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ORIGINAL RESEARCH

Regional differences in the risk of insomnia symptoms among patients from general hospital outpatient clinics

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Background: Region-specific differences in the prevalence of insomnia symptoms in outpatient clinics in China have received little systematic study. This study was conducted preliminarily to examine region-specific differences in the risk of insomnia symptoms in Chinese outpatients.

Method: In total, 4,399 adult outpatients (urban vs rural residents: 1,768 vs 2,631) who completed three questions focusing on insomnia symptoms were included. Their sociodemographic and clinical information were collected with standardized questionnaires.

Results: The prevalence of self-reported insomnia symptoms in urban residents (23.4%) was more frequent than the prevalence in rural residents (21.2%). The estimated prevalence of insomnia symptoms was significantly lower in rural than urban residents after adjusting for the potential confounders (P=0.015). Similarly, more urban (22.9%) than rural (13.4%) residents with insomnia symptoms had significantly higher treatment rates (χ^2=14.9, P<0.001). Multiple regression analyses showed that depressive symptoms, old age, and low education level were the most common risk factors for insomnia symptoms in both urban and rural residents.

Conclusion: Our findings show that the prevalence of insomnia symptoms was relatively lower in rural than urban residents. Longitudinal studies are warranted to confirm the current findings.

Keywords: insomnia symptoms, regional differences, China, outpatients

Introduction

Sleep, as one of the most essential physiological processes, is associated with cognitive performance,[1–3] homeostatic processes,[4] metabolism,[5] and immune responses.[6] Insomnia symptoms have been one of the most frequent sleep complaints in the general population with significant morbidities.[7,8] For example, previous studies involving different definitions and time frames found that sleep problems were frequent in the Chinese general population and ranged from 8% to 39.4%.[9–12]

Insomnia symptoms or sleep deprivation, as a stressor for the brain,[2] may lead to serious health and personal consequences.[13] Emergent evidence has indicated that insomnia symptoms can lead to daily dysfunction during daytime school or work,[13] and low quality of life (QOL).[14] Additionally, insomnia symptoms commonly exacerbate other medical and psychiatric conditions, especially depression and anxiety.[15–17]

Over the past decades, increasing attention has been paid to examining the relationships between insomnia symptoms and social and demographic factors. Studies of Western[18–21] and Chinese[9,11,22] populations have consistently found that certain factors, such as being older, being female, having low education and income levels, and having somatic or psychiatric conditions, were associated with insomnia symptoms.

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The prevalence of insomnia symptoms and its related factors may substantially vary by residential location,[10,23] but these findings have received little attention or systematic study. Previous studies in Western populations[23,24] have reported that neighborhood environments may influence the prevalence of sleep-related adverse events. For example, Hale and Do[24] found that non-Hispanic Blacks were more likely to have sleep durations associated with increased mortality.

Although an examination of insomnia symptoms with residential status in China is also essential, only a few studies have been conducted in the general population, with mixed findings.[9,10,25] For example, Xiang et al[9] interviewed 5,926 subjects and found no significant difference in the prevalence of insomnia symptoms between the urban (8.8%) and rural (9.7%) residents, while Yang et al[25] reported the opposite result. A growing number of evidence consistently showed that insomnia symptoms are multifactorial including psychosocial factors and biological determinants.[7,26] Therefore, it is important to examine regional differences in the prevalence of insomnia symptoms with different ethnic and cultural backgrounds.

Importantly, region-specific differences in the risk of insomnia symptoms are less well characterized in Chinese outpatients than in Chinese and European general populations. Thus, the main purpose of this study was to investigate the differences in insomnia symptoms in Chinese outpatients by residential location. We also tried to investigate whether regional differences are associated with insomnia symptoms with specific demographic and clinical profiles.

Methods

Study setting and sampling

This study was part of a large-scale epidemiologic survey on somatic diseases and emotion management in Guangzhou, China, which was initiated by the Affiliated Brain Hospital of Guangzhou Medical University (Guangzhou Huiai Hospital) and undertaken from March 2016 to June 2016. The recruitment criteria for the study subjects who consecutively visited one of the neurological, cardiovascular, gastrointestinal, or gynecological outpatient clinics in four level-III general hospitals included (1) being Han Chinese and aged 18 years or older, (2) having the ability to communicate with investigators, and (3) being able to comprehend the contents of this interview. In this multicenter, cross-sectional survey, all subjects provided written informed consent. The study protocol was approved by the Institutional Review Board of the Affiliated Brain Hospital of Guangzhou Medical University in accordance with the declaration of Helsinki.

Assessment tools

In this face-to-face survey, each subject was asked to answer a retrospective self-reported battery of questionnaires, which consisted of sociodemographic and clinical information that were administered by the investigators. The basic sociodemographic sections were aimed to obtain general information, such as gender, age, marital status, employment status, years of education, personal income, and smoking and drinking behavior. In this survey, insomnia symptoms were defined based on the occurrence of following three basic forms of insomnia symptoms during the preceding month: "Do you have difficulties in falling sleep?" for difficulty initiating sleep (DIS); "Do you have difficulties in maintaining sleep and wake up?" for difficulty maintaining sleep (DMS); and "Do you wake up in the middle of the night or early morning and have difficulties in falling asleep again?" for early morning awakening (EMA). Each question included a 3-point scale with scores ranging from 0 (no) to 2 (often). Respondents who answered "often" to either DIS, DMS, or EMA were classified as "having insomnia symptoms". This definition of insomnia symptoms has also been used in previous studies.[27,28] The validated 9-item Chinese version of the Patient Health Questionnaire (PHQ-9)[29,30] and the 7-item Chinese version of Generalized Anxiety Disorder (GAD-7)[31,32] were used to assess depressive and anxiety symptoms, respectively. Higher scores indicate more serious depressive and anxiety symptoms.

Statistical analysis

Demographic and clinical profiles of rural and urban residents were compared using the chi-squared test for categorical variables and the *t*-test or the Mann–Whitney U test for continuous variables, if appropriate. The prevalence of insomnia symptoms by region was analyzed by chi-squared test. Odds ratios with 95% confidence intervals (CIs) for risk of insomnia symptoms were calculated using logistic regression analyses to examine the associations between insomnia symptoms and region, after adjusting for significant confounders. Next, data for rural and urban residents were analyzed separately for associations between insomnia symptoms and the other variables. Finally, a binary logistic regression analysis was conducted separately for the two groups to examine which factors were most strongly associated with insomnia symptoms. In binary logistic regression analyses, insomnia symptoms in each region were dependent variable and the variables that significantly differed between with and without insomnia symptoms in univariate analyses were independent variables. All statistical analyses were

carried out by using SPSS 20.0 statistical software with two-tailed significance levels set at 0.05.

Results

A total of 5,284 outpatients were approached and screened for this survey. In the end, 4,399 outpatients including rural (n=2,631) and urban (n=1,768) residents met the study entry criteria and completed the three questions on insomnia symptoms. Fewer rural (21.2%) than urban residents (23.4%) reported any type of insomnia symptoms. The estimated prevalence of insomnia symptoms was significantly lower in rural than urban residents after adjusting for the potential confounders presented in Table 1 (P=0.015, 95% CI=1.04–1.47). Similarly, significantly fewer rural (13.4%) than urban residents with insomnia symptoms (22.9%) reported taking "sleeping pills" (χ^2=14.9, P<0.001).

Significant differences were found between the rural and urban residents in terms of employment status, living conditions (ie, living alone), personal income, and health insurance, family history of psychiatric disorders, taking sleeping pills, age, and education level (Table 1). In China, the age of ≥50 years has usually been used as the cutoff value for "older adults".[33,34] Following the methodology of other studies,[33–35] the prevalence figures of insomnia symptoms by age and region (or gender) groups are presented in Table S1.

In the rural cohort, divorced/widowed status, a lack of health insurance, the presence of a family history of psychiatric disorder, taking sleeping pills, greater age, lower education level, and relatively high GAD-7 and PHQ-9 total scores were significantly associated with insomnia symptoms (Table 2). The significant findings remained in terms of taking sleeping pills, PHQ-9 total score, greater age, and lower education level in the logistic regression analysis (Table 3).

In the urban cohort, being female, divorced/widowed status, unemployed or retired status, lower personal income, the presence of a family history of psychiatric disorder, taking sleeping pills, greater age, lower education level, and relatively high GAD-7 and PHQ-9 total scores were significantly associated with insomnia symptoms (Table 2). The significant findings remained in terms of taking sleeping pills, PHQ-9 total score, greater age and lower education level in the logistic regression analysis (Table 3).

Discussion

This is the first study to examine the prevalence of insomnia symptoms and its associated risk factors by region in

Table 1 Comparison between rural and urban regions in basic sociodemographic and clinical characteristics

Characteristics	Total sample (n=4,399)		Rural region (n=2,631)		Urban region (n=1,768)		Statistics		
	n	%	n	%	n	%	χ^2	df	*P*-value
Any type of insomnia symptoms	973	22.1	559	21.2	414	23.4	2.9	1	0.089
Females	2,896	65.8	1,746	66.4	1,150	65.0	0.8	1	0.366
Marital status							5.7	2	0.057
Unmarried	728	16.5	432	16.4	296	16.7			
Married	3,528	80.2	2,127	80.8	1,401	79.2			
Divorced/widowed	143	3.3	72	2.7	71	4.0			
Employment status							234.9	2	**<0.001**
Employed	2,900	65.9	1,824	69.3	1,076	60.9			
Unemployed	800	18.2	565	21.5	235	13.3			
Retired	699	15.9	242	9.2	457	25.8			
Live alone	415	9.4	267	10.1	148	8.4	3.9	1	**0.048**
Personal income ≥6,000 yuan/month	951	21.6	413	15.7	538	30.4	135.4	1	**<0.001**
No health insurance	2,825	64.2	1,967	74.8	858	48.5	316.7	1	**<0.001**
Family history of psychiatric disorders	217	4.9	109	4.1	108	6.1	8.7	1	**0.003**
Current drinking	959	21.8	564	21.4	395	22.3	0.5	1	0.476
Current smoking	594	13.5	376	14.3	218	12.3	3.5	1	0.062
Taking sleeping pills	257	5.8	125	4.8	132	7.5	14.2	1	**<0.001**
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**T**	**df**	***P*-value**
Age (years)	41.8	15.9	40.3	15.2	43.9	16.7	–7.4	4,397	**<0.001**
Education (years)	10.3	4.2	9.3	4.0	11.7	4.2	–19.1	4,397	**<0.001**

Notes: Values in bold are P<0.05 or P<0.001.

Table 2 Sociodemographic and clinical characteristics associated with insomnia symptoms by region

Characteristics	Rural region (n=2,631)					Urban region (n=1,768)				
	Without insomnia symptoms (n=2,072)		With insomnia symptoms (n=559)		*P*-value	Without insomnia symptoms (n=1,354)		With insomnia symptoms (n=414)		*P*-value
	n	%	n	%		n	%	n	%	
Females	1,361	65.7	385	68.9	0.157	864	63.8	286	69.1	**0.049**
Marital status					**<0.001**					**<0.001**
Unmarried	341	16.5	91	16.3		240	17.7	56	13.5	
Married	1,689	81.5	438	78.4		1,074	79.3	327	79.0	
Divorced/widowed	42	2.0	30	5.4		40	3.0	31	7.5	
Employment status					0.131					**0.001**
Employed	1,454	70.2	370	66.2		857	63.3	219	52.9	
Unemployed	428	20.7	137	24.5		171	12.6	64	15.5	
Retired	190	9.2	52	9.3		326	24.1	131	31.6	
Living alone	202	9.7	65	11.6	0.192	202	9.7	65	11.6	0.894
Personal income ≥6,000 yuan/month	338	16.3	75	13.4	0.095	435	32.1	103	24.9	**0.005**
No health insurance	1,529	73.8	438	78.4	**0.028**	651	48.1	207	50.0	0.494
Family history of psychiatric disorders	65	3.1	44	7.9	**<0.001**	65	4.8	43	10.4	**<0.001**
Current drinking	446	21.5	118	21.1	0.832	299	22.1	96	23.2	0.636
Current smoking	285	13.8	91	16.3	0.130	173	12.8	45	10.9	0.302
Taking sleeping pills	50	2.4	75	13.4	**<0.001**	37	2.7	95	22.9	**<0.001**
	Mean	**SD**	**Mean**	**SD**	***P*-value**	**Mean**	**SD**	**Mean**	**SD**	***P*-value**
Age (years)	39.8	15.1	42.4	15.4	**0.001**	42.9	16.6	47.2	16.6	**0.004**
Education (years)	9.5	3.9	8.6	4.0	**0.001**	12.0	4.2	10.9	4.1	**<0.001**
GAD-7 total score	2.7	3.7	5.6	5.4	**<0.001**[a]	2.4	3.5	4.8	5.3	**<0.001**[a]
PHQ-9 total score	3.0	3.6	6.8	5.6	**<0.001**[a]	2.6	3.3	6.1	5.4	**<0.001**[a]

Notes: [a]Mann-Whitney U test; Values in bold are $P<0.05$ or $P<0.001$.
Abbreviations: GAD-7, Generalized Anxiety Disorder-7; PHQ-9, Patient Health Questionnaire-9.

Chinese outpatients. We found higher prevalence and level of treatment for insomnia symptoms in urban residents than in rural residents. Multiple regression analyses showed that depressive symptoms, greater age, and relatively low education level were the most common risk factors for insomnia symptoms in both urban and rural residents.

Unlike the higher prevalence of suicide and psychiatric disorders in rural areas of China,[36–38] fewer rural residents suffered from self-reported insomnia symptoms than did urban residents. A large number of previous studies,[24,25] although not all of them,[9,10] have consistently reported findings similar to the present study. For example, Yang et al interviewed 1,048 children aged between 6 and 12 years and found that children in urban (60.3%) areas had significantly higher rates of insomnia symptoms than children in rural (40.3%) areas.[25] However, Tang et al[10] interviewed a sample of persons aged 12 years or older in the general population and found diametrically opposed findings that rural residents (29.4%) had significantly higher frequency of insomnia symptoms than urban residents (25.5%). There are two possible explanations for this conflicting result. First, in the Tang et al's study,[10] insomnia symptoms were assessed using the Pittsburgh Sleep Quality Index (PSQI).[39] Second, the general populations (aged 12–99 years) were recruited in their study.[10]

Despite lower socioeconomic status and less medical insurance coverage in rural compared to urban areas, rural residents were more likely to report fewer insomnia symptom complaints, since urban residents often face an abundance of career and life stressors due to the rapid living pace.[8,24] Hale and Do[24] found living in an inner city was related to increased risk of short sleeping when compared to non-urban areas. Night shifts or multiple jobs are an unavoidable working pattern for urban residents,[11,25] which may disrupt their biological sleep rhythm and result in insomnia symptoms.[40] Yang et al found that children suffered from a higher frequency of sleep complaints if one of their parents had late-night or

Table 3 The regression analyses for factors associated with insomnia symptoms by region

Characteristics	Rural region with insomnia symptoms (n=559)				Urban region with insomnia symptoms (n=414)			
	Wald χ^2	*P*-value	OR	95% CI	Wald χ^2	*P*-value	OR	95% CI
Females	–	–	–	–	2.498	0.114	1.254	0.95–1.66
Marital status								
Unmarried			1.0				1.0	
Married	1.156	0.282	0.839	0.61–1.16	1.154	0.283	1.268	0.82–1.96
Divorced/widowed	0.839	0.360	1.345	0.71–2.54	2.864	0.091	1.884	0.90–3.92
Employment status								
Employed			–				1.0	
Unemployed	–	–	–	–	0.185	0.667	0.913	0.60–1.38
Retired	–	–	–	–	1.046	0.306	0.782	0.49–1.25
Personal income ≥6,000 yuan/month	–	–	–	–	1.273	0.259	0.828	0.60–1.15
No health insurance	2.554	0.110	0.816	0.64–1.05	–	–	–	–
Family history of psychiatric disorders	1.787	0.181	1.385	0.86–2.23	1.769	0.183	1.420	0.85–2.38
Taking sleeping pills	**37.938**	**<0.001**	**3.674**	**2.43–5.56**	**76.046**	**<0.001**	**6.890**	**4.47–10.63**
Age (years)	**12.994**	**<0.001**	**1.017**	**1.01–1.03**	**7.846**	**0.005**	**1.020**	**1.01–1.03**
Education (years)	**7.600**	**0.006**	**0.955**	**0.92–0.99**	**5.713**	**0.017**	**0.957**	**0.92–0.99**
GAD-7 total score	0.661	0.416	1.014	0.98–1.05	2.048	0.152	0.968	0.93–1.01
PHQ-9 total score	**103.295**	**<0.001**	**1.189**	**1.15–1.23**	**85.175**	**<0.001**	**1.250**	**1.19–1.31**

Notes: As reported in the "Methods" section, in binary logistic regression analyses, insomnia symptoms in each region were dependent variable and the variables that significantly differed between with and without insomnia symptoms in univariate analyses were independent variables. Thus, "–" means not applicable.
Abbreviations: CI, confidence interval; GAD-7, generalized anxiety Disorder-7; OR, odds ratio; PhQ-9, Patient health Questionnaire-9.

shift work, indicating the lack of a quiet sleeping environment for their children.[25] Unfortunately, these factors were not assessed in the present study.

Social factors may also contribute to the understanding of such discrepancies. For example, late-night socializing was common in the urban areas where more opportunities for various social activities were provided.[24] Additionally, differing social and cultural practices by region may begin early in life and potentially increase the risk of insomnia symptoms.[32,41] Furthermore, the widespread use of multimedia entertainment devices, such as computers and smart phones, in urban residents may affect the normal sleep pattern.[42] However, these factors have not been collected in this study.

Another explanation of the higher prevalence in urban compared with rural residents may be attributed to the living environment.[24] For example, the crowded residences of urban environments are associated with busy streets, little rooms with thin walls and noisy neighbors, and many people live together. The greater noise or light pollution may keep urban residents awake later or wake them up earlier compared with rural residents.[10] These factors were also associated with an increased risk of insomnia symptoms.

It is generally acknowledged that sleep habits and sleep behaviors are determined by multidimensional gene–environment interactions. Of these interactions, the role of biological differences in sex hormones were essential in accounting for age associated with insomnia symptoms.[43] Hormone changes in women due to peri- or post-menopause disturbed the normal sleep pattern.[43–45] Greater age was associated with insomnia symptoms in Chinese[9,11,22] and Western[18–21] populations. Thus, urban residents with insomnia symptoms were older than rural residents with insomnia symptoms in this study, which may potentially account for the higher rate of insomnia symptoms in urban than rural residents.

In this study, significantly fewer rural (13.4%) than urban residents (22.9%) who had insomnia symptoms reported their symptoms to medical practitioners. One explanation may be due to the relatively larger proportion of rural residents lacking health insurance when compared to urban residents in this study. Other explanations for this significant difference may be fewer existing sleep clinics in rural areas and a higher awareness of sleep hygiene in urban residents than in rural residents. Overall, the treatment rate of patients with insomnia symptoms was still low, which urgently warrants improvement in both rural and urban residents.

The major strengths of this study included the careful study plan and design, a large sample, and the questionnaire-based

face-to-face survey. However, the findings should be treated with caution due to the following limitations. First, this study was only conducted in outpatient clinics in China, limiting the generalization of our findings. Second, a retrospective, self-reported approach was used in this study, which may increase the potential subjective recall bias. However, simple definitions and a specific time frame for the insomnia symptoms in this study may partly compensate for this limitation. Given that polysomnography is a gold standard in the assessment of sleep problems,[46] thus it should be used in this population. Third, some other important variables (ie, environmental noise, caffeine consumption, and the presence and severity of medical conditions) related to insomnia symptoms were not collected or examined. Fourth, in this study divorced/widowed individuals had a very small sample size compared with those in other categories of marital status. Finally, we were unable to make inferences with regard to the causality of insomnia symptoms and the relevant factors based on this cross-sectional analysis. Thus, to further determine the causality between insomnia and these factors, a longitudinal design with a large sample size and relatively balanced region ratio and/or the balanced number of each marital status is needed.

Conclusion

The prevalence of insomnia symptoms was relatively lower in rural than urban residents treated at medical outpatient clinics. Longitudinal studies are warranted to examine the sociodemographic and clinical predictors of insomnia symptoms.

Ethics approval and consent to participate

Written informed consent was obtained from each subject. The research was approved by the Ethics Committee of the Affiliated Brain Hospital of Guangzhou Medical University.

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Disclosure

The authors report no conflicts of interest in this work.

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Supplementary material

Table S1 Prevalence of insomnia symptoms by age and region (or gender)

Age (years)	Insomnia symptoms			Age (years)	Insomnia symptoms		
	Rural region % (95% CI)	Urban region % (95% CI)	Total % (95% CI)		Female % (95% CI)	Male % (95% CI)	Total % (95% CI)
<50 (n=3,119)	19.8 (18.0–21.5)	20.7 (18.4–23.1)	20.1 (18.7–21.5)	<50 (n=3,119)	20.8 (19.1–22.5)	18.7 (16.3–21.2)	20.1 (18.7–21.5)
≥50 (n=1,280)	25.6 (22.3–28.9)	28.4 (24.8–31.9)	27.0 (24.5–29.4)	≥50 (n=1,280)	30.1 (26.8–33.4)	22.6 (19.0–26.1)	27.0 (24.5–29.4)
Total (n=4,399)	21.2 (19.7–22.8)	23.4 (21.4–25.4)	22.1 (20.9–23.3)	Total (n=4,399)	23.2 (21.6–24.7)	20.1 (18.1–22.1)	22.1 (20.9–23.3)