical statement

The study was approved by the Institutional Review Boards of the University of Washington and Ditan Hospital and was performed in accordance with the ethical standards laid in the 1964 Declaration of Helsinki and its later amendments. All participants in this study gave their informed consent prior to their inclusion in the study. Details that might disclose the identity of the subjects under study were omitted and all data reported were unidentified.

References

Alansari, B. M. (2005). Beck Depression Inventory (BDI-II) items characteristics among undergraduate students of nineteen Islamic countries. *Social Behavior & Personality, 33*(7), 675–684.

Anderson, D., Bilodeau, B., Deshaies, G., Gilbert, M., & Jobin, J. (2005). French-Canadian validation of the MOS Social Support Survey. *The Canadian Journal of Cardiology, 21*(10), 867–873.

Arriola, K. J., Spaulding, A. C., Booker, C. A., Williams, C., Avery, A., Porter, N. J., et al. (2013). Understanding the relationship between social support and physical and mental well-being among jail detainees living with HIV. *Journal of Health Psychology,* 1–10.

Bastardo, Y. M., & Kimberlin, C. L. (2000). Relationship between quality of life, social support and disease-related factors in HIV-infected persons in Venezuela. *AIDS Care, 12*(5), 673–684.

Beck, A. T., Steer, R. A., & Brown, G. K. (1996). *Manual for Beck Depression Inventory-II.* San Antonio, TX: Psychological Corporation.

Beck, A. T., Ward, C. H., Mendelson, M., Mock, J., & Erbaugh, J. (1961). An inventory for measuring depression. *Archives of General Psychiatry, 4*(6), 561–571.

Bekele, T., Rourke, S. B., Tucker, R., Greene, S., Sobota, M., Koornstra, J., et al. (2013). Direct and indirect effects of perceived social support on health-related quality of life in persons living with HIV/AIDS. *AIDS Care, 25*(3), 337–346.

Bollen, K. A. (1989). *Structural equations with latent variables.* New York: Wiley.

Chaaya, M., Osman, H., Naassan, G., & Mahfoud, Z. (2010). Validation of the Arabic version of the Cohen Perceived Stress Scale (PSS-10) among pregnant and postpartum women. *BMC Psychiatry, 10,* 111–118.

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior, 24*(4), 385–396.

Cohen, S., & Wills, T. A. (1985). Stress, social support and the buffering hypothesis. *Psychological Bulletin, 98*(2), 310–357.

Corbière, M., Bonneville-Roussy, A., Franche, R. L., Coutu, M. F., Choinière, M., Durand, M. J., et al. (2011). Further validation of the BDI-II among people with chronic pain originating from musculoskeletal disorders. *The Clinical Journal of Pain, 27*(1), 62–69.

Gomes-Oliveira, M. H., Gorenstein, C., Lotufo Neto, F., Andrade, L. H., & Wang, Y. P. (2012). Validation of the Brazilian Portuguese version of the Beck Depression Inventory-II in a community sample. *Revista Brasileira de Psiquiatria, 34*(4), 389–394.

Griep, R. H., Chor, D., Faerstein, E., Werneck, G. L., & Lopes, C. S. (2005). Construct validity of the Medical Outcomes Study's social support scale adapted to Portuguese in the Pro-Saude Study. *Cadernos de Saúde Pública, 21*(3), 703–714.

Group, W (1998). Development of the World Health Organization WHOQOL-BREF quality of life assessment. The WHOQOL Group. *Psychological Medicine, 28*(3), 551–558.

Horvath, K. J., Oakes, J. M., Rosser, B. R., Danilenko, G., Vezina, H., Amico, K. R., et al. (2013). Feasibility, acceptability and preliminary efficacy of an online peer-to-peer social support ART adherence intervention. *AIDS and Behavior, 17*(6), 2031–2044.

House, J. S., Robbins, C., & Metzner, H. L. (1982). The association of social relationships and activities with mortality: Prospective evidence from the Tecumseh Community Health Study. *American Journal of Epidemiology, 116*(1), 123–140.

Huynh, A. K., Kinsler, J. J., Cunningham, W. E., & Sayles, J. N. (2013). The role of mental health in mediating the relationship between social support and optimal ART adherence. *AIDS Care, 25*(9), 1179–1184.

Jia, H., Uphold, C. R., Wu, S., Reid, K., Findley, K., & Duncan, P. W. (2004). Health-related quality of life among men with HIV infection: Effects of social support, coping, and depression. *AIDS Patient Care and STDs, 18*(10), 594–603.

Jia, H., Uphold, C. R., Zheng, Y., Wu, S., Chen, G. J., Findley, K., et al. (2007). A further investigation of health-related quality of life over time among men with HIV infection in the HAART era. *Quality of Life Research, 16*(6), 961–968.

Kline, P. (1986). *A handbook of test construction.* London: Methuen.

Lam, P. K., Naar-King, S., & Wright, K. (2007). Social support and disclosure as predictors of mental health in HIV-positive youth. *AIDS Patient Care and STDs, 21*(1), 20–29.

Lee, D. T., Thompson, D. R., Yu, D. S., et al. (2005). Reliability and validity of the Medical Outcomes Study Social Support Survey (Chinese version). *Journal of the American Geriatrics Society, 53*(5), 920–921.

Liu, L., Pang, R., Sun, W., Wu, M., Qu, P., Lu, C., et al. (2013). Functional social support, psychological capital, and depressive and anxiety symptoms among people living with HIV/AIDS employed full-time. *BMC Psychiatry, 13,* 324–334.

Mahmud, W. M., Awang, A., & Mohamed, M. N. (2004). Psychometric Evaluation of the Medical Outcome Study (MOS) social support survey among Malay postpartum women in Kedah, north west of peninsular Malaysia. *The Malaysian Journal of Medical Sciences, 11*(2), 26–33.

McHorney, C. A., Ware, J. E., Jr., Lu, J. F., & Sherbourne, C. D. (1994). The MOS 36-item Short-Form Health Survey (SF-36): III. Tests of data quality, scaling assumptions, and reliability across diverse patient groups. *Medical Care, 32*(1), 40–66.

Ministry of Health of the People's Republic of China (MHPRC) (2012). *2012 China AIDS response progress report.* Beijing: MHPRC (Available online at: http://www.unaids.org/en/dataanalysis/knowyourresponse/countryprogressreports/2012countries/ce_CN_Narrative_Report[1].pdf[verified November 2013]).

Mitchell, A. M., Crane, P. A., & Kim, Y. (2008). Perceived stress in survivors of suicide: Psychometric properties of the Perceived Stress Scale. *Research in Nursing and Health, 31*(6), 576–585.

Mizuno, Y., Purcell, D. W., Dawson-Rose, C., & Parsons, J. T., SUDIS Team. (2003). Correlates of depressive symptoms among HIV-positive injection drug users: The role of social support. *AIDS Care, 15*, 689–698.

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory* (3rd ed.). New York: McGraw-Hill.

Olatunji, B. O., Deacon, B. J., Abramowitz, J. S., & Tolin, D. F. (2006). Dimensionality of somatic complaints: Factor structure and psychometric properties of the Self-Rating Anxiety Scale. *Anxiety Disorders, 20*(5), 543–561.

Penley, J. A., Wiebe, J. S., & Nwosu, A. (2003). Psychometric properties of the Spanish Beck Depression inventory II in a medical sample. *Psychological Assessment, 15*(4), 569–577.

Rao, D., Chen, W. T., Pearson, C. R., Simoni, J. M., Fredriksen-Goldsen, K., Nelson, K., et al. (2012). Social support mediates the relationship between HIV stigma and depression/quality of life among people living with HIV in Beijing, China. *International Journal of STD and AIDS, 23*(7), 481–484.

Reich, W. A., Lounsbury, D. W., Zaid-Muhammad, S., & Rapkin, B. D. (2010). Forms of social support and their relationships to mental health in HIV-positive persons. *Psychology, Health & Medicine, 15*(2), 135–145.

Remien, R. H., Stirratt, M. J., Dognin, J., Day, E., El-Bassel, N., & Warne, P. (2006). Moving from theory to research to practice. Implementing an effective dyadic intervention to improve antiretroviral adherence for clinic patients. *Journal of Acquired Immune Deficiency Syndromes, 43*(Suppl. 1), S69–S78.

Robitaille, A., Orpana, H., & McIntosh, C. N. (2011). Psychometric properties, factorial structure, and measurement invariance of the English and French versions of the Medical Outcomes Study social support scale. *Health Reports, 22*(2), 33–40.

Sherbourne, C. D., & Stewart, A. L. (1991). The MOS social support survey. *Social Science and Medicine, 32*(6), 705–714.

Shih, S. N., & Shih, F. J. (1999). Health needs of lone elderly Chinese men with heart disease during their hospitalization. *Nursing ethics: An international journal for health care professionals, 6*(1), 58–72.

Shyu, Y. I., Tang, W. R., Liang, J., & Weng, L. J. (2006). Psychometric testing of the social support survey on a Taiwanese sample. *Nursing Research, 55*(6), 411–417.

Soares, A., Biasoli, I., Scheliga, A., Baptista, R. L, Brabo, E. P., & Morais, J. C. (2012). Validation of the Brazilian Portuguese version of the **Medical Outcomes Study-Social Support Survey in Hodgkin's lymphoma survivors. *Support Care Cancer, 20*(8), 1895–1900.

Tamaka, J. S. (1987). How big is big enough? Sample size and goodness of fit in structural equation models with latent variables. *Child Development, 58*(1), 134–146.

Thompson, D. R., Ski, C. F., Watson, R., & Wang, W. (2014). Mokken scaling of the Chinese version of the Medical Outcomes Study Social Support Survey. *Quality of Life Research: An International Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation, 23*(2), 581–584.

Wang, Y. P., & Gorenstein, C. (2013). Assessment of depression in medical patients: A systematic review of the utility of the Beck Depression Inventory-II. *Clinics (São Paulo, Brazil), 68*(9), 1274–1287.

Wang, W., Zheng, X., He, H. G., & Thompson, D. R. (2013). Psychometric testing of the Chinese Mandarin version of the Medical Outcomes Study Social Support Survey in patients with coronary heart disease in mainland China. *Quality of Life Research, 22*(8), 1965–1971.

Westaway, M. S., Seager, J. R., Rheeder, P., & Van Zyl, D. G. (2005). The effects of social support on health, well-being and management of diabetes mellitus: A black South African perspective. *Ethnicity and Health, 10*(1), 73–89.

Yadav, S. (2010). Perceived social support, hope, and quality of life of persons living with HIV/AIDS: A case study from Nepal. *Quality of Life Research, 19*(2), 157–166.

Yu, D. S., Lee, D. T., & Woo, J. (2004a). Issues and challenges of instrument translation. *Western Journal of Nursing Research, 26*(3), 307–320.

Yu, D. S., Lee, D. T., & Woo, J. (2004b). Psychometric testing of the Chinese version of the Medical Outcomes Study Social Support Survey (MOS-SSS-C). *Research in Nursing and Health, 27*(2), 135–143.

Zung, W. W. K. (1971). A rating instrument for anxiety disorders. *Psychosomatics, 12*(6), 371–379.

水源 (1994). 社会支持评定量表的理论基础与研究应用. 临床医学精神杂志, *4*(2), 98–100.