

# Poor sleep quality is significantly associated with low sexual satisfaction in Chinese methadone-maintained patients

Hui-Shi Zhang, MD, Yan-Min Xu, MD, Jun-Hong Zhu, MD, Bao-Liang Zhong, MD, PhD\*

## Abstract

Sleep disturbance negatively affects sexual function. Sleep problem and sexual dysfunction are common in methadone-maintained patients; however, their association is understudied in this patient population.

This study examined the association between sleep quality and sexual satisfaction in Chinese patients receiving methadone maintenance treatment (MMT).

This was a cross-sectional study. A total of 480 MMT patients who had sex with their sex partners within 1 month before the survey were recruited from 3 MMT clinics in Wuhan, China. Sexual satisfaction was assessed with a single question, and sociodemographic and clinical data were collected with a standardized questionnaire. Sleep quality was assessed with the Pittsburgh Sleep Quality Index. Multiple ordinary logistic regression was used to control for potential confounders that may bias the sleep-sexual satisfaction relationship.

Sexual satisfaction scores were significantly higher in poor sleepers than normal sleepers ( $3.2 \pm 0.9$  vs.  $2.8 \pm 1.0$ ,  $t = 4.297$ ,  $P < .001$ ). After controlling for potential confounders, results of the multiple regression analysis reveal that poor sleep quality was still significantly and independently associated with low sexual satisfaction (odds ratio = 1.58,  $P = .009$ ).

Poor sleep quality is significantly associated with low sexual satisfaction of methadone-maintained patients. Improving sleep quality might improve sexual satisfaction of patients receiving MMT.

**Abbreviations:** MMT = methadone maintenance treatment, OR = odds ratio.

**Keywords:** methadone, sexual satisfaction, sleep quality

## 1. Introduction

Sleep disorder is associated with increased mental and physical morbidity, including diabetes, hypertension, and depression, as well as increased mortality.<sup>[1–3]</sup> The use of opioids, either heroin or methadone, could lead to insomnia and sleep disturbance.<sup>[4,5]</sup> There is evidence that the prevalence of sleep problem is as high as 80.8% in methadone-maintained heroin-dependent patients.<sup>[6]</sup> In methadone-maintained patients, sleep problem is significantly associated with more intense pain, poor quality of life, relapse of

heroin addiction, polysubstance abuse, and early drop-out from methadone maintenance treatment (MMT).<sup>[7–11]</sup>

Sexual dysfunction is also commonly seen among methadone-maintained patients.<sup>[12–15]</sup> Sexual dysfunction in the general population is influenced by a variety of physical, psychological, and social factors.<sup>[16–18]</sup> Although there is preliminary evidence that sex, age, education, methadone dosage, depression, and anxiety are significantly associated with sexual satisfaction of methadone-maintained patients,<sup>[19,20]</sup> the underlying psychosocial factors of sexual dysfunction of methadone-maintained patients remain poorly understood.<sup>[12,14,21]</sup>

Accumulating evidence from studies with samples of postmenopausal women, fibromyalgia patients, shift workers, and schizophrenia patients has shown the significant association between sexual dysfunction and sleep disturbance.<sup>[22–25]</sup> Given the high prevalence of sleep problem in methadone-maintained patients, sleep disturbance may impair the sexual function, leading to the high prevalence of sexual dysfunction in methadone-maintained patients. However, such association is understudied in methadone patients. To the best of our knowledge, only 1 previous study has investigated the sleep-sexual function association in patients of MMT clinics in Kerman, Iran, but this study reported no association between sleep problem and sexual dysfunction.<sup>[26]</sup> Because the sample size of this study was relatively small ( $n = 198$ ) and its sample was male-dominated (male proportion: 93.4%), the generality of its findings may be limited.

For patients receiving MMT, adequate sleep and sexual functioning are considered important for their physical and mental well-being. A greater understanding on the relationship between sleep and sexual function would inform the clinical management of MMT patients. The present study examined the

Editor: Antonio Palazón-Bru.

Funding sources: This study was supported by Wuhan Health and Family Planning Commission (WG16A02, BL Zhong, PI). The funder had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

The authors report no conflicts of interest.

Department of Psychiatry, Affiliated Wuhan Mental Health Center (The Ninth Clinical School), Tongji Medical College of Huazhong University of Science & Technology, Wuhan, Hubei Province, China.

\* Correspondence: Bao-Liang Zhong, Department of Psychiatry, Wuhan Mental Health Center, No. 89, Gongnongbing Rd., Wuhan, Hubei 430019, China (e-mail: haizhilan@gmail.com).

Copyright © 2017 the Author(s). Published by Wolters Kluwer Health, Inc. This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

Medicine (2017) 96:39(e8214)

Received: 4 July 2017 / Received in final form: 6 August 2017 / Accepted: 25 August 2017

<http://dx.doi.org/10.1097/MD.0000000000008214>

characteristics of sleep quality and its association with sexual satisfaction in patients of Chinese MMT clinics.

## 2. Methods

### 2.1. Subjects

This study was part of a large cross-sectional survey, which investigated the mental health, sexual life satisfaction, suicidal behaviors, and quality of life of Chinese patients of 3 city-owned MMT clinics in Wuhan, China, between June 2009 and July 2010.<sup>[27–29]</sup> Eligible participants for the present study were those aged 20 years and above, met DSM-IV criteria for a lifetime diagnosis of heroin dependence, had regular or irregular sex partners, and had sex with their sex partners within 1 month before the study. Patients with severe physical illnesses, alcohol dependence, organic mental disorders, or psychotic symptoms were additionally excluded.

This study tested the relationship between sleep quality and sexual satisfaction, primarily by comparing the sexual satisfaction scores between poor sleepers and normal sleepers. The sample size was therefore estimated according to the formula for detecting the difference in means between 2 independent populations.<sup>[30]</sup> Data from our pilot study showed that approximately 30% of the methadone-maintained patients had poor sleep, and sexual satisfaction scores of poor and normal sleepers were 3.3 (standard deviation [SD]=0.87) and 3.0 (SD=0.86), respectively. Accordingly, a minimum sample size of 132 for both poor and normal sleepers should be recruited to detect a difference in sexual satisfaction from 3.3 (SD=0.87) in the poor sleep group to 3.0 (SD=0.86) in the normal sleep group with a 2-sided *P* value of .05, and an approximate power of 80%. Finally, the required minimum total sample size of methadone-maintained patients was estimated to be 440 (132/30%).

At the time of the survey, a total of 749 patients, who were taking methadone at the 3 MMT clinics, were screened for eligibility, and 519 met the study entry criteria. All these eligible patients were consecutively invited to participate in our study, and 480 finally completed the survey questionnaires.

The institutional review board of Wuhan Mental Health Center approved the study protocol before the data collection of the study. All subjects provided written informed consent.

### 2.2. Procedures and instruments

This was a self-completed questionnaire survey. Trained investigators were assigned to assist illiterate respondents to complete the questionnaires. Before the main study, a pilot study was conducted among a sample 48 MMT patients to test the feasibility of our study procedures. The survey questionnaire was also finalized after the pilot study.

Sociodemographic data collected in the questionnaire included age, sex, education years, marital status, and employment status.

Clinical variables collected were route of heroin administration before MMT, duration of heroin use before MMT, methadone dosage, MMT duration, and depressive symptoms. We used the Chinese version of Zung's Self-rating Depression Scale (SDS) to assess the severity of depressive symptoms.<sup>[31]</sup> The SDS has 20 items and all items use a 4-point rating scale (1 = a little of the time to 4 = most of the time). The total SDS score ranges between 20 and 80, with higher scores indicating more severe depression. A cutoff value of  $\geq 40$  is used to indicate clinically significant depression in the Chinese population. The Chinese SDS has been

shown to be reliable and valid to screen for depression in Chinese population.<sup>[32]</sup> In this study, the Cronbach  $\alpha$  coefficient of the SDS was 0.918.

Sleep quality was assessed with the Chinese version of the Pittsburgh Sleep Quality Index (PSQI).<sup>[33]</sup> The PSQI is the most widely used scale assessing a person's sleep quality and disturbances during the past month. The total PSQI score varies from 0 to 21, with higher scores denoting poorer sleep quality. A cutoff score of 8 or higher is used to screen for poor sleep quality in China.<sup>[34]</sup> Studies have proved that the Chinese PSQI has good reliability and validity to assess the sleep quality of Chinese population.<sup>[35,36]</sup> In the present study, the Cronbach  $\alpha$  coefficient of the PSQI was 0.875.

Sexual function was measured with a single question: "In the past month, how satisfied were you with your sex life?". Response options were: 1 = very satisfied; 2 = satisfied; 3 = fair; 4 = dissatisfied; 5 = very dissatisfied. This single-item measure of sexual satisfaction has been widely used in previous epidemiological studies of sex health and has good validity to assess sexual function.<sup>[19,20,37]</sup> Most of the available sexual dysfunction scales focus on 1 sex.<sup>[38]</sup> The advantage of this single-item measure is that it can simply measure and compare the quality of sexual function for both sexes. In the sample of our pilot study, the scores of this single item and the 4 subscales of Scale for Quality of Sexual Function<sup>[38]</sup> were moderate to highly correlated: their intraclass correlation coefficients ranged between  $-0.453$  (for psychosomatic quality of life) and  $-0.716$  (for sexual dysfunction-self-reflection).

### 2.3. Statistical analysis

Prevalence of poor sleep quality was calculated. Sociodemographic and clinical characteristics and sexual satisfaction of poor sleepers and normal sleepers were described and compared by  $\chi^2$  test or *t* test, as appropriate. To test whether sleep quality was independently and significantly associated with sexual satisfaction, multivariable ordinary logistic regression model that entered sexual satisfaction as the outcome variable, sleep quality as the predictor, and sociodemographic and clinical variables at once to adjust for the potential confounding effects of these sociodemographic and clinical factors. Odds ratios (ORs) and 95% confidence intervals (CIs) were used to quantify the associations between factors and sexual satisfaction. Continuous variables were dichotomized at the median value. The statistical significance level was set at *P* < .05 (2-sided). SPSS software version 22.0 package was used for all analyses (SPSS Inc, Chicago, IL).

## 3. Results

The mean age of the 480 patients was 38.3 years (standard deviation [SD]=7.0, range=21–59), and 69.0% were males. The majority of patients (84.4%) injected heroin before MMT, and the mean dose of methadone and duration of MMT were 69.6 mg/day (SD=30.0) and 25.6 months (SD=10.8), respectively. Table 1 shows detailed sociodemographic and clinical characteristics of the study participants.

The average sexual satisfaction score was 3.0 (SD=1.0). In total, 32.1% patients were dissatisfied with their sex lives (7.7% "very dissatisfied" and 24.4% "dissatisfied"), 28.1% rated their sex lives as "fair," and 39.6% were satisfied (36.5% "satisfied" and 3.1% "very satisfied").

A total of 169 patients had poor sleep quality. The prevalence of poor sleep quality was 35.2%. Compared to normal sleepers

**Table 1**  
**Characteristics of methadone-maintained patients with poor and normal sleep quality.**

Variables	Poor sleepers (n = 169)	Normal sleepers (n = 311)	$\chi^2$	P
Sex				
Male	116 (68.6)	215 (69.1)	0.002	.961
Female	53 (31.4)	96 (30.9)		
Age, y				
$\leq 39$	90 (53.3)	170 (54.7)	0.128	.72
$> 39$	79 (46.7)	141 (45.3)		
Education years				
$\leq 8$	46 (27.2)	248 (79.7)	3.426	.064
$> 8$	123 (72.8)	63 (20.3)		
Marital status*				
Married	82 (48.5)	185 (59.5)	4.232	.041
Unmarried	87 (51.5)	126 (40.5)		
Employment				
Yes	72 (42.6)	180 (57.9)	8.607	.003
No	97 (57.4)	131 (42.1)		
Route of heroin administration				
Smoking	15 (8.9)	60 (19.3)	11.316	.001
Injecting	154 (91.1)	251 (80.7)		
Duration of heroin use, y				
$\leq 9$	40 (23.7)	133 (42.8)	16.651	$< .001$
$> 9$	129 (76.3)	178 (57.2)		
Methadone dosage, mg/day				
$< 70$	77 (45.6)	144 (46.3)	0.051	.823
$\geq 70$	92 (54.4)	167 (53.7)		
MMT duration, mo				
$< 24$	44 (26.0)	131 (42.1)	13.2	$< .001$
$\geq 24$	125 (74.0)	180 (57.9)		
Clinically significant depressive symptoms				
No	58 (34.3)	207 (66.6)	47.076	$< .001$
Yes	111 (65.7)	104 (33.4)		

MMT = methadone maintenance treatment.

\* "Married" included married and remarried. "Unmarried" included never-married, separated, cohabitating, divorced, and widowed.

(Table 1), poor sleepers were more likely to be unmarried (never-married, separated, cohabitating, divorced, or widowed), be unemployed, inject heroin before MMT, have long duration of heroin use, have long MMT duration, and suffer from depression.

Sexual satisfaction scores were significantly higher in poor sleepers than normal sleepers ( $3.2 \pm 0.9$  vs.  $2.8 \pm 1.0$ ,  $t = 4.297$ ,

$P < .001$ ). Because poor and normal sleepers were not comparable in terms of marital status, employment status, route of heroin administration, duration of heroin use, MMT duration, and depression, these variables may also contribute to the difference in sexual satisfaction between poor and normal sleepers. In other words, these variables may have confounding effects on the sleep-sexual satisfaction association, which needs to be further controlled in multiple regression analysis. After controlling for potential confounders, results of the multiple ordinary logistic regression analysis (Table 2) reveal that poor sleep quality was still significantly and independently associated with low sexual satisfaction (OR = 1.58,  $P = .009$ ).

#### 4. Discussion

To the best of our knowledge, this is the first large-scale study in China to examine the clinical characteristics of sleep quality and its association with sexual function in Chinese methadone-maintained patients. We found a 35.2% prevalence of poor sleep quality in Chinese methadone-maintained patients, which was lower than that of previous studies (48.3%–97.6%).<sup>[6]</sup> The prevalence disparities might be related to different cutoff values of PSQI used in previous studies, sample characteristics (i.e., proportion of subjects with a history of injecting heroin), sampling (i.e., convenient vs. consecutive), and clinical settings (i.e., clinics vs. inpatients). Importantly, the inclusion criteria of subjects may also result in the low prevalence of poor sleep quality because our study participants must have sex partners and the support from partners/spouses may reduce the risk of sleep problem in methadone-maintained patients. However, the finding, more than one-third of the methadone-maintained patients had sleep problem, still suggests that poor sleep quality is a common health issue in patients of Chinese MMT clinics.

Consistent with findings on the risk factors of poor sleep quality in the general population, we found marital status of "unmarried," unemployment, and depression were significantly associated with poor sleep quality of MMT patients.<sup>[39–41]</sup> In addition, we also found that patients' substance use characteristics were associated with poor sleep quality, that is, patients who injected heroin before MMT, had long duration of heroin use, and had received MMT for a long time were at greater risk for poor sleep quality. This phenomenon may be explained by the low level of endogenous opioid peptides owing to the long-term intake of external opioid peptides (i.e., heroin and methadone) via the physiologic negative feedback inhibition loop because

**Table 2**  
**Multiple ordinary logistic regression on factors associated with low sexual satisfaction in Chinese methadone-maintained patients\*.**

Factor	Risk level	Reference level	Coefficient	Standard error	Wald $\chi^2$	P	OR (95% CI)
Sleep quality	Poor	Normal	0.458	0.203	5.09	.009	1.58 (1.25, 2.79)
Sex	Male	Female	0.669	0.219	9.312	.002	1.95 (1.27, 3.00)
Age, y	$> 39$	$\leq 39$	0.959	0.212	20.382	$< .001$	2.61 (1.72, 3.96)
Education years	$\leq 8$	$> 8$	0.762	0.225	11.452	.001	2.14 (1.38, 3.33)
Marital status <sup>†</sup>	Unmarried	Married	0.321	0.207	2.393	.122	1.38 (0.92, 2.07)
Employment	No	Yes	0.542	0.195	7.705	.006	1.72 (1.17, 2.52)
Route of heroin administration	Injecting	Smoking	0.135	0.265	0.259	.611	1.14 (0.68, 1.92)
Duration of heroin use, y	$\leq 9$	$> 9$	0.143	0.202	0.499	.48	1.15 (0.78, 1.71)
Methadone dosage, mg/day	$\geq 70$	$< 70$	0.067	0.197	0.114	.735	1.07 (0.73, 1.57)
MMT duration, mo	$\geq 24$	$< 24$	0.668	0.203	10.872	.001	1.95 (1.31, 2.90)
Clinically significant depressive symptoms	Yes	No	1.25	0.244	26.156	$< .001$	3.49 (2.16, 5.64)

CI = confidence interval, MMT = methadone maintenance treatment, OR = odds ratio.

\* Results of modified  $\chi^2$  test show that this ordinary logistic regression model fits the data well ( $\chi^2 = 493.355$ ,  $P = .257$ ).

<sup>†</sup> "Married" included married and remarried. "Unmarried" included never-married, separated, cohabitating, divorced, and widowed.

reduced endogenous opioid peptides could cause difficulties in sleep initiation and maintenance.<sup>[42,43]</sup>

Our study replicated the significant sleep-sexual function association in methadone-maintained patients: poor sleep quality was significantly associated with low sexual satisfaction, even after adjustment for potential confounders. This may be related to the decreased level of testosterone in poor sleepers, as there is evidence that testosterone plays an important role in maintaining normal sexual desire of both men and women and insomnia could cause reductions in blood testosterone level.<sup>[44,45]</sup> Although the low sexual satisfaction can be induced by methadone,<sup>[46,47]</sup> our adjustment analysis demonstrated a significant association between sleep quality and sexual satisfaction, which was independent of methadone dose and MMT duration, suggesting that sleep quality is also a potential contributor of sexual satisfaction.

This study has a few methodological limitations. First, the study was a cross-sectional survey; therefore, the causality of relationship between poor sleep quality and low sexual satisfaction could not be explored. Second, we did not measure the level of blood testosterone; therefore, the biological mechanisms underlying the sleep-sexual function link could not be verified.

Our results indicate the significant association between poor sleep quality and low sexual satisfaction, which remained significant after adjustment for multiple possible confounders. These findings suggest the potential importance of obtaining high-quality sleep in improving the sexual function of methadone-maintained patients. Prospective, longitudinal studies of sleep and its impact on sexual function in patients of MMT clinics would help clarify the relationship.

## Acknowledgments

The authors thank all patients involved in this study.

## References

- Koren D, Dumin M, Gozal D. Role of sleep quality in the metabolic syndrome. *Diabetes Metab Syndr Obes* 2016;9:281–310.
- Luca A, Luca M, Calandra C. Sleep disorders and depression: brief review of the literature, case report, and nonpharmacologic interventions for depression. *Clin Interv Aging* 2013;8:1033–9.
- Parthasarathy S, Vasquez MM, Halonen M, et al. Persistent insomnia is associated with mortality risk. *Am J Med* 2015;128:268–75. e262.
- Angarita GA, Emadi N, Hodges S, et al. Sleep abnormalities associated with alcohol, cannabis, cocaine, and opiate use: a comprehensive review. *Addict Sci Clin Pract* 2016;11:9.
- Zahari Z, Siong LC, Musa N, et al. Report: Demographic profiles and sleep quality among patients on methadone maintenance therapy (MMT) in Malaysia. *Pak J Pharm Sci* 2016;29:239–46.
- Xu YM, Zhong BL, Liu TB. The prevalence of sleep problem among heroin addicts: a meta-analysis. *Chin J Drug Depend* 2014;23:369–74.
- Wang J, Zhong BL, Zhu JH. Relationship between pain and sleep in heroin-dependent patients receiving methadone maintenance treatment. *Chin J Drug Depend* 2016;25:513–6.
- Zhu JH, Zhong BL. Effect of sleep quality on quality of life of heroin addicts receiving methadone maintenance treatment. *Chin J Behav Med Brain Sci* 2013;22:607–10.
- Liao Y, Tang J, Liu T, et al. Sleeping problems among Chinese heroin-dependent individuals. *Am J Drug Alcohol Abus* 2011;37:179–83.
- Khazaie H, Najafi F, Ghadami MR, et al. Sleep disorders in methadone maintenance treatment volunteers and opium-dependent patients. *Addict Health* 2016;8:84–9.
- Zahari Z, Inrahim MA, Tan SC, et al. Sleep quality in opioid-naive and opioid-dependent patients on methadone maintenance therapy in Malaysia. *Turk J Med Sci* 2016;46:1743–8.
- Zhang Y, Wang P, Ma ZL, et al. Sexual function of 612 male addicts treated by methadone. *J Cent South Univ (Med Sci)* 2011;36:739–43.
- Yee A, Danaee M, Loh HS, et al. Sexual dysfunction in heroin dependents: a comparison between methadone and buprenorphine maintenance treatment. *PLoS One* 2016;11:e0147852.
- Gerra G, Manfredini M, Somaini L, et al. Sexual dysfunction in men receiving methadone maintenance treatment: clinical history and psychobiological correlates. *Eur Addict Res* 2016;22:163–75.
- Zhang M, Zhang H, Shi CX, et al. Sexual dysfunction improved in heroin-dependent men after methadone maintenance treatment in Tianjin, China. *PLoS One* 2014;9:e88289.
- Lou WJ, Chen B, Zhu L, et al. Prevalence and factors associated with female sexual dysfunction in Beijing, China. *Chin Med J (Engl)* 2017;130:1389–94.
- Ishak IH, Low WY, Othman S. Prevalence, risk factors, and predictors of female sexual dysfunction in a primary care setting: a survey finding. *J Sex Med* 2010;7:3080–7.
- Rosen RC. Prevalence and risk factors of sexual dysfunction in men and women. *Curr Psychiatry Rep* 2000;2:189–95.
- Zhu JH, Zhong BL, Xu LJ, et al. Sex life satisfaction and its associated factors among heroin-dependent male patients receiving methadone maintenance treatment. *Chin J Andrology* 2015;29:37–41.
- Shan JM, Chen GD, Kong YB, et al. Sexual satisfaction and its related factors among heroin-dependent women receiving methadone maintenance treatment. *Chin J Behav Med Brain Sci* 2015;24:625–8.
- Yee A, Loh HS, Hisham Hashim HM, et al. Clinical factors associated with sexual dysfunction among men in methadone maintenance treatment and buprenorphine maintenance treatment: a meta-analysis study. *Int J Impot Res* 2014;26:161–6.
- Kling JM, Manson JE, Naughton MJ, et al. Association of sleep disturbance and sexual function in postmenopausal women. *Menopause* 2017;24:604–12.
- Koca TT, Acet GK, Tanrikut E, et al. Evaluation of sleep disorder and its effect on sexual dysfunction in patients with Fibromyalgia syndrome. *Turk J Obstet Gynecol* 2016;13:167–71.
- Pastuszek AW, Moon YM, Scovell J, et al. Poor sleep quality predicts hypogonadal symptoms and sexual dysfunction in male nonstandard shift workers. *Urology* 2017;102:121–5.
- Boin AC, Nozoe KT, Polesel DN, et al. The potential role of sleep in sexual dysfunction in patients with schizophrenia. *Schizophr Res* 2014;154:126–7.
- Kheradmand A, Amini Ranjbar Z, Zeynali Z, et al. Sleep quality and sexual function in patients under methadone maintenance treatment. *Int J High Risk Behav Addict* 2015;4:e23550.
- Liu LZ, Tan LX, Xu YM, et al. Significantly more intense pain in methadone-maintained patients who are addicted to nicotine. *Oncotarget* 2017;8:60576–80.
- Zhong BL, Li HJ, Zhu JH, et al. Depression, anxiety and insomnia among methadone maintenance treatment outpatients: detection rates, comorbidity and correlates. *Chin J Drug Depend* 2010;19:371–5.
- Yang YJ, Xu YM, Chen WC, et al. Loneliness and its impact on quality of life in Chinese heroin-dependent patients receiving methadone maintenance treatment. *Oncotarget* 2017;doi: 10.18632/oncotarget.19565.
- Zhong B. How to calculate sample size in randomized controlled trial? *J Thorac Dis* 2009;1:51–4.
- Wang XD, X.L. W, Ma H. Rating scales for mental health. *Chin Ment Health J* 1999;Suppl:122–4.
- Li MJ, Xu J, Liu YZ, et al. Clinical application and assessment of Zung's Self-rating Depression Scale. *Int J Nurs* 2010;29:1512–3.
- Buysse DJ, Reynolds CF3rd, Monk TH, et al. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res* 1989;28:193–213.
- Liu XC, tang MQ, Hu L, et al. Reliability and validity of the Pittsburgh sleep quality index. *Chin J Psychiatry* 1996;29:103–7.
- Zheng B, Li M, Wang KL, et al. Analysis of the reliability and validity of the Chinese version of Pittsburgh sleep quality index among medical college students. *J Peking Univ (Health Sci)* 2016;48:424–8.
- Tsai PS, Wang SY, Wang MY, et al. Psychometric evaluation of the Chinese version of the Pittsburgh Sleep Quality Index (CPSQI) in primary insomnia and control subjects. *Qual Life Res* 2005;14:1943–52.
- Ji F, Jiang D, Lin X, et al. Sexual life satisfaction and its associated socio-demographic and workplace factors among Chinese female nurses of tertiary general hospitals. *Oncotarget* 2017;8:54472–7.
- Heinemann LA, Potthoff P, Heinemann K, et al. Scale for Quality of Sexual Function (QSF) as an outcome measure for both genders? *J Sex Med* 2005;2:82–95.

- [39] Luo J, Zhu G, Zhao Q, et al. Prevalence and risk factors of poor sleep quality among Chinese elderly in an urban community: results from the Shanghai aging study. *PLoS One* 2013;8:e81261.
- [40] Kang JM, Lee JA, Jang JW, et al. Factors associated with poor sleep quality in primary care. *Korean J Fam Med* 2013;34:107–14.
- [41] Li K, Sun X, Cui L, et al. A survey on sleep quality of the people aged over 18-years-old in Hebei Province. *Chin Ment Health J* 2008;22:302–5.
- [42] Paturi AK, Surani S, Ramar K. Sleep among opioid users. *Postgrad Med* 2011;123:80–7.
- [43] Panagiotou I, Mystakidou K. Non-analgesic effects of opioids: opioids' effects on sleep (including sleep apnea). *Curr Pharm Des* 2012;18:6025–33.
- [44] Andersen ML, Tufik S. Could sleep exert a relevant role on sexual problems in young men recruited to military service? *J Adolesc Health* 2014;55:848–9.
- [45] van Anders SM. Testosterone and sexual desire in healthy women and men. *Arch Sex Behav* 2012;41:1471–84.
- [46] Ajo R, Segura A, Mira L, et al. The relationship of salivary testosterone and male sexual dysfunction in opioid-associated androgen deficiency (OPIAD). *Aging Male* 2017;20:1–8.
- [47] Parvaresh N, Sabahi AR, Mazhari S, et al. A Study of the sexual function, sleep, and weight status of patients after 6 months of methadone maintenance treatment. *Addict Health* 2015;7:24–9.