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Validation of the Chinese version of the Opiate Addiction Severity Inventory (OASI) and the Severity of Dependence Scale (SDS) in non-institutionalized heroin users in China

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Abstract

No fully validated Chinese instrument measuring severity of drug dependence exists. The Chinese Opiate Addiction Severity Inventory (OASI) and the translated Chinese version of the Severity of Dependence Scale (SDS) were validated in this study. A total of 178 eligible participants were recruited using snowballing method. The 11-item revised version of OASI (OASI-R) exhibited good reliability (item-total correlation coefficients ranged from 0.50 to 0.73, Cronbach's alpha was 0.85, test–retest Intra-class Correlation Coefficient was 0.81, $p<0.001$). Two factors were identified by principal component method and correlated significantly with the Quality of Life-Drug Addiction (QOL-DA). The 3-item revised version of SDS (SDS-R) was one of the two factors of SDS (item-total correlation coefficients were 0.79 to 0.86, Cronbach's alpha was 0.78, test–retest Intra-class Correlation Coefficient was 0.64, $p<0.001$). It correlated significantly with QOL-DA. OASI-R and SDS-R were also significantly correlated with each other and with some heroin-related characteristics. The validation of the Chinese version of OASI-R and SDS-R would facilitate research in

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different Chinese populations. SDS has been translated to different languages and the Chinese version allows for international comparison.

Keywords: Opiate dependence; Severity; Validation study; Validity; Reliability; China

1. Introduction

Substance dependence is a multi-dimensional concept and the diagnostic criteria are prescribed in both Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) and International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD-10) (American Psychiatric Association, 1994; World Health Organization, 1993). The severity of dependence has been measured by different researchers in terms of quantity/frequency of substance use (Armor, Polich, & Stambul, 1978; Caetano & Caetano, 1991), physical consequences/symptoms (Miele et al., 2000; Miele et al., 2001), psychological dependence (Gossop et al., 1995) and multi-system impairment (Darke et al., 1992; McLellan, Erdlen, Erdlen, & O'Brien, 1981). Changes in severity of substance dependence have been used as an outcome measure to evaluate intervention programs (Hillhouse et al., 2007). The concept has also been useful in identifying treatment needs (Friedman & Utada, 1989; Schmitz, Oswald, Baldwin, & Grabowski, 1994), as well as to investigate other forms of risk behaviors (e.g. HIV-related sexual risk behaviors, Gossop, Griffiths, Powis, & Strang, 1993; Gossop, Powis, Griffiths, & Strang, 1994).

Use of opiates continues to be a worldwide problem (UNOCD, 2006). A number of instruments have been developed to measure the severity of opiate/heroin dependence. Of these instruments, Addiction Severity Index (ASI) has been widely used (McLellan et al., 1981). It has, however, more than 160 items which takes more than 40 min to complete (Alterman et al., 2001). Another instrument, the Opiate Treatment Index (OTI), also takes about 30 min to complete (Darke et al., 1992). Besides, the ASI and OTI were primarily designed for clinic-based studies (e.g. treatment evaluation) (Darke et al., 1992; McLellan et al., 1981) and have not been translated into Chinese. The Severity of Dependence Scale (SDS) (Gossop et al., 1995) and Opiate Addiction Severity Inventory (OASI) (Liu et al., 2000) are two relatively short instruments and their Chinese versions are available. The SDS has been widely used but it only measures the psychological dimension (Gossop et al., 1995); no validation was reported in the Chinese population. The OASI is another short instrument and good reliability was documented in some studies (Lian & Liu, 2003, 2004). However, further validation is still required as no factor analysis or correlations with external variables were reported and the previous studies were based on institutional samples (Liu et al., 2000; Lian & Liu, 2003, 2004).

Drug use is a severe problem in China (Liu, Lian, & Zhao, 2006) and it has been the driving force of the HIV epidemic (Qian, Vermund, & Wang, 2005). The official number of drug users registered in the Chinese public security system increased from 70,000 to 1.14 million during 1990 through 2004, among whom most were heroin users (Qian et al., 2005). About half of all reported HIV cases in China could be attributed to injecting heroin use (The Ministry of Health of the People's Republic of China et al., 2006). However, there is a dearth of research data investigating the severity of heroin dependence among non-institutionalized drug users in China. This may partially be attributed to the absence of a fully validated Chinese instrument measuring severity of heroin dependence. The development and validation of such instruments is hence greatly warranted. In the present study, the psychometric properties of the OASI and

SDS were documented. It was hypothesized that these two scales and some relevant external measurements were related to each other.

2. Methods

2.1. Data collection

Data of this study were collected in a city located in the northeast of Sichuan province, China during September and December 2006. The city has a total population of about 6.5 million and at least 5 thousand registered heroin users. As no sampling frame of non-institutionalized drug users exists, community-based snowballing method was used for recruitment of participants. This method was used in other studies to recruit community-based drug use population (Ruan et al., 2004). Eligibility criteria required that participant was at least 18 years old, was taking heroin as the major mode of addiction in the past six months and was willing to participate in the study. Several short questions (such as time of last heroin use and injection mode) were asked to confirm the eligibility. Scars due to injection in arms were also examined in some cases. A total of 188 prospective participants were identified by peer heroin users; 186 met the inclusion criteria, amongst whom 178 finished the questionnaire. Twenty participants were invited to come back in one week to take the retest.

All interviewers were medical staff of the local Center for Disease Control and Prevention (CDC), who were experienced in conducting field work targeting HIV-related risk populations. Formal training was given before the field work began. A pilot study was conducted to examine the feasibility and acceptability of the actual field work. Face-to-face interviews were implemented in needle exchange sites, tea parlors, mahjong house, respondents' home or other gathering places where privacy was ensured. Respondents were assured that participation was absolutely voluntary, anonymous and confidential. A reimbursement of RMB50 (about US$6) was given to the participants for time compensation. Quality control, including close supervision and regular site visits, was exercised by a team composed of researchers from the Chinese University of Hong Kong. Ethics approval was obtained from the Chinese University of Hong Kong.

2.2. Measures

2.2.1. Socio-demographic and heroin use-related characteristics

Background data of each participant were recorded, including sex, age, ethnicity, residential district, education level and marriage status. Characteristics related to heroin use were also recorded, including age at first heroin use, age at first heroin injection, daily heroin dosage and frequency of daily heroin use.

2.2.2. The Opiate Addiction Severity Inventory (OASI)

Three studies were conducted by researchers of the National Institution of Drug Dependence (NIDD), Peking University, China in order to develop a Chinese measurement of opiate dependence (Liu et al., 2000; Lian & Liu, 2003; Lian & Liu, 2004). In the first study, an item pool which consisted of 30 items in 9 domains was formed by making reference to the DSM-IV diagnostic criteria of substance dependence, items of ASI and OTI. This instrument was tested in a sample of 369 members of drug rehabilitation centers in four cities, but psychometric properties were not reported (Liu et al., 2000).

In the second study, items the first version became specific to heroin use and a number of items were added to some domains. Using a sample of 60 members of a drug rehabilitation center, the study recorded

Cronbach's alpha coefficient of 0.81 for the overall scale. Item-total correlation coefficients were calculated and 24 out of the 28 items were significantly correlated with the total score. The correlation coefficient of test–retest reliability was 0.90 ($p<0.001$) (Lian & Liu, 2003).

In the third study, a 12-item simplified version of OASI was further developed in 2004 (Lian & Liu, 2004). It consisted of 4 subscales: Physical Dependence, Psychological Dependence, Health Injury and Social Function Injury (see Appendix A). Questions were asked with reference to heroin use in the past month. Each item was rated on a 4-point Likert scale and the severity of opiate dependence was assessed by summing up the item scores. In a study using a sample of 360 members of a drug rehabilitation center, the overall Cronbach's alpha coefficient was 0.82 and it ranged from 0.42 to 0.72 for different subscales. Subscale–scale correlation coefficients were all significant at the 0.001 level ($r=0.47$ to 0.67). The correlation coefficients of test–retest reliability ranged from 0.79 to 0.86 ($p<0.001$) of the four subscales (Lian & Liu, 2004).

Though the 12-item of the OASI was generated via a careful process and its reliability was encouraging, its construct validity as well as concurrent validity were not established. The present study therefore further validated the OASI among non-institutionalized drug users in China.

2.2.3. The Severity of Dependence Scale (SDS)

The SDS was translated into Chinese by the National Institute on Drug Dependence (NIDD), China on behalf of the World Health Organization (WHO) (Yuan, Li, & Shi, 2003). The translation followed a WHO translation protocol (WHO, 2003). SDS measures the psychological dependence over the preceding 30 days. Scores of each of the 5 items range from 0 to 3 and a higher total score indicates a greater degree of dependence (Gossop et al., 1995). It has been used in a number of studies as it is short and easy to administer (de las Cuevas, Sanz, de la Fuente, Padilla, & Berenguer, 2000; Strang, Griffiths, Powis, & Gossop, 1999). Satisfactory psychometric properties were established in a number of studies (Ferri, Marsden, de Araujo, Laranjeira, & Gossop, 2000; Martin et al., 2006). However, some other studies did not show satisfactory results (Gonzalez-Saiz & Salvador-Carulla, 1998) and there is no validation study of SDS conducted in the Chinese population. The present study reports on the validity and reliability of the 5-item Chinese version of the SDS.

2.2.4. The Quality of Life-Drug Addiction (QOL-DA)

A number of studies showed that quality of life was associated with the severity of drug dependence (Brogly, Mercier, Bruneau, Palepu, & Franco, 2003; Christo et al., 2000). The QOL-DA was used in this study (Fang, 2000). A nominal group first put forward 102 items making reference to the WHOQOL, Sickness Impact Profile (SIP), Symptom-Check-List 90 (SCL-90) and some contextual adaptation was made. A focus group then graded each item according to its relevance with respect to quality of life. A total of 65 items were hence selected and each item was scored on a 5-point Likert scale (Fang, 2000).

The validation study of the QOL-DA was conducted among 158 institution-based drug users in Kunming (Wan, Fang, Chen, He, & Gao, 1997). A total of 25 items were removed from the primary version due to consideration of their psychometric properties. Four subscales, namely Physical Function, Psychological Function, Symptoms and Social Function, consisting of 40 items were hence generated. The Intra-class Correlation Coefficients (ICC) for test–retest reliability of each subscale and the overall scale ranged from 0.64 to 0.82 and Cronbach's alpha values ranged from 0.87 to 0.93. The overall QOL-DA scale correlated significantly with the WHOQOL-100 and SF-36 ($r=0.73$ and 0.71, $p<0.01$). The QOL-DA was more sensitive in predicting changes in quality of life after two weeks of detoxification, as compared to the WHOQOL and SF-36.

The QOL-DA has been used in some Chinese studies to measure the QOL status of heroin users: to compare the differences of quality of life in different places (Cai, Wan, He, Shang, & Shen, 2000) and to describe the changes in QOL of heroin users after drug rehabilitation treatment (Wan et al., 2000). In this study, QOL-DA was used as an external instrument to validate OASI and SDS.

2.3. Statistical analyses

Exploratory factor analysis, using principal components method for factor extraction (Sharma, 1996) was employed to investigate the factor structures of the OASI and SDS. Cronbach's alpha, Spearman correlations among items and their respective subscale, the other subscale, and the total scale were examined. Internal consistency of different scales and their subscales were calculated using Cronbach's and Split-half alpha; test–retest reliability was calculated using Intra-class Correlation Coefficient. To establish concurrent validity, Pearson correlation coefficients between the OASI, SDS and QOL-DA were derived. Relationship between OASI/SDS scores and heroin use-related characteristics were also tested using 2-samples t test and One-Way ANOVA for two and three sample analyses respectively. SPSS of Windows (version 14.0) was used for all statistical analyses and a p value of <0.05 was taken as statistically significant.

3. Results

3.1. Respondents' characteristics

Of all respondents, 64% were male; 60.7% were 30–39 years of age; 79.8% had received less than 9 years' of education; 26.4% were currently married; 72.5% had ever taken HIV-antibody test and of whom 18.6% were tested positive. With respect to heroin use, 91.0% of all respondents were injecting drug users; 22.9% started using heroin at age less than 20; 44.7% had used heroin for more than 6 years; 34.8% usually used more than 3 times of heroin per day and 55.0% of users had daily dosage exceeding 1.0 g.

3.2. Factor structures

The overall exploratory factor analysis (using Varimax rotation) of the OASI revealed two factors with Eigen value exceeding 1.0 (Table 1). Items 6, 7, 8, 9, 10, 11 and 12 loaded strongly on the first factor, which could be conceptualized as 'Functional Impact' due to heroin use (28% of the total variance explained). Items 1, 2, 3, 4 and 5 loaded strongly on the second factor, which could be conceptualized as 'Demand for Heroin' (24.4% of the total variance explained). Item 6 (number of times receiving compulsory drug rehabilitation) loaded relatively low on both Factor 1 and Factor 2 (0.40 and 0.27 respectively). Furthermore, this item was quite unique to the Chinese context. Another round of exploratory factor analysis was hence conducted without this item. The 11-item scale was termed as OASI-R. Similarly, two factors emerged and the factor loadings were similar to OASI (55.4% of the total variance explained); Factor 1 (Functional Impact) consisted of 6 items (item 7–12) and Factor 2 (Demand for Heroin) consisted of the other 5 items. Two subscales of OASI and OASI-R were formed respectively according to the factor structures.

Using similar methods, the 5-item SDS clustered into two factors. Factor 1 consists of items 1, 2 and 5, and was named as 'Impact' due to heroin (subscale 1), while the other 2 items formed Factor 2, which was

Table 1
Factor loadings of OASI/OASI-R and SDS/SDS-R

OASI items		OASI-factor loadings (12 items)		OASI-R-factor loadings (11 items)	
		Factor 1 Functional Impact	Factor 2 Demand for Heroin	Factor 1 Functional Impact	Factor 2 Demand for Heroin
1	Frequency of daily heroin use	0.14	0.83	0.13	0.83
2	Amount of daily heroin use	−0.01	0.78	0.00	0.79
3	Interval between waking up and first heroin taking	0.23	0.75	0.22	0.75
4	Perceived severity of craving for heroin	0.29	0.64	0.28	0.64
5	Time spent on heroin use	0.48	0.62	0.46	0.62
6	Number of times receiving compulsory drug rehabilitation	0.40	0.27	NA	NA
7	Changes in physical health after using heroin	0.62	0.23	0.63	0.23
8	Changes in sex drive after using heroin	0.66	0.18	0.67	0.19
9	Depressive feeling	0.73	0.27	0.73	0.28
10	Influence of heroin use on work	0.70	0.14	0.70	0.15
11	Influence of heroin use on relationship with family/friends	0.64	−0.03	0.65	−0.02
12	Influence of heroin use on social activity	0.76	0.19	0.75	0.19
	Eigen values	4.70	1.59	4.51	1.59
	Cumulative % of Variance explained	28.0	52.4	29.09	55.4

SDS items		SDS-Factor loadings (5 items)		SDS-R-Factor loadings (3 items)
		Factor 1 Impact	Factor 2 Perception	Factor 1 Impact
1	Do you think your use of heroin was out of control?	0.84	−0.01	0.85
2	Did the prospect of missing a fix or dose make you anxious or worried?	0.80	0.18	0.80
3	Did you worry about your use of heroin?	0.17	0.82	NA
4	Did you wish you could stop?	−0.06	0.82	NA
5	How difficult did you find it to stop or go without heroin?	0.86	−0.01	0.86
	Eigen values	2.13	1.35	2.10
	Cumulative % of Variance explained	42.63	69.59	69.94

NA: Not applicable.

named as ‘Perception’ related to heroin use (subscale 2). A total of 69.59% of variance was explained by these two factors (Table 1). It was seen from the later part of the results (item analysis and reliability) that the psychometric properties of Factor 2 were not satisfactory. A modified SDS consisting of the 3 items of Factor 1 was hence recommended to be used and was renamed as SDS-R (which was hence equivalent to the Factor 1 of SDS). A subsequent factor analysis showed that these 3 items of SDS-R clustered into one factor explaining 69.94% of the cumulative variance.

Table 2
Item analysis for OASI and SDS

Items		Cronbach's alpha if item is deleted		% Floor effect [c]	% Ceiling effect [d]	Item-total correlation coefficient [e]		Item-subscale correlation coefficient [f]		Correlation coefficients between the item and the other subscale [g]	
		Original [a]	Revised [b]			Original	Revised	Original	Revised	Original	Revised
OASI											
1	Frequency of daily heroin use	0.83	0.83	11.2	10.1	0.65***	0.65***	0.80***	0.80***	0.37***	0.35***
2	Amount of daily heroin use	0.84	0.84	22.5	14.6	0.53***	0.55***	0.74***	0.74***	0.23**	0.24**
3	Interval between waking up and first heroin taking	0.84	0.83	32.0	43.8	0.69***	0.69***	0.82***	0.82***	0.42***	0.39***
4	Perceived severity of craving for heroin	0.84	0.83	5.1	24.2	0.62***	0.63***	0.71***	0.71***	0.40***	0.39***
5	Time spent on heroin use	0.85	NA	32.0	13.5	0.50***	NA	0.53***	NA	0.32***	NA
6	Number of times receiving compulsory drug rehabilitation	0.83	0.83	1.1	12.4	0.73***	0.73***	0.72***	0.72***	0.57***	0.54***
7	Changes in physical health after using heroin	0.84	0.83	7.3	15.7	0.60***	0.61***	0.66***	0.68***	0.36***	0.36***
8	Changes in sex drive after using heroin	0.84	0.83	11.2	24.7	0.61***	0.62***	0.68***	0.70***	0.35***	0.35***
9	Depressive feeling	0.83	0.83	9.0	45.5	0.71***	0.71***	0.76***	0.77***	0.45***	0.45***
10	Influence of heroin use on work	0.84	0.83	5.1	41.6	0.61***	0.61***	0.69***	0.71***	0.32***	0.32***
11	Influence of heroin use on relationship with family/friends	0.85	0.85	10.1	23.6	0.49***	0.50***	0.60***	0.64***	0.20**	0.20**
12	Influence of heroin use on social activity	0.83	0.83	13.5	28.7	0.69***	0.69***	0.78***	0.78***	0.39***	0.39***
SDS											
1	Do you think your use of heroin was out of control?	0.49	0.69	7.3	24.7	0.73***	0.86***	0.86***	0.86***	0.02	NA
2	Did the prospect of missing a fix or dose make you anxious or worried?	0.46	0.76	3.9	18.5	0.75***	0.79***	0.79***	0.79***	0.15*	NA

(continued on next page)

Table 2 (*continued*)

Items		Cronbach's alpha if item is deleted		% Floor effect [c]	% Ceiling effect [d]	Item-total correlation coefficient [e]		Item-subscale correlation coefficient [f]		Correlation coefficients between the item and the other subscale [g]	
		Original [a]	Revised [b]			Original	Revised	Original	Revised	Original	Revised
3	Did you worry about your use of heroin?	0.61	NA	7.9	23.0	0.49***	NA	0.82***	NA	0.13	NA
4	Did you wish you could stop?	0.66	NA	1.7	42.1	0.36***	NA	0.79***	NA	−0.01	NA
5	How difficult did you find it to stop or go without heroin?	0.48	0.67	19.1	7.9	0.74***	0.85***	0.85***	0.85***	0.04	NA

***: p value < 0.001, **: p value < 0.01, *: p value < 0.05. NA: Not applicable.

[a] The original scales of the 12-item OASI and the 5-item SDS.

[b] The revised scales of the 11-item OASI-R and the 3-item SDS-R.

[c] The percentages of respondents scored the minimum value of the scales.

[d] The percentages of respondents scored the maximum value of the scales.

[e] Spearman correlation coefficients between each item and the overall scale.

[f] Spearman correlation coefficients between each item and the relevant subscale.

[g] Spearman correlation coefficients between item and the other subscale.

3.3. Item analyses for OASI and SDS

The results of the item analyses were summarized in Table 2. For OASI, no significant floor effect was observed for all the 12 items, while there were substantial ceiling effects for items 3, 9 and 10. The item-total correlation coefficients ranged from 0.49 to 0.73 ($p<0.001$) for OASI and 0.50 to 0.73 ($p<0.001$) for OASI-R. For OASI, all item-subscale correlation coefficients were moderate to high ($r=0.53$ to 0.82, $p<0.001$), whereas all such correlation coefficients were relatively high for OASI-R ($r=0.64$ to 0.82, $p<0.001$). All correlation coefficients between individual items and their respective subscale were higher than those between the items and the other subscale.

For SDS, floor effect was observed for item 4 (Table 2). The item-total correlation coefficients were all significant and ranged from 0.36 to 0.75. Item 4 had the lowest correlation coefficient with the overall scale ($r=0.36$) which was followed by item 3 ($r=0.49$). The item-subscale correlation coefficients were all significantly high ($r=0.79$ to 0.86) while item-other subscale correlation coefficients were all nonsignificant except item 2.

3.4. Reliability measures of the OASI and SDS

The Cronbach's alpha values were 0.85 for both OASI and OASI-R. For the two subscales of OASI and OASI-R, Cronbach's alpha coefficients were also high (0.80–0.81). Cronbach's alpha could not be improved by deleting any of their items (Table 2). The Split-half alpha values were 0.68 and 0.69 for OASI and OASI-R. The test–retest ICC were high for both OASI and OASI-R, respectively 0.83 and 0.81 ($p<0.001$). For the two subscales of OASI and OASI-R, the test–retest ICC ranged from 0.75 to 0.90.

Table 3
Correlation coefficients among OASI, OASI-R, SDS and QOL-DA

	OASI			OASI-R			QOL-DA				
	Total	Functional Impact	Demand for Heroin	Total	Functional Impact	Demand for Heroin	Total	Physical Function	Psychological Function	Symptoms	Social Function
OASI total	1.00	0.90***	0.84***	0.99***	0.87***	0.84***	−0.69***	−0.71***	−0.58***	−0.56***	−0.57***
Functional Impact		1.00	0.51***	0.88***	0.98***	0.51***	−0.72***	−0.76***	−0.63***	−0.54***	−0.61***
Demand for Heroin			1.00	0.85***	0.49***	1.00***	−0.45***	−0.44***	−0.36***	−0.41***	−0.37***
OASI-R total				1.00	0.88***	0.85***	−0.68***	−0.70***	−0.58***	−0.54***	−0.58***
Functional Impact					1.00	0.49***	−0.71***	−0.75***	−0.63***	−0.52***	−0.61***
Demand for Heroin						1.00	−0.45***	−0.44***	−0.36***	−0.41***	−0.37***
SDS total	0.55***	0.49***	0.48	0.55***	0.47***	0.48***	−0.51***	−0.46***	−0.46***	−0.42***	−0.41***
Impact (SDS-R, Factor 1)	0.63***	0.54***	0.55***	0.61***	0.50***	0.55***	−0.55***	−0.55***	−0.44***	−0.46***	−0.47***
Perception (Factor 2)	0.07	0.08	0.04	0.07	0.09	0.04	−0.10	−0.02	−0.20**	−0.08	−0.03

***: p value < 0.001; **: p value < 0.01; *: p value < 0.05.

Table 4
Relationship between OASI-R, SDS and characteristics related to heroin use

	OASI-R						SDS					
	Total		Functional Impact		Demand for Heroin		Total		Impact (SDS-R)		Perception	
	$\bar{x}$ ±SD	*p* value	$\bar{x}$ ±SD	*p* value	$\bar{x}$ ±SD	*p* value	$\bar{x}$ ±SD	*p* value	$\bar{x}$ ±SD	*p* value	$\bar{x}$ ±SD	*p* value
Mode of heroin use												
Chase-dragon	14.1±5.6	**0.001**	9.0±4.3	**0.02**	5.1±2.8	**0.001**	7.4±3.1	**0.017**	3.6±2.5	**0.024**	3.8±1.7	0.315
Injection	19.6±6.5		11.4±3.9		8.2±3.6		9.0±2.5		4.9±2.1		4.1±1.3	
Age of first heroin use(years)												
19 or below	19.3±6.8	0.254	10.4±4.7	0.177	8.9±3.2	**0.023**	8.9±2.2	0.445	4.7±2.1	0.339	4.2±1.3	0.867
20–29	19.6±6.1		11.7±3.3		7.8±3.6		9.0±2.7		4.9±2.3		4.1±1.2	
30 or above	17.6±7.3		10.9±4.6		6.7±3.5		8.4±3.0		4.3±2.2		4.1±1.6	
Age of first heroin injection (years)												
19 or below	18.9±6.3	0.344	10.1±4.4	0.158	8.8±3.3	0.053	8.4±2.2	0.231	4.6±2.2	0.334	4.1±1.3	0.813
20–29	20.0±6.7		11.7±3.8		8.3±3.7		9.1±2.6		5.0±2.2		4.26±1.2	
30 or above	18.4±6.5		11.3±3.9		7.1±3.4		8.6±2.9		4.6±2.2		4.0±1.5	
Duration of heroin use(years)												
3 years or below	15.4±6.4	<**0.001**	9.7±4.8	**0.001**	5.7±2.5	<**0.001**	7.2±3.1	<**0.001**	3.4±2.0	<**0.001**	3.8±1.5	0.420

4–6 years	17.3±6.4		10.0±4.1		7.2±3.4		8.9±2.6		4.7±2.0		4.2±1.2	
7–9 years	20.3±5.7		11.9±3.3		8.5±3.8		9.2±2.2		5.0±2.3		4.2±1.5	
10 years or above	21.5±6.1		12.5±23.5		9.0±3.6		9.6±2.3		5.4±2.1		4.2±1.2	
Duration of heroin injection (years)												
3 years or below	15.9±6.1	<**0.001**	9.7±4.2	<**0.001**	6.2±3.1	<**0.001**	7.9±2.8	**0.012**	3.8±2.0	**0.001**	4.1±1.4	0.734
4–6 years	18.9±6.6		11.2±3.8		7.7±3.6		8.7±2.9		4.7±2.2		3.9±1.4	
7–9 years	19.6±6.1		11.0±4.0		8.6±3.6		9.4±2.1		5.1±2.0		4.3±1.3	
10 years or above	23.1±5.3		13.4±2.9		9.7±3.2		9.5±2.3		5.4±2.2		4.0±1.2	
Frequency of daily heroin use (times)												
Less than once/day	11.6±4.1	<**0.001**	8.6±3.5	<**0.001**	3.0±1.7	<**0.001**	8.1±2.3	<**0.001**	3.7±2.0	<**0.001**	4.4±1.1	0.406
1–2 times/day	16.0±5.6		10.3±4.0		5.6±2.3		7.9±2.9		4.0±2.2		3.9±1.3	
3–4 times/day	21.6±5.0		12.0±3.9		9.7±2.2		9.5±2.2		5.3±2.0		4.2±1.4	
More than 5 times/day	26.5±3.4		13.6±2.2		12.9±1.9		10.2±2.9		5.9±2.2		4.3±1.2	
Dose of daily heroin use (g)												
Less than 0.5 g	13.7±5.6	<**0.001**	9.5±4.0	**0.009**	4.2±2.4	<**0.001**	8.2±3.0	**0.019**	3.7±2.2	<**0.001**	4.5±1.4	**0.047**
0.5–0.99 g	18.5±5.7		11.3±3.8		7.2±2.7		8.7±2.5		4.6±2.0		4.1±1.2	
1.0–1.49 g	22.3±4.7		12.1±3.5		10.1±2.0		9.0±2.8		5.4±2.5		3.7±1.4	
1.5 g or above	24.6±5.7		12.3±4.2		12.3±2.4		10.2±1.5		5.9±1.3		4.3±1.3	

Cronbach's alpha coefficient of the 5-item SDS was 0.61. The Split-half alpha of SDS was 0.47 and test–retest ICC was 0.63 ($p<0.001$). Reliability coefficients of the Impact factor (SDS-R) and Perception factor of SDS were calculated separately. The 3-item Impact factor (SDS-R) had higher internal consistency (Cronbach's alpha coefficient=0.78) and test–retest reliability (ICC=0.64, $p=0.001$) than both the 5-item SDS and 2-item Perception factor (Cronbach's alpha coefficient=0.52, ICC=0.48, $p=0.012$).

3.5. Correlation coefficients among OASI/OASI-R, SDS and QOL-DA

The OASI and OASI-R scores were both significantly correlated with the SDS at the 0.001 level ($r=0.55$, Table 3). The correlation coefficients between QOL-DA and OASI or OASI-R were all negative and significant. The results showed that the Functional Impact subscale of OASI-R had higher correlation coefficients with QOL-DA and its subscales ($r=-0.52$ to -0.75, $p<0.001$), as compared to the Demand for Heroin subscale of OASI-R ($r=-0.36$ to -0.45, $p<0.001$).

The overall score of SDS was significantly correlated with OASI/OASI-R, QOL-DA and their subscales ($r=0.41$ to 0.55, $p<0.001$). As for the two factors, the Impact factor (SDS-R) yielded higher correlation coefficients with all above-mentioned scales/subscales ($r=0.50$ to 0.63 for correlation between SDS-R and OASI/OASI-R, and $r=-0.44$ to -0.55 for correlation between SDS-R and QOL-DA, $p<0.001$). For the Perception factor, almost all correlation coefficients with OASI/OASI-R, QOL-DA and their subscales were not statistically significant (Table 3).

3.6. Relationship between OASI-R, SDS and characteristics related to heroin use

OASI-R and its two subscales were significantly associated with the mode of heroin use, duration of heroin use, duration of heroin injection, frequency of daily heroin use and dose of daily heroin use. Age at first heroin use was significantly associated with demand for heroin ($p=0.023$) (Table 4).

Similar results were found for the overall SDS and SDS-R, but not for the 2-item Perception factor. Only dose of daily heroin use was significantly associated with scores of the Perception factor and this significance was only marginal (Table 4).

4. Discussion

The present study found the psychometric properties of the 11-item OASI-R and 3-item SDS-R satisfactory. Factor structures were clear for both OASI-R and SDS-R; good internal and test–retest reliability coefficients were reported and strong correlations with external variables were documented.

Items of OASI-R were generated and selected carefully in three separated studies, involving an expert panel and drug users. It was comprehensive to measure different aspects of severity of opiate dependence (frequency and dosage of drug use, physical, psychological and social functioning, etc.) and these items were sorted into 4 subscales by the original authors (Lian & Liu, 2004). Factor analysis and external correlation coefficients were however not reported by the original authors and their samples were based on institutionalized drug users. Here, authors found that items of the original Health Injury and Social Function Injury subscales clustered exactly into the first factor (Functional Impact), whereas items of the original Physical Dependence and Psychological Dependence subscales clustered into the second factor (Demand for Heroin). We suggested the removal of item 6 from the 12-item OASI as it contributed little to the psychometric properties of the whole scale (factor loading and reliability), together with the fact that

this item is unique to China context. Compulsory rehabilitation might be related to factors such as police action or economic status of the drug users rather than the severity of dependence.

SDS is an internationally used instrument and the development of a Chinese version allows for cross-cultural comparisons. The SDS showed good psychometric properties in some but not all studies (Gonzalez-Saiz & Salvador-Carulla, 1998; Gossop et al., 1995; Hides, Dawe, Young, & Kavanagh, 2007; Topp & Mattick, 1997). In the present study the internal consistency was acceptable but not outstanding (alpha=0.61). Two factors emerged from the factor analysis while some other studies reported a one-dimension structure of the SDS (Gossop et al., 1995). Similar results of imperfect reliability and multi-dimensional structure of SDS were observed in some non-English speaking countries (Ferri, Marsden, de Araujo, Laranjeira, & Gossop, 2000; Gonzalez-Saiz & Salvador-Carulla, 1998), highlighting the significance of cultural differences. The 2-item factor (Perception) showed lower reliability and weaker correlation with external variables (OASI-R, QOL-DA and characteristics related to heroin use), and was hence not recommended to be used. These 2 items ('Did you worry about your use of heroin?' and 'Did you wish you could stop?') could be affected by other social, cognitive and experiential characteristics of the drug users (e.g., hopelessness about future, family situation, accessibility to services), which may not be directly related to severity of drug use. After these 2 items were removed, much better validity and reliability properties were achieved by the 3-item SDS-R.

The OASI/OASI-R and SDS/SDS-R were hence validated and they were significantly associated with each other. The study therefore provides two short Chinese instruments for studying severity of substance use. This would facilitate research in various Chinese drug use populations in different countries. The OASI-R focused on demand for heroin and impact of heroin use on health and social function, while the SDS-R focused on psychological dependence. The next step is to translate the OASI into English and to validate the English version. This would add to the literature of drug research. The good psychometric properties of the Chinese version illustrate the potential for developing an English version of the OASI.

Heroin use-related problems in China have been receiving strong concern because of their close relationships with HIV/AIDS and other social issues. About half of reported HIV cases in China could be attributed to injecting heroin use (The Ministry of Health of the People's Republic of China et al., 2006). Female injecting drug users involving in commercial sex have also been a concern (Lau, Feng, Lin, Wang, & Tsui, 2005). Different harm reduction programs were much enhanced in China recently. These include the Needle Exchange Program (NEP) (there were 392 sites in 2006 whereas the government planned to open 1400 sites by the end of 2008) and the Methadone Maintenance Treatment (MMT) clinics (there were 500 sites in 2006 and there would be 1500 sites by the end of 2008) (Sullivan & Wu, 2007). The OASI-R and SDS-R could therefore be used as instruments to evaluate the effectiveness of relevant intervention programs, to assess treatment needs of heroin users, as well as being used in other heroin use-related studies in China. Moreover, the OASI-R and SDS-R were validated using a sample of non-institutionalized drug users, making it possible to apply these instruments to community-based drug users.

The study has a few limitations. Firstly, onsite random sampling was not feasible thus peer-driven snowballing method was implemented to collect data. How representative this sample was to the wider drug-using community could not be assessed. Secondly, although anonymous and privacy guaranteed, reporting bias due to social desirability may also exist and this applies to all risk behavior-related studies. Thirdly, the test–retest sample size was relatively small though very consistent results were observed.

In summary, the OASI-R and SDS-R were both easy to administer. The results of this study would hence facilitate relevant researches in China and other Chinese populations.

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Appendix A. The Opiate Addiction Severity Inventory (OASI)

We are going to ask you some questions about your drug (heroin) use in the last month. For each question (except Q4), please select one statement that most closely reflects your situation. For Q4, please give an appropriate score according to your experience.

In the last month:

Q1. How many times did you use heroin per day?

0) needn't use heroin everyday

1) once or twice/d

2) 3 or 4 times/d

3) ≥5 times/d

Q2. What's the average amount of your daily heroin use?

0) less than 0.5 g/d

1) 0.5–0.9 g/d

2) 1.0–1.4 g/d

3) ≥1.5 g/d

Q3. When was your first use of heroin after waking up in the morning?

0) in 1 h or more

1) in 30–59 min

2) in 10–29 min

3) in less than 10 min

Q4. How would you describe your heroin craving level? (0 represents no cravings at all; 10 represents extreme craving.) _____

Q5. How much time did you spend on heroin use (including looking for heroin, using heroin, and thinking about heroin, etc.) per day?

0) almost no time

1) a small proportion of the time

2) a large proportion of the time

3) almost all of the time

Q6. How many times have you received compulsory drug rehabilitation?

0) none

1) once or twice

2) 3 or 4 times

3) ≥5 times

Q7. Compared with your health status before using heroin, was your physical health getting worse?

0) no change

1) worsened some

2) worsened much
3) worsened extremely much

Q8. Compared with your libido before heroin use, were you experiencing reduced sex drive?
0) no change
1) worsened some
2) worsened much
3) worsened extremely much

Q9. How often did you have depressive feeling (e.g., hard to cheer up, loss of interest in life and entertainment)?
0) no
1) sometimes
2) often
3) always

Q10. How did heroin use affect your work (including doing house chores, business, etc.)?
0)none
1) to some (less than half) extent
2) to much (more than half) extent
3) to an extreme extent

Q11. How did heroin use affect your relationship with your family or friends?
0)none
1) to some (less than half) extent
2) to much (more than half) extent
3) to an extreme extent

Q12. How did heroin use affect your social activities?
0) none
1) to some (less than half) extent
2) to much (more than half) extent
3) to an extreme extent

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