

# Sleep quality and anxiety among nurses in tertiary hospitals in China and the influencing factors: A cross-sectional study

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## Research article

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# Abstract

**Background:** The purpose of the study was to investigate to understand the situation of sleep quality and anxiety among nurses in tertiary hospitals in China, and analyze their influencing factors.

**Methods:** A cross-sectional survey was performed for nurses in Beijing tertiary hospitals including Beijing Tongren hospital, Anzhen Hospital and Beijing Children Hospital. The Pittsburgh Sleep Quality Index (PSQI) and Zung Self-Rating Anxiety Scale (SAS) were used to measure the sleep quality and anxiety symptoms, respectively. Survey of quality of life in nurses was measured by 36-item Short Form Health Survey (SF-36). Spearman's correlations analysis and logistic regression analysis was used to understand the influencing factors with sleep disorder, anxiety symptoms and quality of sleep. Quality of life (both PCS and MCS) were affected by influencing factors including marital status, working years, education background, income monthly, working hours, regular diet, physical exercise, sleep disorder, anxiety symptoms, feeling of stress, and stress from economic, social, occupational.

**Results:** 643 registered nurses in three tertiary hospitals were surveyed, 517 (80.4%) returned questionnaires were valid for analysis. The average PSQI score was  $7.71 \pm 3.62$ , including 372 participants that scores were above 5 (72.0%). The average SAS score was  $45.18 \pm 9.90$ , including 157 participants with a SAS score  $\geq 50$  (30.4%) that had different anxiety symptoms. The nurses' sleep quality were affected by some factors including income monthly, working hours, regular diet, physical exercise, stress from economic, social, occupational. Education background, income monthly, working hours, regular diet and economic stress, social stress, occupational stress have significantly related to anxiety symptoms. Correlation between sleep disorder and anxiety severity was positive for nurses.

**Conclusions:** The situation of sleep disorder and anxiety symptoms among nurses in tertiary hospitals in China were very serious. The problem has negative effect on physical and mental health in nurses which reminded hospital administrators should take preventive actions. In addition, the results of the study hinted that promotion of health lifestyle, effort-reward balance and providing social support may be significant to decrease the poor sleep quality and anxiety symptoms and increase quality of life in nurses.

## Background

The status of physical and mental health have important effect for quality of life and work for medical staffs[1]. Clinical nurses, as an important medical group, maintain faster work pace and heavier workload for a long time that increase the risk of physical and mental health problem, including feeling stress, fatigue, burnout, anxiety, and decreasing the quality of life. However, as a negative result, poor sleep quality has becoming an obvious and complaint problem for nursing staff all over the world[2-5]. Shift work disorder, stressful workload and complex work environment had been studied that may be the main reasons of sleep problems for nurses[2,3,4,6]. Poor sleep quality has negative effects for physical health such as metabolic disturbance, cardiometabolic disorders and chronic diseases[6-10].

Moreover, sleep problems for a long time also could result in serious effects for psychology and mental health including thought retardation, low spirit, irritability, depression and so on[11,12]. In fact, apart from impacting health of nurses, the previous studies have been improved that poor sleep quality could decrease the work performance and increase the risk of medical errors, impaired psychomotor performance over the past 40 years[13-18].

As we know, anxiety is an unpleasant emotion characterized by fear, worry, rumination[19]. However, anxiety disorder is medical disease if it was persistent and intense[19]. Anxiety disorder has become a worldwide problem that we need focus on. Previous researches reported that one-eighth population of world may suffer from inappropriate anxiety[20]. Some influencing factors were supposed like women, older age, urban, obese, and so on[21-22]. Previous studies also have indicated that nurses was a higher risk professional group that with anxiety disorder that others, 21% of Singapore general hospital nurses, 20% of ICU and general care nurses in the US, 43.2% of shift-work nurses in Iranian have suffered from anxiety disorder, respectively[23-25].

Chinese hospitals are divided into three degrees: tertiary hospital; second-class hospital; class-I hospital according to hospital scale, clinical staffs, work quality, technical facilities, etc. As of 2016, there were 2232 tertiary hospital (7.6% all kinds of hospitals in China). In 2016, there were 2213718 hospital beds (the proportion of all is 43.97%, this number was 40.71% in 2012) in Chinese tertiary hospitals and there were 1246308 registered nurses; and have provided high-quality medical care for 1627848 thousands of patients (the proportion of all is 49.78%, this number was 42.75% in 2012)[26]. As we know, tertiary hospital represents the highest medical care level in China, Chinese patients would like obtaining their clinical care no matter how far and how long time spent in waiting. Therefore, nurses in Chinese tertiary hospitals were faced with heavy workload, stressful work environment and complex interpersonal relationship. Chinese studies indicated that the quality of life of nurses in Chinese tertiary hospital was facing great challenge[6,27-28].

Previous researches have shown that we should pay more attention to physical and mental health of clinical nurses. Nurses are encountering more stressful job and workload in tertiary hospital than that in secondary and first-level hospitals. Not only that, they were more possibility and risk for physical and mental health and medical errors. However, we do not know that clearly. Then, the purpose of our study was understanding the status and influencing factors of sleep quality, source of stress, mental health, quality of life and their correlation among nurses in tertiary hospitals in China. We also hope to offer some suggestion for improving their quality of life and work.

## Methods

### Participants

We selected three famous tertiary hospitals in China locating in Beijing into our cross-sectional survey that a lot of patients all over China were coming because of their high quality of medical care, including Beijing Children hospital, Beijing Tongren Hospital, and Anzhen hospital. We have surveyed 643 nurses by

self-administered questionnaire from April to June in 2018, and 517 questionnaires were returned valid(80.4%). These 517 nurses were becoming our participants in our study.

## **Survey questionnaire**

Our self-administered questionnaire consisted of five parts, including survey of basic information, source of stress, quality of sleep, anxiety and quality of life.

### **Basic information and source of stress**

The basic information of study contained sex; age; marital status; seniority; education level (junior college degree or below, bachelor degree or above); professional status (primary, intermediate or above); monthly income; working hours per week, smoking, drinking, regular diet and physical exercise. We understood the subjective feeling of source of stress by the question “what do you think the main source of your stress? Economic stress, occupational stress, social stress, or other reason”.

### **Quality of sleep**

The Pittsburgh Sleep Quality Index(PSQI) is a valid and widely instrument to measure and assess the quality of sleep for the general and clinical populations over a 1-month period[29,30]. The Chinese version of Pittsburgh Sleep Quality Index(C-PSQI) had an good reliability and sensitivity using cutoff value of 5 that discriminate poor from good quality of sleep[30]. C-PSQI contain 19 items that are combined into 7 component scores including subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, used sleep medication, daytime dysfunction[30]. The range of global score is from 0 to 21 summing 7 component scores, and higher scores represent the subjective quality of sleep is poorer[6,29,30].

### **Anxiety**

We measured the anxiety symptoms of our participants by the Zung Self-Rating Anxiety Scale(SAS) that has an good internal consistency and test-retest reliability[31-33]. There are 20 items gathered the scale, and every item has 4 options that scored different scores. The range of total raw score is from 20 to 80, or index score is from 25 to 100. The upper limit for the normal was a raw score 40 or index score 50, respectively. A higher score indicate higher level of anxiety symptoms. The study used the index score to measure the anxiety symptom. When the total index score  $\geq 50$  was defined as “mild anxiety symptom”,  $\geq 60$  that was moderate anxiety,  $\geq 70$  was severe anxiety according to Chinese version[34].

### **Quality of life**

In the study, we selected the 36-item Short Form Health Survey (SF-36) to evaluate the quality of life (QOL) for our participants. The SF-36 is also a reliable and effective measuring tool to assess QOL of patients and occupational populations [35-36]. The measurement contents of 8 dimensions constitute the scale, including physical function (PF), role physical (RP), bodily pain (BP), global health (GH), vitality

(VT), social function(SF), role emotional (RE), mental health(MH). The range of scores of every dimension is from 0 to 100. The higher score represents the better possible health status. The scores of eight dimensions are summarized in physical component summary (PCS) and mental component summary (MCS) scores.

## **Statistical Analyses**

Firstly, we understood the status of quality of sleep, source of stress, anxiety and quality of life among our participants by descriptive statistical analysis. Secondly, Spearman's correlations analysis was used to compare the scores of PSQI and SAS and the t-test and the analysis of variance (ANOVA) were used to compare the scores of SF-36 (the scores of PCS and MCS) among the factors about demographic characteristics, lifestyle, and feeling of stress. The t-test was used to compare the scores of SF-36(PCS and MCS) between whether there is sleep disorder, and the analysis of variance (ANOVA) was used to compare that among different anxiety severity groups. Thirdly, Spearman's correlations analysis was used to understand the relationship between sleep disorder and anxiety severity. Finally, logistic regression analysis was using to explore factors associated with sleep disorder and anxiety symptoms. SPSS version 20.0 was used to analysis the data in the study. All tests accepted the 5% significance level.

## **Results**

### **Characteristics of participants**

All the participants of our study were female, and their average age was  $30.49 \pm 7.53$  years. The average PSQI score was  $7.71 \pm 3.62$ , including 372 participants that scores were above 5 (72.0%). The average SAS score was  $45.18 \pm 9.90$ , including 157 participants with a SAS score  $\geq 50$  (30.4%) that had different anxiety symptoms. According our results, there were 334 nurses (64.6%) feeling heavy or very heavy stress, and 355 nurses(68.7%) feeling economic stress, 407 nurses (78.7%) feeling occupational stress and 249 nurses(48.2%) feeling social stress.

### **Influencing factors analysis related to quality of sleep**

Table 1 showed the results that different factors affected the quality of sleep. The nurses' sleep quality were affected by some factors including income monthly, working hours, regular diet, physical exercise, stress from economic, social, occupational. However, we did not find the marital status, working years, education background, professional title, leader, smoking and alcohol consumption were significantly related to quality of sleep.

### **Influencing factors analysis related to anxiety symptoms**

Results of influencing factors analysis showed education background, income monthly, working hours, regular diet and economic stress, social stress, occupational stress have significantly related to anxiety

symptoms. Whereas marital status, working years, professional title, leader, smoking, alcohol consumption and physical exercise were not. The results were showed in Table 2.

### **Influencing factors analysis related to quality of life**

Table 3 indicated quality of life (both PCS and MCS) were affected by influencing factors including marital status, working years, education background, income monthly, working hours, regular diet, physical exercise, sleep disorder, anxiety symptoms, felling of stress, and stress from economic, social, occupational. However, smoking, alcohol consumption and leader were not. Professional title was significant related to MCS, but not to PSC.

### **The relationship between sleep disorder and anxiety severity**

Correlation between sleep disorder and anxiety severity was positive for nurses. The result was showed in Table 4.

### **Logistic regression analysis of multiple factors influencing sleep disorder**

Table 5 showed that physical exercise, regular diet and income monthly have independent influence with sleep disorder for nurses. In other words, physical exercise frequency, keeping regular diet and salary suitably were positive factors for preventing sleep disorder for nurses.

### **Logistic regression analysis of multiple factors influencing anxiety symptoms**

Table 6 showed that anxiety symptoms revealed an independent relevance with education background, working hours, regular diet, economic stress. In other words, the risk factors for anxiety in nurses were higher education background, longer working hours, irregular diet and economic stress.

### **Table 1 Influencing factors analysis related to quality of sleep (N=517)**

Demographic characteristics		Number of participants without Sleep disorder	Number of participants with sleep disorder	P value
Marital status	Married/cohabitation	75	223	0.089
	Unmarried/divorced/widowed	70	149	
Working years	≤5 years	64	130	0.288
	6-10 years	20	75	
	11-15 years	24	70	
	15-20 years	14	35	
Education background	≥20 years	23	62	0.283
	Junior college or below	64	145	
	Bachelor degree or above	81	227	
Professional level	Junior	105	244	0.137
	Medium-grade or above	40	128	
Smoker	Yes	9	14	0.226
	No	136	358	
Income monthly(RMB)	≤5000	37	31	0.000
	5000-10000	99	325	
	≥10000	9	16	
Working hours per week	≤40H	88	172	0.000
	41-56H	55	190	
Working ≥56H	Yes	2	9	0.244
	No	143	359	
Alcohol consumption	Yes	8	24	0.701
	No	134	342	
Regular diet	Yes	85	142	0.000
	General	52	168	
	no	8	62	
Physical exercise	3 or more times a week	21	14	0.000
	1-2 times a week	41	98	
Economic stress	No	83	260	0.044
	No	55	107	
Occupational stress	Yes	90	265	0.000
	No	41	69	
Social stress	Yes	104	303	0.034
	No	86	182	
	Yes	59	190	

Table 2 Influencing factors analysis related to anxiety symptoms (N=517)

Sociographic characteristics		Number of participants without anxiety symptom	Number of participants with anxiety symptom	P value
Marital status	Married/cohabitation	198	100	0.066
	Unmarried/divorced/widowed	162	57	
Working years	≤5 years	149	45	0.089
	6-10 years	61	34	
	11-15 years	64	30	
	15-20 years	32	17	
Education background	≥20 years	54	31	0.015
	Junior college or below	158	51	
	Bachelor degree or above	202	106	
Professional level	Junior	247	102	0.416
	Medium-grade or above	113	55	
Smoker	yes	16	7	0.994
	no	344	150	
Income monthly(RMB)	≤5000	56	12	0.019
	5000-10000	284	140	
	≥10000	20	5	
Working hours per week	≤40H	199	61	0.000
	41-56H	157	88	
Working	≥56H	4	7	0.107
	Yes	7	7	
Smoking assumption	No	352	150	0.514
	Yes	24	8	
Regular diet	No	331	145	0.003
	Yes	175	52	
	General	144	76	
Physical exercise	No	41	29	0.250
	3 or more times a week	28	7	
Economic stress	1-2 times a week	100	39	0.007
	No	232	111	
Occupational stress	No	126	36	0.050
	Yes	234	121	
Social stress	No	85	25	0.029
	Yes	275	132	
	No	198	70	
	Yes	162	87	

Table 3 Influencing factors analysis related to quality of life (N=517)

Demographic characteristics	N	PCS	P value	MCS	P value
<b>Marital status</b>					
Married/cohabitation	298	68.13±17.99	0.000	63.15±18.94	0.000
Unmarried/divorced/widowed	219	76.41±16.48		70.33±16.97	
<b>Working years</b>					
≤5 years	194	76.83±16.00	0.000	70.99±17.06	0.000
6-10 years	95	65.66±16.83		59.94±17.80	
11-15 years	94	70.56±18.80		65.97±17.42	
15-20 years	49	69.49±17.33		61.23±21.45	
≥20 years	85	68.89±19.19		65.30±18.94	
<b>Education background</b>					
Junior college or below	209	75.11±16.83	0.000	70.71±16.83	0.000
Bachelor degree or above	308	69.28±18.04		63.18±18.72	
<b>Professional title</b>					
Junior	349	72.06±18.08	0.439	67.33±18.39	0.042
Medium-grade or above	168	70.76±17.29		63.81±18.43	
<b>Smoker</b>					
Yes	23	74.70±14.23	0.399	68.93±13.03	0.467
No	494	71.49±17.97		66.06±18.67	
<b>Income monthly(RMB)</b>					
≤5000	68	81.48±17.83	0.000	74.26±18.38	0.000
5000-10000	424	69.53±17.35		64.61±18.25	
≥10000	25	80.59±14.02		70.96±16.14	
<b>Working hours a week</b>					
≤40H	260	75.04±17.06	0.000	69.60±16.93	0.000
41-56H	245	68.89±17.81		63.43±18.88	
≥56H	11	52.83±15.17		44.97±20.90	
<b>Smoking</b>					
Yes	14	66.84±15.83	0.306	57.89±16.36	0.086
No	502	71.80±17.88		66.47±18.46	
<b>Alcohol consumption</b>					
Yes	32	72.75±14.17	0.764	60.90±17.38	0.103
No	476	71.78±17.91		66.42±18.58	
<b>Regular diet</b>					
Yes	227	74.92±17.73	0.000	69.19±18.58	0.000
General	220	70.09±17.78		65.66±17.44	
No	70	65.84±16.28		58.14±18.90	
<b>Physical exercise</b>					
3 or more times a week	35	78.34±19.50	0.019	73.06±20.19	0.034
1-2 times a week	139	73.22±20.19		67.34±16.95	
No	343	70.31±17.70		65.02±18.74	
<b>Anxiety symptoms</b>					
No	360	77.37±15.29	0.000	72.25±15.54	0.000
Mild	116	62.12±15.21		55.59±15.58	
Moderate	34	48.79±15.31		44.31±18.14	
Severe	7	45.52±11.02		36.51±16.71	
<b>Sleep disorder</b>					
Yes	372	68.20±17.46	0.000	62.23±18.20	0.000
No	145	80.44±15.64		76.33±14.98	
<b>Perceived stress</b>					
Very heavy	124	63.43±17.15	0.000	57.78±19.42	0.000
Heavy	210	69.90±18.28		64.10±17.66	
General	175	78.91±14.56		73.84±15.38	
Little	4	78.53±11.99		84.24±9.27	
Very little	4	91.96±12.00		83.89±11.47	
<b>Economic stress</b>					
Yes	355	70.04±17.60	0.002	64.41±18.61	0.001
No	162	75.13±17.86		70.08±17.58	
<b>Occupational stress</b>					
Yes	407	70.08±18.06	0.000	64.74±18.84	0.001
No	110	77.40±15.68		71.56±15.95	
<b>Social stress</b>					
Yes	249	69.12±17.29	0.002	63.24±18.79	0.000
No	268	73.97±18.02		68.93±17.75	

Table 4 Correlation between sleep disorder and anxiety severity for nurses

Anxiety severity	NO. of subjects with Sleep disorder		X <sup>2</sup>	P value
	NO	YES		
No	134	226	50.81	0.000
Mild	11	105		
Moderate	0	34		
severe	0	7		

**Table 5 logistic regression analysis of multiple factor influencing quality of sleep**

Demographic characteristics	B	S.E.	P	OR	95%CI for OR	
					lower	upper
<b>Physical exercise</b>						
3 or more times a week				1.000		
1-2 times a week	-1.267	0.386	0.001	0.282	0.132	0.600
No	-0.008	0.239	0.972	0.992	0.620	1.585
<b>Regular diet</b>						
Yes				1.000		
General	-1.484	0.417	0.000	0.227	0.100	0.513
No	-0.938	0.422	0.026	0.392	0.171	0.896
<b>Income monthly(RMB)</b>						
≤5000				1.000		
5000-10000	-1.021	0.504	0.043	0.360	0.134	0.966
>10000	0.281	0.451	0.533	1.325	0.548	3.204

**Table 6 Logistic regression analysis of multiple factor influencing anxiety symptom**

Demographic characteristics	B	S.E.	P	OR	95%CI for OR	
					lower	upper
<b>Education background</b>						
Junior college or below				1.000		
Bachelor degree or above	0.462	0.209	0.027	0.630	0.419	0.949
<b>Working hours a week</b>						
≤40H				1.000		
41-56H	-1.550	0.651	0.017	0.212	0.059	0.760
≥56H	-1.079	0.647	0.095	0.340	0.096	1.207
<b>Regular diet</b>						
Yes				1.000		
General	-0.719	0.304	0.018	0.487	0.269	0.884
No	-0.221	0.292	0.449	0.802	0.453	1.420
<b>Economic stress</b>						
NO				1.000		
YES	0.503	0.227	0.027	0.605	0.388	0.944

## Discussion

Prevalence and influencing factors of sleep disorder among nurses in tertiary hospitals

Under the environment of long-term heavy workload, shift work system and high requirement of work quality, health care workers were lower status of physical and mental health than other groups. As a typical physical problem, Sleep disorder has become the focus of attention. According to our results and previous studies, the overall prevalence of sleep disorder in hospital staffs was higher than the general population [6,37-40]. However, the status in nurses was even more serious. A pilot study in Urumqi(Xinjiang,China) using PSQI to evaluate the quality of sleep in physicians, indicated 59.92% participants had sleep disorders[41], that was lower than our results. The Other researcher in Tehran(Iran) and Taiwan(China) also revealed that nurses had higher incidence rate than other health care workers[42-43]. However, as a high-risk group, compare to other health care workers, nurses were most likely to suffer from sleep disorder that be focused first.

The previous study found highly stress correlated positively with sleep disorder[6,44].In our study, nurses had sleep disorder with felling economic, occupational and social stress. Nurses in tertiary hospitals need deal with different kinds of medical condition, keep learning new medical knowledge and solving different social relationship problem. In fact, nurses always be exposed to high level stress for a long time[45-46].The percentage of nurses (working hours $\geq$ 40H per week) was 49.6% in our study. The previous studies indicated that heavy workload and longer working hours squeeze time for rest and exercise, and made nurses felling highly stress which influence quality of sleep[6]. However, along with the rapid rhythm of work and work time uncertainty, nurses develop a habit of irregular diet and exercise that affect the circadian rhythms which decrease the quality of life[2].

### **Prevalence and influencing factors of anxiety symptoms among nurses in tertiary hospitals**

The prevalence of anxiety symptoms in nurses was 30.4% in our study that converged towards the results of similar studies[27,47-49]. However, the prevalence in medical students and doctors were 12.5% and 21.1%, respectively[50-51]. The previous studies indicated, nurses were risk group of anxiety symptom in health care workers. Comparing with other populations in China, the prevalence was obvious higher[52-53]. According to the fact, it was warranted to in-depth studies and active interventions about anxiety symptoms in Chinese nurses.

Our study found higher education backgrounds was risk factor about anxiety symptom in nurses. The results of Liaoning general hospital also indicate nurses with higher education backgrounds may more likely be anxiety symptoms[27]. The results may reflect nurses with higher education backgrounds have higher learning and working target and demand. The previous study indicated nurses with regular meals have lower anxiety symptom $\times$ OR 0.719 $\times$ that was similar with our study[27]. Keeping healthy lifestyle may be helpful for reducing anxiety symptoms in nurses. Longer working hours, heavier workload and lower salary make effort-reward imbalance in nurses that have negative effect for mental health and their job satisfaction[27,54-55] however, a lot of researches have shown that the status of stress was significantly related to physical and mental health, including anxiety symptom[56-57].

### **The correlation between sleep disorder and anxiety symptoms that influence the quality of life**

Several previous studies indicated sleep disorder have position relation with anxiety symptoms[58-59]. We also find the strong correlation between sleep disorder and anxiety symptom. We think there maybe correlation between physical health and mental health that the previous similar studies shown the same viewpoint[60].We also found nurses with sleep disorder or anxiety symptoms have lower quality of life, no matter PCS or MCS. The results may indicate that sleep disorder and anxiety symptom could respect poor quality of life. However, as the common influencing factors, stress, effort-reward imbalance and irregular lifestyle have significantly related to sleep disorder and anxiety symptom in our study. We should pay attention to these factors and talk steps to prevent these problems in nurses.

The previous studies shown that nurses with higher social support have higher quality of life, higher quality of sleep and lower anxiety symptoms[27,61-62]. However, providing social support like peer support, may be helpful for quality of sleep, relieve anxiety and increase quality of life in tertiary hospitals' nurses. The present results remanded hospital managers that need pay more attention on the effort-reward balance by effective system like building appropriate performance measures. Meanwhile, by building positive channel like group activity, nurses could relieve the stress form job, economy and social. In addition, by healthy education, let nurses in tertiary maintain good lifestyle like keep regular diet and exercises. In other words, improving the quality of life, decreasing sleep disorder and anxiety symptoms must be on the agenda.

## **Conclusion**

Hospital administrators had met challenges that nurses had bad sleep quality and anxiety symptoms because of heavy workload in tertiary hospitals in China. However, hierarchical diagnosis system engineering was carried out by National Health Commission of the People's Republic of China that relieve the pressure of tertiary hospitals' medical treatment, including doctors and nurses. In addition, from the perspective of hospital management, promotion of health lifestyle, effort-reward balance and providing social support may be significant to decrease the poor sleep quality and anxiety symptoms and increase quality of life in nurses.

## **Limitation**

The limitation of this study was participants were concentrated in Beijing's tertiary hospitals. However, as the Chinese capital, high-quality medical resources are gathered in Beijing. By the rapid development of Chinese economy and traffic infrastructure construction, patients from all over China want to see a doctor in Beijing tertiary hospitals. It has imposed a heavy burden on medical resources in Beijing, including job burden in nurses. Ensuring physical and mental health of nurses in tertiary hospitals is more significant for Beijing medical system. However, we have plan to take a nationwide survey about quality of life in nurses.

## **Abbreviations**

PSQI: Pittsburgh Sleep Quality Index; SAS: Zung Self-Rating Anxiety Scale; SF-36: 36-item Short Form Health Survey; PCS: physical component summary; MCS: mental component summary; OR:Odds ratio; ANOVA: analysis of variance

## **Declarations**

### **Ethics approval and consent to participate**

This study was approved by the Ethics Committee of Beijing Children hospital, Beijing Tongren Hospital, and Capital Medical University Affiliated Anzhen Hospital. All the participants were orally informed after our researchers had introduced the study. Written informed consent concerning conduct of the survey was obtained from each respondent before data collection. Confidentiality and privacy were maintained by using unique identification numbers instead of names.

### **Consent for publication**

Not applicable

### **Availability of data and material**

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

### **Competing interests**

The authors declare that they have no competing interests.

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### **Authors' contributions**

DW and DH designed the study and questionnaire. JL,MH and HY collected the data and control the quality of study. DW and YP analyze the date and wrote the manuscript. DH supervised the study and data analysis. All authors read and approved the manuscript.

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