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Sleep-Related Healthcare Utilization Prevalence among Adults with Insomnia Symptoms in Hebei, China: A Population-Based Cross-Sectional Study

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4 **Sleep-Related Healthcare Utilization Prevalence among Adults with Insomnia Symptoms in**
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6 **Hebei, China: A Population-Based Cross-Sectional Study**
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Sleep-Related Healthcare Utilization Prevalence among Adults with Insomnia Symptoms in Hebei, China: A Population-Based Cross-Sectional Study

Abstract

Objective: This study investigated sleep-related healthcare utilization's prevalence and associated factors among adults with different insomnia symptoms.

Design & setting: This was a population-based study with a cross-sectional design conducted in Hebei province, China.

Participants: Participants were community residents aged 18 years and above, and we analyzed a total of 21,376 valid questionnaires.

Primary and secondary outcome measures: The Athens Insomnia Scale (AIS) was used to evaluate the participants' insomnia symptoms. Variables such as sleep-related healthcare utilization, chronic disease, living alone, and social-demographic were assessed for all the participants.

Results: The results found that only 2.1% of the adults with any insomnia symptoms used sleep-related healthcare in the last year. In contrast, the prevalence of sleep-related healthcare use was only 6.2% among the adults with insomnia. Sleep-related healthcare utilization's prevalence among adults with sleep induction, night awakenings, earlier awakening, sleep duration, sleep quality, daytime well-being, daytime functioning, or daytime sleepiness were 3.1%, 2.9%, 3.6%, 3.4%, 3.9%, 4.9%, 4.6%, or 2.8%, respectively. The factors associated with sleep-related healthcare utilization among adults with insomnia were: male ($OR=0.52, p<0.01$), younger age ($OR=1.02, p<0.01$), rural region ($OR=0.45, p<0.001$) and AIS score ($OR=1.23, p<0.001$). These same factors were also associated with sleep-related healthcare utilization among the adults with insomnia symptoms.

Conclusions: Sleep-related healthcare utilization's prevalence among adults with insomnia symptoms is very low. It was found that rural young males with insomnia symptoms tend not to use healthcare. As such, some policies and strategies should be made to promote the sleep-related healthcare utilization among rural young females with insomnia symptoms.

Strengths and limitations of this study

1. Only 2.1% of adults with any insomnia symptoms used healthcare last year, and the prevalence was only 6.2% among adults with insomnia ($AIS \geq 7$).
2. The rural young males tend not to use healthcare when they suffered insomnia symptoms, and they were the target populations to increase healthcare utilization's prevalence among adults with insomnia symptoms.
3. All the findings were achieved based on a population-based cross-sectional study with a large sample size ($n > 20,000$).
4. As a cross-sectional design, we cannot infer any causal relationship for the factors found that are associated with sleep-related healthcare utilization.

Sleep-Related Healthcare Utilization Prevalence among Adults with Insomnia Symptoms in Hebei, China: A Population-Based Cross-Sectional Study

Introduction

Insomnia is one of the most prevalent sleep problems in general population. Previous international epidemiological studies indicated that insomnia's prevalence varied from 4.7% to 37.2% in different countries because of the varying criteria of insomnia^{1,2}. In China, a meta-analysis study reported that insomnia's prevalence was about 15% in general population³. Additionally, insomnia's far-reaching negative impacts contain a multitude of emotional, social, physical problems⁴⁻⁶. As such, insomnia is an important public health problem in China and some other countries in the world^{7,8}.

Although it is hard for us to accurately evaluate professional sleep-related healthcare utilization's effect on insomnia among general populations, professional sleep-related healthcare utilization is one of the best ways of dealing with the insomnia problems. One of the reasons is that insomnia's treatment is varied. These treatments include medicine, herbal, psychological intervention, behavior therapy, and so on⁹. However, healthcare utilization is the best and the most professional way to select an appropriate treatment. Besides, grasping sleep-related healthcare utilization's prevalence among adults with insomnia symptoms is very important for us to understand insomnia's current situation. It is also one of insomnia's several important public health aspects. Finally, analyzing the associated factors of sleep-related healthcare utilization can inform us the target populations to control, and it will help us manage insomnia problems.

In the recent decades, insomnia's impact on healthcare utilization and health had been identified in the different countries^{10,11}. However, sleep-related healthcare utilization's prevalence among people with insomnia symptoms was less reported, especially in population-based studies. Previous telephone or postal surveys in Canada and Australia reported that medical care consultation's prevalence among people with insomnia symptoms were about 13%¹²⁻¹⁴. A second analysis of the primary care record or health insurance record in United Kingdom and Chinese Taiwan reported that insomnia's health-seeking prevalence were 4.2% and 19%, respectively^{15,16}. Although all these studies gave us important information about the healthcare utilization's prevalence factors among people with insomnia symptoms and its associated factors, a population-based face-to-face study urgently needs to be conducted. This is in consideration of the various findings, low response rate for telephone or postal surveys, and the weakness of the second analysis in the previous studies

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3 especially in the Chinese mainland.
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6 Since sleep-related healthcare utilization's prevalence among adults was a fundamental and
7 important work for insomnia prevention, grasping such prevalence is vital for us to understand
8 insomnia' situation. We conducted this population-based study to investigate the sleep-related
9 healthcare utilization's prevalence among adults with different insomnia symptom. This was likewise
10 performed to analyze its associated factors. The study's findings are helpful for us to understand the
11 situation of sleep-related healthcare utilization among adults with different insomnia symptoms.
12 These can provide some valuable information for us to make some health policies to control and
13 manage insomnia.
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21 **Participants and Methods**

22 **Participants**

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24 This is a cross-sectional study conducted in Hebei province, China. Hebei is a province located
25 in northern China. It is economically prosperous in both industry and agriculture. A multistage
26 stratified cluster sampling was used to select the community residents in Hebei. First, five cities
27 (Shijiazhuang, Baoding, Xingtai, Zhangjiakou, Qinhuangdao) were randomly selected from all the
28 11 cities in Hebei. Second, we randomly selected three counties and one district in each selected city.
29 Third, one township or sub-district was randomly selected from each county or district. Fourth, we
30 randomly selected one village (community) in each selected township (sub-district). In total, we
31 selected 15 villages and five communities to conduct the study's survey. All adults aged 18 years and
32 above were interviewed in the current study. We collected a total of 21,376 valid questionnaires in
33 this study.
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45 **Interviewing procedures**

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47 The interview was conducted from June to August 2018. Before conducting the survey, all
48 interviewers were trained well to fully understand the research and questionnaire. A face-to-face
49 interview was scheduled by one interviewer for all the participants upon their agreement with written
50 informed consent form. To ensure the quality of the interview, all the questionnaires were checked
51 by different reviewers on each interview day. Moreover, the questionnaires with missing data were
52 revisited or called on the next day.
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59 **Patient and public involvement**

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4 The public was also not involved in the design, or conduct, or reporting, or dissemination plans
5 of the research.
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8 **Measures**

9 10 *Sleep-related healthcare utilization*

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14 Sleep-related *healthcare utilization* was evaluated through the question: “Have you ever seen a
15 doctor because of sleep problems in the last year?” The participant may answer “yes” or “no.” The
16 participants who chose answer “yes” were seen as using healthcare. On the other hand, and the
17 participants who chose “no” were seen as not using healthcare in the data analysis.
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20 21 *Insomnia status*

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24 *Insomnia status* was evaluated using the Chinese version of the Athens Insomnia Scale (AIS).
25 It is a valid instrument based on the ICD-10 (International Classification of Diseases-10) criteria
26 worldwide^{17,18}. Higher scores mean more severe insomnia symptoms. It contained eight symptoms
27 besides sleep induction, night awakenings, earlier awakening, sleep duration, sleep quality, daytime
28 well-being, daytime functioning, and daytime sleepiness. Each symptom should occur at least three
29 times a week during the last month so that the participant may be assessed as one with insomnia
30 symptoms (The score ≥ 1). The Chinese version of the AIS was also proved to be a reliable and valid
31 instrument. Moreover, the optimal cut-off point was a total score ≥ 7 for the insomnia disorder’s
32 diagnosis¹⁹. In this study, we analyzed the factors associated with healthcare utilization among
33 adults with insomnia symptoms (total AIS score ≥ 1) and adults with an insomnia disorder (total AIS
34 score ≥ 7).
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44 *Living alone*

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47 *Living alone* was evaluated by the question: “How many persons have lived together with you
48 (not including yourself)?” The answer “0” was considered as living alone (1). All other answers were
49 analyzed as not living alone (0).
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52 53 *Chronic disease*

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56 *Chronic disease* was assessed using the diagnostic conditions of the 13 self-reported questions
57 about chronic diseases in the last year. These questions asked whether they were diagnosed with
58 chronic diseases concerning the respiratory system, cerebrovascular disease, immune system disease,
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3 skin complaint, hypertension, diabetes, thyropathy, gastritis, anemia, anaphylactic rhinitis, cancer, or
4 other chronic diseases. The answers were wither “yes” or” no.” The subjects with all negative
5 responses were to have no chronic diseases.
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8 9 *Social-demographic variables*

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12 Gender was measured by “male” (1) or “female” (0). Age was calculated through the
13 participants’ date of birth. Ethnicity was evaluated by “Han” (1) or “others” (0). Education level was
14 assessed by the academic degree with the following options: “elementary school,” “middle school,”
15 “high school,” or “above.” Married status was evaluated through one question about the participants’
16 married status. The possible answers were: “never married,” “married,” “divorced,” “widowed,”
17 “deuterogamist,” or “others.” We recoded the small percentage of the last four answers into
18 “unmarried” (1), “married” (2), and “others” (3). Monthly income was assessed through one question
19 about their monthly family income. The possible answers were: “no income,” “below 1000 RMB”
20 (7 RMB≈1 dollar), “1001 RMB–3000 RMB,” “3001 RMB–7000 RMB,” “7001 RMB–10000 RMB,”
21 “10001 RMB–20000 RMB,” or “above 20000 RMB.” We recoded the small percentages in the last
22 classification into “below 1000 RMB” (1),” 1001 RMB–7000 RMB” (2) or “above 7000 RMB” (3).
23 Region was assessed by asking the region where the participants lived, and the answers were “urban
24 region” (0) or “rural region” (1).
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35 **Statistical methods**

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38 Data analysis was conducted using SPSS for Windows 24.0 (web version). Descriptive statistics
39 were reported as means and standard deviations for continuous variables, and percentages for
40 categorical variables. Student's t-test or Chi-square test was performed to compare the means or
41 proportions between sleep-related healthcare utilization or not. Logistic regression was performed to
42 examine the factors associated with sleep-related healthcare utilization’s. Missing data was deleted
43 from the data analysis. All significance tests were two-tailed. Finally, a p-value of 0.05 or lower
44 would be considered statistically significant.
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51 **Results**

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54 We interviewed a total of 21,376 community residents in Hebei province, China. The sample’s
55 descriptions were listed in the second column of Table 1. The remaining parts of Table 1 analyzed
56 the prevalence of the participants who used healthcare. The results found that there were 10,718
57 (50.1%) adults who reported insomnia symptoms. Contrarily, 2,430 adults (11.4%) can be
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3 categorized to have an insomnia disorder. The prevalence of each insomnia symptoms ranged from
4 10.5% to 28.9%. Except the ethnicity factor ($p=0.219$), all the factors we analyzed (i.e., gender, age,
5 10.5% to 28.9%. Except the ethnicity factor ($p=0.219$), all the factors we analyzed (i.e., gender, age,
6 ethnicity, education, married status, living alone, region, and all eight kinds of insomnia symptoms)
7 were associated with sleep-related healthcare utilization. In this table, we analyzed sleep-related
8 healthcare utilization's prevalence among adults with different insomnia symptoms. The results
9 showed that only 2.1% of the adults with any insomnia symptoms used sleep-related healthcare in
10 the last year. On the contrary, the said prevalence was only 6.2% among the adults with insomnia
11 disorder. Sleep-related healthcare utilization's prevalence among adults with sleep induction, night
12 awakenings, earlier awakening, sleep duration, sleep quality, daytime well-being, daytime
13 functioning, and daytime sleepiness were 3.1%, 2.9%, 3.6%, 3.4%, 3.9%, 4.9%, 4.6%, and 2.8%,
14 respectively.

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23 Table 2 showed the results of the single analysis between social-demographic variables and
24 sleep-related healthcare utilization among adults with insomnia symptoms and insomnia disorder.
25 For the adults with insomnia symptoms, the associated factors were gender ($\chi^2=40.44, p<0.001$),
26 age ($t=6.02, p<0.001$), married status ($\chi^2=12.41, p=0.002$), region ($\chi^2=17.89, p<0.001$), chronic
27 disease ($\chi^2=20.70, p<0.001$), and AIS score ($t=18.16, p<0.001$). For the adults with insomnia
28 disorder, the associated factors were gender ($\chi^2=8.25, p=0.004$), age ($t=2.39, p=0.017$), region (χ^2
29 $=21.01, p<0.001$), and AIS score ($t=4.76, p<0.001$).

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31 In Table 3, the logistic regressions were conducted to analyze the factors associated with sleep-
32 related healthcare utilization among adults with insomnia symptoms and insomnia disorder. The
33 results showed that the factors associated with sleep-related healthcare utilization among adults with
34 insomnia symptoms were male ($OR=0.44, p<0.001$), age ($OR=1.02, p<0.001$), rural region
35 ($OR=0.45, p<0.001$), and AIS score ($OR=1.23, p<0.001$). The factors associated with sleep-related
36 healthcare utilization among adults with insomnia disorder were male ($OR=0.56, p<0.01$), age
37 ($OR=1.01, p<0.01$), rural region ($OR=0.41, p<0.001$), and AIS score ($OR=1.13, p<0.001$).

48 49 Discussion

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51 We found that only 2.1% of the adults with insomnia symptoms in this study used sleep-related
52 healthcare. The prevalence was also only 6.2% even for the adults with insomnia disorders ($AIS\geq 7$).
53 Sleep-related healthcare utilization's decreased ranking for different insomnia symptoms was
54 daytime well-being, daytime functioning, sleep quality, earlier awakening, sleep duration, sleep
55 induction, night awakenings, and daytime sleepiness. The findings also indicated that people who
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3 were male, younger age, and living in a rural region tend not to use healthcare when they
4 experienced insomnia symptoms. Considering insomnia symptoms' serious prevalence and
5 healthcare utilization's importance for insomnia symptoms, all the findings are worthy of more
6 attention.
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11 Our first finding was about insomnia symptoms' prevalence among adults (age ≥ 18 years old).
12 About half of the subjects (50.1%) reported insomnia symptoms. One in ten of subjects (11.4%) were
13 in a higher risk of insomnia disorder ($AIS \geq 7$). This prevalence is higher than the findings in United
14 Kingdom and Korea^{20,21}. However, it is similar with the findings in the United States²². The
15 possible reasons may be the different criterion and number of insomnia symptoms evaluated in
16 different studies. In some studies, only three important kinds of insomnia symptoms (i.e., difficulty
17 initiating sleep, difficulty maintaining sleep, and early morning awakening) were assessed^{23,24}.
18 Insomnia symptoms' evaluation did not meet the frequentness of diagnostic criteria for insomnia
19 (more than three nights a week in some studies)^{25,26}. Both of these made our findings different from
20 other studies. For insomnia disorders' prevalence, our findings were similar with other studies^{27,28}.
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29 One of the major findings in this study is on sleep-related healthcare utilization's prevalence
30 among the adults with insomnia symptoms in a given year. The result showed that it was in a very
31 low level (2.1%) even for adults with insomnia disorders ($AIS \geq 7$). Moreover, the prevalence is also
32 in a low level (6.2%). The sleep-related healthcare utilization's prevalence among adults with
33 insomnia symptoms was similar to some pervious findings^{16,29}. However, it was lower than the
34 findings in Australia and Canada^{13,14}. One of the possible reasons may be that many people do not
35 see insomnia symptoms as medical problem. Furthermore, they lack awareness on healthcare
36 utilization for insomnia symptoms. The other reason may be the high-level utilization of
37 complementary and alternative medicine, which was found in previous studies^{30,31}.
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46 We also analyzed the sleep-related healthcare utilization's prevalence among the adults with
47 different insomnia symptoms. Our studies supported that adults with daytime functioning and well-
48 being symptoms have the highest sleep-related healthcare utilization's prevalence. We found that the
49 prevalence was the lowest among adults with daytime sleepiness and night awakening symptoms.
50 This also reminded us that it is not ideal considering the higher prevalence, burden, and negative
51 influence of other insomnia symptoms^{32,33}. The reason may be explained by the different insomnia
52 symptoms' seriousness which people experienced. More adults feel that the symptoms of functioning
53 and well-being are more serious than other insomnia symptoms in their daily lives.
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4 This study suggested that rural young males did not use sleep-related healthcare when they
5 suffered from insomnia symptoms, after controlling the AIS scores. For the gender differences, the
6 females tended to use sleep-related healthcare when they suffered insomnia symptom. This was also
7 supported in previous study³⁴. One of the reasons may be the associations of inflammatory markers,
8 cardiovascular diseases, and insomnia are stronger in females than in males³⁵⁻³⁷. We also found that
9 younger adults do not use sleep-related healthcare when they experienced insomnia symptoms.
10 These findings are also similar with previous findings¹³. Comparing this finding with older adults,
11 the younger ones may be more careless about their insomnia symptoms. This may reduce their
12 medical-seeking behavior. The rural adults with insomnia symptoms were also in a lower level of
13 healthcare utilization. However, this may be explained by their scarce accessibility to healthcare³⁸.
14 The association between AIS and healthcare utilization is also easy to understand. A higher AIS
15 score means more severe insomnia symptoms, and it can promote the sleep-related healthcare
16 utilization for the adults.
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26 This study also has some limitations, which should be considered when we interpret these
27 results. First, as a cross-sectional design, all the factors were collected at a certain time. Thus, we
28 cannot infer any causal relationship for the factors found that are associated with sleep-related
29 healthcare utilization. Second, all insomnia symptoms were evaluated by the participants' self-report,
30 and the recall bias cannot be avoided. This may produce some influence on the results. Third, sleep-
31 related healthcare utilization was evaluated by one question on the healthcare-seeking of people with
32 sleep problems. Since there is a variety of sleep problems, the sleep-related healthcare utilization's
33 prevalence may be overrated in this study. Finally, the factors associated with sleep-related
34 healthcare utilization analyzed in this study are limited since there are many factors associated with
35 healthcare utilization. However, we achieved a large sample size of 21,376 community residents
36 based on a population-based study. Moreover, our findings provide sleep-related healthcare
37 utilization's prevalence and associated factors among people with insomnia symptoms. This is one of
38 several important public health aspects of insomnia.
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50 **Conclusions**

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52 In conclusion, the sleep-related healthcare utilization's prevalence among adults with insomnia
53 symptoms was at a very low level. Considering insomnia's high prevalence and burden in China, we
54 should realize the importance of controlling insomnia. Some policies and strategies should be made
55 to promote sleep-related healthcare utilization among adults with insomnia symptoms. This study
56 also suggested that rural young males do not use healthcare when they suffered from insomnia
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3 symptoms. Thus, some policies about their health education are urgently needed to deal with the
4 sleep-related healthcare utilization's situations among adults with insomnia symptoms.
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12 71974114).
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15 **Competing interests**

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18 All the authors declared that they have no conflicts of interest.
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21 **Author's contribution**

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24 All authors read and approved the final manuscript. LS analyzed the data and wrote the draft,
25 KL and LZ commented on the manuscript. YZ designed the study and commented on the draft of this
26 manuscript.
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30 **Data sharing statement**

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33 Data are available upon reasonable request from the corresponding author.
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36 **Acknowledgments**

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39 We would like to thank all the subjects for their participation in this study.
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42 **Ethics statement**

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44
45 The study protocol was approved by the Institutional Review Board (IRB) of Hebei Provincial
46 Mental Health Center before data collection (No. 201805). Written informed consent was obtained
47 from all the participants.
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Table 1: Sample description and single analysis between social-demographic variables, insomnia symptoms and sleep-related healthcare utilization (n=21,376)

Variables	Total	Sleep-related healthcare utilization		t/χ^2	p
		Yes, n (%)	No, n (%)		
All	21,376 (100.0)	242 (1.1)	21,134 (98.9)	-	-
Gender				67.60	<0.001
Male	9,839 (46.0)	48 (0.5)	9,791 (99.5)		
Female	11,537 (54.0)	194 (1.7)	11,343 (98.3)		
Age (yr, mean±SD)	50.85±16.30	60.75±13.03	50.74±16.30	9.52	<0.001
Ethnicity				1.51	0.219
Hans	20,094 (94.0)	232 (1.2)	19,862 (98.8)		
Others	1,282 (6.0)	10 (0.8)	1,272 (99.2)		
Education				12.15	0.007
Illiteracy	2,691 (12.6)	42 (1.6)	2,649 (98.4)		
Elementary	5,264 (24.6)	71 (1.3)	5,193 (98.7)		
Middle school	8,274 (38.7)	88 (1.1)	8,166 (98.9)		
High school or above	5,147 (24.1)	41 (0.8)	5,106 (99.2)		
Married Status				23.14	<0.001
Unmarried	1,548 (7.2)	3 (0.2)	1,545 (99.8)		
Married	18,487 (86.5)	211 (1.1)	18,276 (98.9)		
Others	1,341 (6.3)	28 (2.1)	1,313 (97.9)		
Monthly income				7.17	0.028
≤1000 RMB	5,367 (25.1)	77 (1.4)	5,290 (98.6)		
1001 RMB-	13,961 (65.3)	149 (1.1)	13,812 (98.9)		
7001 RMB-	2,048 (9.6)	16 (0.8)	2,032 (99.2)		
Living alone				8.73	0.003
Yes	1,193 (94.4)	24 (2.0)	1,169 (98.0)		
No	20,183 (5.6)	218 (1.1)	19,965 (98.9)		
Region				17.10	<0.001
Urban	5,100 (23.9)	85 (1.7)	5,015 (98.3)		
Rural	16,276 (76.1)	157 (1.0)	16,119 (99.0)		
Chronic disease				64.83	<0.001
Yes	5,589 (26.1)	118 (2.1)	5,471 (97.9)		
No	15,787 (73.9)	124 (0.8)	15,663 (99.2)		
Sleep induction				302.86	<0.001
Yes	6,180 (28.9)	192 (3.1)	5,988 (96.9)		
No	15,196 (71.1)	50 (0.3)	15,146 (99.7)		
Night awakenings				227.81	<0.001
Yes	6,131 (28.7)	175 (2.9)	5,956 (97.1)		
No	15,245 (71.3)	67 (0.4)	15,178 (99.6)		
Earlier awakening				218.24	<0.001
Yes	3,397 (15.9)	122 (3.6)	3,275 (96.4)		
No	17,979 (84.1)	120 (0.7)	17,859 (99.3)		
Sleep duration				262.40	<0.001

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Yes	4,394 (20.6)	151 (3.4)	4,243 (96.6)		
No	16,982 (79.4)	91 (0.5)	16,891 (99.5)		
Sleep quality				411.41	<0.001
Yes	4,693 (22.0)	183 (3.9)	4,510 (96.1)		
No	16,683 (78.0)	59 (0.4)	16,624 (99.6)		
Daytime well-being				316.66	<0.001
Yes	2,252 (10.5)	110 (4.9)	2,142 (95.1)		
No	19,124 (89.5)	132 (0.7)	18,992 (99.3)		
Daytime functioning				370.24	<0.001
Yes	2,948 (13.8)	136 (4.6)	2,812 (95.4)		
No	18,428 (86.2)	106 (0.6)	18,322 (99.4)		
Daytime sleepiness				123.34	<0.001
Yes	4,154 (19.4)	115 (2.8)	4,039 (97.2)		
No	17,222 (80.6)	127 (0.7)	17,095 (99.3)		
Any insomnia symptoms				193.78	<0.001
Yes	10,718 (50.1)	229 (2.1)	10,489 (97.9)		
No	10,658 (49.9)	13 (0.1)	10,645 (99.9)		
Insomnia disorder				622.38	<0.001
Yes	2,430 (11.4)	150 (6.2)	2,280 (93.8)		
No	18,946 (88.6)	92 (0.5)	18,854 (99.5)		
AIS	2.15±3.39	8.17±5.04	2.09±3.30	28.25	<0.001

Note: AIS means the scores of Athens Insomnia Scale (AIS).

Table 2: Single analysis between social-demographic variables and sleep-related healthcare utilization among adults with insomnia symptoms and insomnia disorder

Variables	Sleep-related healthcare utilization			t/χ^2	<i>p</i>
	Total	utilization			
		Yes, n (%)	No, n (%)		
Any insomnia symptoms (n=10,718)					
All	10,718 (100.0)	229 (2.1)	10,489 (97.9)	-	-
Gender				40.44	<0.001
Male	4,289 (40.0)	45 (1.0)	4,244 (99.0)		
Female	6,429 (60.0)	184 (2.9)	6,245 (97.1)		
Age (yr, mean±SD)	54.51±15.43	60.57±12.31	54.37±15.47	6.02	<0.001
Ethnicity				0.76	0.383
Hans	557 (5.2)	9 (1.6)	548 (98.4)		
Others	10,161 (94.8)	220 (2.2)	9,941 (97.8)		
Education				1.92	0.589
Illiteracy	1,738 (16.2)	41 (2.4)	1,697 (97.6)		
Elementary	3,023 (28.2)	66 (2.2)	2,957 (97.8)		
Middle school	3,859 (36.0)	85 (2.2)	3,774 (97.8)		
High school or above	2,098 (19.6)	37 (1.8)	2,061 (98.2)		
Married Status				12.41	0.002
Unmarried	493 (4.6)	1 (0.2)	492 (99.8)		
Married	9,342 (87.2)	201 (2.2)	9,141 (97.8)		
Others	883 (8.2)	27 (3.1)	856 (96.9)		
Monthly income				1.15	0.563
≤1000 RMB	3334 (31.1)	72 (2.2)	3262 (97.8)		
1001 RMB-7001 RMB-	6526 (60.9)	143 (2.2)	6383 (97.8)		
7001 RMB-	858 (8.0)	14 (1.6)	844 (98.4)		
Living alone				1.46	0.227
Yes	765 (7.1)	21 (2.7)	744 (97.3)		
No	9,953 (92.9)	208 (2.1)	9,745 (97.9)		
Region				17.89	<0.001
Urban	2,413 (22.5)	78 (3.2)	2,335 (96.8)		
Rural	8,305 (77.5)	151 (1.8)	8,154 (98.2)		
Chronic disease				20.70	<0.001
Yes	3,767 (35.1)	113 (3.0)	3,654 (97.0)		
No	6,951 (64.9)	116 (1.7)	6,835 (98.3)		
AIS	4.30±3.70	8.63±4.78	4.20±3.62	18.16	<0.001
Insomnia disorder (n=2,430)					
All		150 (6.2)	2,280 (93.8)	-	-
Gender				8.25	0.004
Male	758 (31.2)	31 (4.1)	727 (95.9)		
Female	1,672 (68.8)	119 (7.1)	1,553 (92.9)		
Age (yr, mean±SD)	59.28±13.45	61.82±12.53	59.11±13.50	2.39	0.017
Ethnicity				1.50	0.221
Hans	2,256 (92.8)	143 (6.3)	2,113 (93.7)		
Others	174 (7.2)	7 (4.0)	167 (96.0)		

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3	Education				4.99	0.173
4	Illiteracy	574 (23.6)	31 (5.4)	543 (94.6)		
5	Elementary	819 (33.7)	45 (5.5)	774 (94.5)		
6	Middle school	712 (29.3)	56 (7.9)	656 (92.1)		
7	High school or	325 (13.4)	18 (5.5)	307 (94.5)		
8	above					
9						
10	Married Status				3.38	0.184
11	Unmarried	75 (3.1)	1 (1.3)	74 (98.7)		
12	Married	2,072 (85.3)	133 (6.4)	1,939 (93.6)		
13	Others	283 (11.6)	16 (5.7)	267 (94.3)		
14						
15	Monthly income				2.73	0.255
16	≤1000 RMB	1,003 (41.3)	53 (5.3)	950 (94.7)		
17	1001 RMB-	1,252 (51.5)	87 (6.9)	1,165 (93.1)		
18	7001 RMB-	175 (7.2)	10 (5.7)	165 (94.3)		
19						
20	Living alone				0.19	0.667
21	Yes	252 (10.4)	14 (5.6)	238 (94.4)		
22	No	2,178 (89.6)	136 (6.2)	2,042 (93.8)		
23						
24	Region				21.01	<0.001
25	Urban	414 (17.0)	46 (11.1)	368 (88.9)		
26	Rural	2,016 (83.0)	104 (5.2)	1,912 (94.8)		
27						
28	Chronic disease				0.11	0.739
29	Yes	1,183 (48.7)	75 (6.3)	1,108 (93.7)		
30	No	1,247 (51.3)	75 (6.0)	1,172 (94.0)		
31	AIS	9.99±3.09	11.15±3.87	9.91±3.02	4.76	<0.001

Note: AIS means the scores of Athens Insomnia Scale (AIS).

Table 3: Logistic analysis for the factors associated with sleep-related healthcare utilization among adults with any insomnia symptoms or insomnia disorder [OR (95% CI)]

Variables	Any insomnia symptoms	Insomnia disorder
Observation	10,718	2,430
Male	0.44 (0.31, 0.62)***	0.56 (0.37, 0.85)**
Age (yr, mean±SD)	1.02 (1.01, 1.04)***	1.01 (1.00, 1.04)**
Hans	1.87 (0.92, 3.77)	1.88 (0.85, 4.16)
Education (Ref.= High school or above)		
Illiteracy	0.66 (0.39, 1.13)	0.91 (0.47, 1.80)
Elementary	0.88 (0.56, 1.39)	1.07 (0.58, 1.97)
Middle school	1.22 (0.81, 1.83)	1.61 (0.92, 2.84)
Married Status (Ref.= Others)		
Unmarried	0.20 (0.03, 1.51)	0.42 (0.05, 3.43)
Married	1.04 (0.62, 1.76)	1.38 (0.71, 2.68)
Monthly income (Ref.= 7001RMB-)		
≤1000 RMB	1.11 (0.58, 2.11)	1.13 (0.52, 2.44)
1001 RMB-	1.57 (0.88, 2.79)	1.45 (0.72, 2.92)
Living alone	0.98 (0.54, 1.78)	0.96 (0.47, 1.99)
Rural region	0.45 (0.32, 0.62)***	0.41 (0.27, 0.63)***
Chronic disease	1.11 (0.84, 1.48)	0.90 (0.64, 1.28)
AIS	1.23 (1.20, 1.26)***	1.13 (1.08, 1.19)***
Constant	0.002***	0.003***
R ²	0.158	0.078

Note: **, p<0.01; ***, p<0.001. OR means odd ratio. AIS means the scores of Athens Insomnia Scale (AIS).

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6-7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6-7
Bias	9	Describe any efforts to address potential sources of bias	5
Study size	10	Explain how the study size was arrived at	N/A
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-7
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	7
		(b) Describe any methods used to examine subgroups and interactions	7
		(c) Explain how missing data were addressed	7
		(d) If applicable, describe analytical methods taking account of sampling strategy	N/A
		(e) Describe any sensitivity analyses	N/A
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7
		(b) Give reasons for non-participation at each stage	6
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	15
		(b) Indicate number of participants with missing data for each variable of interest	N/A
Outcome data	15*	Report numbers of outcome events or summary measures	15
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	15-19
		(b) Report category boundaries when continuous variables were categorized	7
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	N/A
Discussion			
Key results	18	Summarise key results with reference to study objectives	8
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	10
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	10
Generalisability	21	Discuss the generalisability (external validity) of the study results	10
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	11

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Sleep-Related Healthcare Utilization Prevalence among Adults with Insomnia Symptoms in Hebei, China: A Population-Based Cross-Sectional Study

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4 **Sleep-Related Healthcare Utilization Prevalence among Adults with Insomnia Symptoms in**
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6 **Hebei, China: A Population-Based Cross-Sectional Study**
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Sleep-Related Healthcare Utilization Prevalence among Adults with Insomnia Symptoms in Hebei, China: A Population-Based Cross-Sectional Study

Abstract

Objective: This study investigated sleep-related healthcare utilization's prevalence and associated factors among adults with different insomnia symptoms.

Design & setting: This was a population-based study with a cross-sectional design conducted in Hebei province, China.

Participants: Participants were community residents aged 18 years and above, and we analyzed a total of 21,376 valid questionnaires.

Primary and secondary outcome measures: The Athens Insomnia Scale (AIS) was used to evaluate the participants' insomnia symptoms. Variables such as sleep-related healthcare utilization, chronic disease, living alone, and social-demographic were assessed for all the participants.

Results: For adults with any insomnia symptoms, only 2.1% of them used sleep-related healthcare in the last year. Even for the adults with insomnia, the prevalence of sleep-related healthcare use was only 6.2%. Sleep-related healthcare utilization's prevalence among adults with sleep induction, night awakenings, earlier awakening, sleep duration, sleep quality, daytime well-being, daytime functioning, or daytime sleepiness were 3.1%, 2.9%, 3.6%, 3.4%, 3.9%, 4.9%, 4.6%, or 2.8%, respectively. The factors associated with sleep-related healthcare utilization among adults with insomnia were: male ($aOR=0.52$, $p<0.01$), younger age ($aOR=1.02$, $p<0.01$), rural region ($aOR=0.45$, $p<0.001$) and AIS score ($aOR=1.23$, $p<0.001$). These same factors were also associated with sleep-related healthcare utilization among the adults with insomnia symptoms.

Conclusions: Sleep-related healthcare utilization's prevalence among adults with insomnia symptoms is very low. It was found that rural young males with insomnia symptoms tend not to use healthcare. As such, some policies and strategies should be made to promote the sleep-related healthcare utilization among rural young females with insomnia symptoms.

Strengths and limitations of this study

1. Only 2.1% of adults with any insomnia symptoms used healthcare last year, and the prevalence was only 6.2% among adults with insomnia ($AIS \geq 7$).
2. The rural young males tend not to use healthcare when they suffered insomnia symptoms, and they were the target populations to increase healthcare utilization's prevalence among adults with insomnia symptoms.
3. All the findings were achieved based on a population-based cross-sectional study with a large sample size ($n > 20,000$).
4. As a cross-sectional design, we cannot infer any causal relationship for the factors found that are associated with sleep-related healthcare utilization.
5. All insomnia symptoms were evaluated by the participants' self-report, and the recall bias cannot be avoided.
6. Sleep-related healthcare utilization was evaluated by one question on the healthcare-seeking of people with sleep problems. Since there is a variety of sleep problems, the sleep-related healthcare utilization's prevalence may be overrated in this study.
7. Factors associated with sleep-related healthcare utilization analyzed in this study are limited since there are many factors associated with healthcare utilization.

Sleep-Related Healthcare Utilization Prevalence among Adults with Insomnia Symptoms in Hebei, China: A Population-Based Cross-Sectional Study

Introduction

Insomnia is one of the most prevalent sleep problems in general population. Previous international epidemiological studies indicated that insomnia's prevalence varied from 4.7% to 37.2% in different countries because of the varying criteria of insomnia^{1,2}. In China, a meta-analysis study reported that insomnia's prevalence was about 15% in general population³. Additionally, insomnia's far-reaching negative impacts contain a multitude of emotional, social, physical problems, such as depression⁴, hypertension⁵, suicidal behaviors⁶, and so on^{7,8}. As such, insomnia is an important public health problem in China and some other countries in the world^{9,10}.

Although it is hard for us to accurately evaluate professional sleep-related healthcare utilization's effect on insomnia among general populations, professional sleep-related healthcare utilization is one of the best ways of dealing with the insomnia problems. One of the reasons is that insomnia's treatment is varied. These treatments include medicine, herbal, psychological intervention, behavior therapy, and so on¹¹. However, healthcare utilization is the best and the most professional way to select an appropriate treatment. Besides, grasping sleep-related healthcare utilization's prevalence among adults with insomnia symptoms is very important for us to understand insomnia's current situation. It is also one of insomnia's several important public health aspects. Finally, analyzing the associated factors of sleep-related healthcare utilization can inform us the target populations to control, and it will help us manage insomnia problems.

In the recent decades, insomnia's impact on healthcare utilization and health had been identified in the different countries^{12,13}. However, sleep-related healthcare utilization's prevalence among people with insomnia symptoms was less reported, especially in population-based studies. Previous telephone or postal surveys in Canada and Australia reported that medical care consultation's prevalence among people with insomnia symptoms were about 13%¹⁴⁻¹⁶. A second analysis of the primary care record or health insurance record in United Kingdom and Chinese Taiwan reported that insomnia's health-seeking prevalence were 4.2% and 19%, respectively^{17,18}. Although all these studies gave us important information about the healthcare utilization's prevalence factors among people with insomnia symptoms and its associated factors, a population-based face-to-face study urgently needs to be conducted. This is in consideration of the various findings, low response rate for telephone or postal surveys, and the weakness of the second analysis in the previous studies

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3 especially in the Chinese mainland.
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6 Since sleep-related healthcare utilization's prevalence among adults was a fundamental and
7 important work for insomnia prevention, grasping such prevalence is vital for us to understand
8 insomnia' situation. We conducted this population-based study to investigate the sleep-related
9 healthcare utilization's prevalence among adults with different insomnia symptom. This was likewise
10 performed to analyze its associated factors. The study's findings are helpful for us to understand the
11 situation of sleep-related healthcare utilization among adults with different insomnia symptoms.
12 These can provide some valuable information for us to make some health policies to control and
13 manage insomnia.
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21 **Participants and Methods**

22 **Participants**

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24 This is a cross-sectional study conducted in Hebei province, China. Hebei is a province located
25 in northern China. It is economically prosperous in both industry and agriculture. A multistage
26 stratified cluster sampling was used to select the community residents in Hebei. First, five cities
27 (Shijiazhuang, Baoding, Xingtai, Zhangjiakou, Qinhuangdao) were randomly selected from all the
28 11 cities in Hebei. Second, we randomly selected three counties and one district in each selected city.
29 Third, one township or sub-district was randomly selected from each county or district. Fourth, we
30 randomly selected one village (community) in each selected township (sub-district). In total, we
31 selected 15 villages and five communities to conduct the study's survey. All adults aged 18 years and
32 above were interviewed in the current study. We collected a total of 21,376 valid questionnaires in
33 this study.
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45 **Interviewing procedures**

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47 The interview was conducted from June to August 2018. Before conducting the survey, all
48 interviewers were trained well to fully understand the research and questionnaire. A face-to-face
49 interview was scheduled by one interviewer for all the participants upon their agreement with written
50 informed consent form. The interview would be scheduled at the participants' home. To ensure the
51 quality of the interview, all the questionnaires were checked by different reviewers on each interview
52 day. Moreover, the questionnaires with missing data were revisited or called on the next day.
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59 **Patient and public involvement**

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4 The public was also not involved in the design, or conduct, or reporting, or dissemination plans
5 of the research.
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8 **Measures**

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10 *Sleep-related healthcare utilization*

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14 Sleep-related *healthcare utilization* was evaluated through the question: “Have you ever seen a
15 doctor because of sleep problems in the last year?” The participant may answer “yes” or “no.” The
16 participants who chose answer “yes” were seen as using healthcare. On the other hand, and the
17 participants who chose “no” were seen as not using healthcare in the data analysis.
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20 *Insomnia status*

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24 *Insomnia status* was evaluated using the Chinese version of the Athens Insomnia Scale (AIS).
25 It is a valid instrument based on the ICD-10 (International Classification of Diseases-10) criteria
26 worldwide^{19,20}. Higher scores mean more severe insomnia symptoms. It contained eight symptoms
27 besides sleep induction, night awakenings, earlier awakening, sleep duration, sleep quality, daytime
28 well-being, daytime functioning, and daytime sleepiness. Each symptom should occur at least three
29 times a week during the last month so that the participant may be assessed as one with insomnia
30 symptoms (The score ≥ 1). The Chinese version of the AIS was also proved to be a reliable and valid
31 instrument. Moreover, the optimal cut-off point was a total score ≥ 7 for the insomnia disorder’s
32 diagnosis²¹. In this study, we analyzed the factors associated with healthcare utilization among
33 adults with insomnia symptoms (total AIS score ≥ 1) and adults with an insomnia disorder (total AIS
34 score ≥ 7).
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44 *Living alone*

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47 *Living alone* was evaluated by the question: “How many persons have lived together with you
48 (not including yourself)?” The answer “0” was considered as living alone (1). All other answers were
49 analyzed as not living alone (0).
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52 *Chronic disease*

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56 *Chronic disease* was assessed using the diagnostic conditions of the 13 self-reported questions
57 about chronic diseases in the last year. These questions asked whether they were diagnosed with
58 chronic diseases concerning the respiratory system, cerebrovascular disease, immune system disease,
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3 skin complaint, hypertension, diabetes, thyropathy, gastritis, anemia, anaphylactic rhinitis, cancer, or
4 other chronic diseases. The answers were wither “yes” or” no.” The subjects with all negative
5 responses were to have no chronic diseases.
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8 9 *Social-demographic variables*

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12 Gender was measured by “male” (1) or “female” (0). Age was calculated through the
13 participants’ date of birth. Ethnicity was evaluated by “Han” (1) or “others” (0). Education level was
14 assessed by the academic degree with the following options: “elementary school,” “middle school,”
15 “senior high school,” or “above.” Married status was evaluated through one question about the
16 participants’ married status. The possible answers were: “never married,” “married,” “divorced,”
17 “widowed,” “deuterogamist,” or “others.” We recoded the small percentage of the last four answers
18 into “unmarried” (1), “married” (2), and “others” (3). Monthly income was assessed through one
19 question about their monthly family income. The possible answers were: “no income,” “below 1000
20 RMB” (7 RMB≈1 dollar), “1001 RMB–3000 RMB,” “3001 RMB–7000 RMB,” “7001 RMB–10000
21 RMB,” “10001 RMB–20000 RMB,” or “above 20000 RMB.” We recoded the small percentages in
22 the last classification into “below 1000 RMB” (1), “1001 RMB–7000 RMB” (2) or “above 7000
23 RMB” (3). Region was assessed by asking the region where the participants lived, and the answers
24 were “urban region” (0) or “rural region” (1).
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35 **Statistical methods**

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38 Data analysis was conducted using IBM SPSS Statistics for Windows version 24.0 (web
39 version). Descriptive statistics were reported as means and standard deviations for continuous
40 variables, and percentages for categorical variables. Student's t-test or Chi-square test was performed
41 to compare the means or proportions between sleep-related healthcare utilization or not. Binary
42 logistic regression with enter method was performed to examine the factors associated with sleep-
43 related healthcare utilizations. Missing data was deleted from the data analysis. All significance tests
44 were two-tailed. Finally, a p-value of 0.05 or lower would be considered statistically significant.
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51 **Results**

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54 We interviewed a total of 21,376 community residents in Hebei province, China. The sample’s
55 descriptions were listed in the second column of Table 1. The remaining parts of Table 1 analyzed
56 the prevalence of the participants who used healthcare. The results found that there were 10,718
57 (50.1%) adults who reported insomnia symptoms. Contrarily, 2,430 adults (11.4%) can be
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3 categorized to have an insomnia disorder. The prevalence of each insomnia symptoms ranged from
4 10.5% to 28.9%. Single analyses supported that self-reported healthcare utilization was associated
5 gender ($p<0.001$), age ($p<0.001$), education ($p=0.007$), married status ($p<0.001$), monthly income
6 ($p<0.028$), living alone ($p<0.003$), region ($p<0.001$), chronic disease ($p<0.001$) and all eight kinds of
7 insomnia symptoms (all $p<0.001$). In this table, we analyzed sleep-related healthcare utilization's
8 prevalence among adults with different insomnia symptoms. For adults with any insomnia
9 symptoms, only 2.1% of them used sleep-related healthcare in the last year. Even for the adults with
10 insomnia, the prevalence of sleep-related healthcare use was only 6.2%. Sleep-related healthcare
11 utilization's prevalence among adults with sleep induction, night awakenings, earlier awakening,
12 sleep duration, sleep quality, daytime well-being, daytime functioning, and daytime sleepiness were
13 3.1%, 2.9%, 3.6%, 3.4%, 3.9%, 4.9%, 4.6%, and 2.8%, respectively.

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23 Table 2 showed the results of the single analysis between social-demographic variables and
24 sleep-related healthcare utilization among adults with insomnia symptoms and insomnia disorder.
25 For the adults with insomnia symptoms, the associated factors were gender ($\chi^2=40.44, p<0.001$),
26 age ($t=6.02, p<0.001$), married status ($\chi^2=12.41, p=0.002$), region ($\chi^2=17.89, p<0.001$), chronic
27 disease ($\chi^2=20.70, p<0.001$), and AIS score ($t=18.16, p<0.001$). For the adults with insomnia
28 disorder, the associated factors were gender ($\chi^2=8.25, p=0.004$), age ($t=2.39, p=0.017$), region (χ^2
29 $=21.01, p<0.001$), and AIS score ($t=4.76, p<0.001$).

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31 In Table 3, the binary logistic regressions with enter method were conducted to analyze the
32 factors associated with sleep-related healthcare utilization among adults with insomnia symptoms
33 and insomnia disorder. The results showed that the factors associated with sleep-related healthcare
34 utilization among adults with insomnia symptoms were male (aOR=0.44, $p<0.001$), age (aOR=1.02,
35 $p<0.001$), rural region (aOR=0.45, $p<0.001$), and AIS score (aOR=1.23, $p<0.001$). The factors
36 associated with sleep-related healthcare utilization among adults with insomnia disorder were male
37 (aOR=0.56, $p<0.01$), age (aOR=1.01, $p<0.01$), rural region (aOR=0.41, $p<0.001$), and AIS score
38 (aOR=1.13, $p<0.001$).

50 Discussion

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52 We found that only 2.1% of the adults with insomnia symptoms in this study used sleep-related
53 healthcare. The prevalence was also only 6.2% even for the adults with insomnia disorders ($\text{AIS}\geq 7$).
54 Sleep-related healthcare utilization's decreased ranking for different insomnia symptoms was
55 daytime well-being, daytime functioning, sleep quality, earlier awakening, sleep duration, sleep
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4 induction, night awakenings, and daytime sleepiness. The findings also indicated that people who
5 were male, younger age, and living in a rural region tend not to use healthcare when they
6 experienced insomnia symptoms. Considering insomnia symptoms' serious prevalence and
7 healthcare utilization's importance for insomnia symptoms, all the findings are worthy of more
8 attention.
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13 Our first finding was about insomnia symptoms' prevalence among adults (age ≥ 18 years old).
14 About half of the subjects (50.1%) reported insomnia symptoms. One in ten of subjects (11.4%) were
15 in a higher risk of insomnia disorder ($AIS \geq 7$). This prevalence is higher than the findings in United
16 Kingdom and Korea ^{22,23}. However, it is similar with the findings in the United States ²⁴. The
17 possible reasons may be the different criterion and number of insomnia symptoms evaluated in
18 different studies. In some studies, only three important kinds of insomnia symptoms (i.e., difficulty
19 initiating sleep, difficulty maintaining sleep, and early morning awakening) were assessed ^{25,26}.
20 Insomnia symptoms' evaluation did not meet the frequentness of diagnostic criteria for insomnia
21 (more than three nights a week in some studies) ^{27,28}. Both made our findings different from other
22 studies. For insomnia disorders' prevalence, our findings were similar with other studies ^{29,30}.
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31 One of the major findings in this study is on sleep-related healthcare utilization's prevalence
32 among the adults with insomnia symptoms in a given year. The result showed that it was in a very
33 low level (2.1%) even for adults with insomnia disorders ($AIS \geq 7$). Moreover, the prevalence is also
34 in a low level (6.2%). The sleep-related healthcare utilization's prevalence among adults with
35 insomnia symptoms was similar to some pervious findings ^{18,31}. However, it was lower than the
36 findings in Australia and Canada ^{15,16}. One of the possible reasons may be that many people do not
37 see insomnia symptoms as medical problem. Furthermore, they lack awareness on healthcare
38 utilization for insomnia symptoms. The other reason may be the high-level utilization of
39 complementary and alternative medicine, which was found in previous studies ^{32,33}.
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48 We also analyzed the sleep-related healthcare utilization's prevalence among the adults with
49 different insomnia symptoms. Our studies supported that adults with daytime functioning and well-
50 being symptoms have the highest sleep-related healthcare utilization's prevalence. We found that the
51 prevalence was the lowest among adults with daytime sleepiness and night awakening symptoms.
52 This also reminded us that it is not ideal considering the higher prevalence, burden, and negative
53 influence of other insomnia symptoms ^{34,35}. The reason may be explained by the different insomnia
54 symptoms' seriousness which people experienced. More adults feel that the symptoms of functioning
55 and well-being are more serious than other insomnia symptoms in their daily lives.
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4 This study suggested that rural young males did not use sleep-related healthcare when they
5 suffered from insomnia symptoms, after controlling the AIS scores. For the gender differences, the
6 females tended to use sleep-related healthcare when they suffered insomnia symptom. This was also
7 supported in previous study³⁶. One of the reasons may be the associations of inflammatory markers,
8 cardiovascular diseases, and insomnia are stronger in females than in males³⁷⁻³⁹. We also found that
9 younger adults do not use sleep-related healthcare when they experienced insomnia symptoms.
10 These findings are also similar with previous findings¹⁵. Comparing this finding with older adults,
11 the younger ones may be more careless about their insomnia symptoms. This may reduce their
12 medical-seeking behavior. The rural adults with insomnia symptoms were also in a lower level of
13 healthcare utilization. However, this may be explained by their scarce accessibility to healthcare⁴⁰.
14 The association between AIS and healthcare utilization is also easy to understand. A higher AIS
15 score means more severe insomnia symptoms, and it can promote the sleep-related healthcare
16 utilization for the adults.
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26 This study also has some limitations, which should be considered when we interpret these
27 results. First, as a cross-sectional design, all the factors were collected at a certain time. Thus, we
28 cannot infer any causal relationship for the factors found that are associated with sleep-related
29 healthcare utilization. Second, all insomnia symptoms were evaluated by the participants' self-report,
30 and the recall bias cannot be avoided. This may produce some influence on the results. Third, sleep-
31 related healthcare utilization was evaluated by one question on the healthcare-seeking of people with
32 sleep problems. Since there is a variety of sleep problems, the sleep-related healthcare utilization's
33 prevalence may be overrated in this study. Finally, the factors associated with sleep-related
34 healthcare utilization analyzed in this study are limited since there are many factors associated with
35 healthcare utilization. However, we achieved a large sample size of 21,376 community residents
36 based on a population-based study. Moreover, our findings provide sleep-related healthcare
37 utilization's prevalence and associated factors among people with insomnia symptoms. This is one of
38 several important public health aspects of insomnia.
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50 **Conclusions**

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52 In conclusion, the sleep-related healthcare utilization's prevalence among adults with insomnia
53 symptoms was at a very low level. Considering insomnia's high prevalence and burden in China, we
54 should realize the importance of controlling insomnia. Some policies and strategies should be made
55 to promote sleep-related healthcare utilization among adults with insomnia symptoms. This study
56 also suggested that rural young males do not use healthcare when they suffered from insomnia
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3 symptoms. Thus, some research about the policies about their health education are urgently needed
4 to deal with the sleep-related healthcare utilization's situations among adults with insomnia
5 symptoms.
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9 10 **Funding statement**

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12 This work was supported by the National Natural Science Foundation of China (71603149 and
13 71974114).
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16 17 **Competing interests**

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19 All the authors declared that they have no conflicts of interest.
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23 24 **Author's contribution**

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26 All authors read and approved the final manuscript. LS analyzed the data and wrote the draft,
27 KL and LZ commented on the manuscript. YZ designed the study and commented on the draft of this
28 manuscript.
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32 33 **Data sharing statement**

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35 Data are available upon reasonable request from the corresponding author.
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38 39 **Acknowledgments**

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41 We would like to thank all the subjects for their participation in this study.
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44 45 **Ethics statement**

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47 The study protocol was approved by the Institutional Review Board (IRB) of Hebei Provincial
48 Mental Health Center before data collection (No. 201805). Written informed consent was obtained
49 from all the participants.
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Table 1: Sample description and single analysis between social-demographic variables, insomnia symptoms and sleep-related healthcare utilization (n=21,376)

Variables	Total	Sleep-related healthcare utilization		t/χ^2	p
		Yes, n (%)	No, n (%)		
All	21,376 (100.0)	242 (1.1)	21,134 (98.9)	-	-
Gender				67.60	<0.001
Male	9,839 (46.0)	48 (0.5)	9,791 (99.5)		
Female	11,537 (54.0)	194 (1.7)	11,343 (98.3)		
Age (yr, mean±SD)	50.85±16.30	60.75±13.03	50.74±16.30	9.52	<0.001
Ethnicity				1.51	0.219
Hans	20,094 (94.0)	232 (1.2)	19,862 (98.8)		
Others	1,282 (6.0)	10 (0.8)	1,272 (99.2)		
Education				12.15	0.007
Illiteracy	2,691 (12.6)	42 (1.6)	2,649 (98.4)		
Elementary	5,264 (24.6)	71 (1.3)	5,193 (98.7)		
Middle school	8,274 (38.7)	88 (1.1)	8,166 (98.9)		
Senior high school or above	5,147 (24.1)	41 (0.8)	5,106 (99.2)		
Married Status				23.14	<0.001
Unmarried	1,548 (7.2)	3 (0.2)	1,545 (99.8)		
Married	18,487 (86.5)	211 (1.1)	18,276 (98.9)		
Others	1,341 (6.3)	28 (2.1)	1,313 (97.9)		
Monthly income				7.17	0.028
≤1000 RMB	5,367 (25.1)	77 (1.4)	5,290 (98.6)		
1001 RMB-7001 RMB-	13,961 (65.3)	149 (1.1)	13,812 (98.9)		
7001 RMB-	2,048 (9.6)	16 (0.8)	2,032 (99.2)		
Living alone				8.73	0.003
Yes	1,193 (94.4)	24 (2.0)	1,169 (98.0)		
No	20,183 (5.6)	218 (1.1)	19,965 (98.9)		
Region				17.10	<0.001
Urban	5,100 (23.9)	85 (1.7)	5,015 (98.3)		
Rural	16,276 (76.1)	157 (1.0)	16,119 (99.0)		
Chronic disease				64.83	<0.001
Yes	5,589 (26.1)	118 (2.1)	5,471 (97.9)		
No	15,787 (73.9)	124 (0.8)	15,663 (99.2)		
Sleep induction				302.86	<0.001
Yes	6,180 (28.9)	192 (3.1)	5,988 (96.9)		
No	15,196 (71.1)	50 (0.3)	15,146 (99.7)		
Night awakenings				227.81	<0.001
Yes	6,131 (28.7)	175 (2.9)	5,956 (97.1)		
No	15,245 (71.3)	67 (0.4)	15,178 (99.6)		
Earlier awakening				218.24	<0.001
Yes	3,397 (15.9)	122 (3.6)	3,275 (96.4)		
No	17,979 (84.1)	120 (0.7)	17,859 (99.3)		

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Sleep duration				262.40	<0.001
Yes	4,394 (20.6)	151 (3.4)	4,243 (96.6)		
No	16,982 (79.4)	91 (0.5)	16,891 (99.5)		
Sleep quality				411.41	<0.001
Yes	4,693 (22.0)	183 (3.9)	4,510 (96.1)		
No	16,683 (78.0)	59 (0.4)	16,624 (99.6)		
Daytime well-being				316.66	<0.001
Yes	2,252 (10.5)	110 (4.9)	2,142 (95.1)		
No	19,124 (89.5)	132 (0.7)	18,992 (99.3)		
Daytime functioning				370.24	<0.001
Yes	2,948 (13.8)	136 (4.6)	2,812 (95.4)		
No	18,428 (86.2)	106 (0.6)	18,322 (99.4)		
Daytime sleepiness				123.34	<0.001
Yes	4,154 (19.4)	115 (2.8)	4,039 (97.2)		
No	17,222 (80.6)	127 (0.7)	17,095 (99.3)		
Any insomnia symptoms				193.78	<0.001
Yes	10,718 (50.1)	229 (2.1)	10,489 (97.9)		
No	10,658 (49.9)	13 (0.1)	10,645 (99.9)		
Insomnia disorder				622.38	<0.001
Yes	2,430 (11.4)	150 (6.2)	2,280 (93.8)		
No	18,946 (88.6)	92 (0.5)	18,854 (99.5)		
AIS	2.15±3.39	8.17±5.04	2.09±3.30	28.25	<0.001

Note: AIS means the scores of Athens Insomnia Scale (AIS).

Table 2: Single analysis between social-demographic variables and sleep-related healthcare utilization among adults with insomnia symptoms and insomnia disorder

Variables	Sleep-related healthcare utilization			t/χ^2	p
	Total	utilization			
		Yes, n (%)	No, n (%)		
Any insomnia symptoms (n=10,718)					
All	10,718 (100.0)	229 (2.1)	10,489 (97.9)	-	-
Gender				40.44	<0.001
Male	4,289 (40.0)	45 (1.0)	4,244 (99.0)		
Female	6,429 (60.0)	184 (2.9)	6,245 (97.1)		
Age (yr, mean±SD)	54.51±15.43	60.57±12.31	54.37±15.47	6.02	<0.001
Ethnicity				0.76	0.383
Hans	557 (5.2)	9 (1.6)	548 (98.4)		
Others	10,161 (94.8)	220 (2.2)	9,941 (97.8)		
Education				1.92	0.589
Illiteracy	1,738 (16.2)	41 (2.4)	1,697 (97.6)		
Elementary	3,023 (28.2)	66 (2.2)	2,957 (97.8)		
Middle school	3,859 (36.0)	85 (2.2)	3,774 (97.8)		
Senior high school or above	2,098 (19.6)	37 (1.8)	2,061 (98.2)		
Married Status				12.41	0.002
Unmarried	493 (4.6)	1 (0.2)	492 (99.8)		
Married	9,342 (87.2)	201 (2.2)	9,141 (97.8)		
Others	883 (8.2)	27 (3.1)	856 (96.9)		
Monthly income				1.15	0.563
≤1000 RMB	3334 (31.1)	72 (2.2)	3262 (97.8)		
1001 RMB-7001 RMB-	6526 (60.9)	143 (2.2)	6383 (97.8)		
8001 RMB-	858 (8.0)	14 (1.6)	844 (98.4)		
Living alone				1.46	0.227
Yes	765 (7.1)	21 (2.7)	744 (97.3)		
No	9,953 (92.9)	208 (2.1)	9,745 (97.9)		
Region				17.89	<0.001
Urban	2,413 (22.5)	78 (3.2)	2,335 (96.8)		
Rural	8,305 (77.5)	151 (1.8)	8,154 (98.2)		
Chronic disease				20.70	<0.001
Yes	3,767 (35.1)	113 (3.0)	3,654 (97.0)		
No	6,951 (64.9)	116 (1.7)	6,835 (98.3)		
AIS	4.30±3.70	8.63±4.78	4.20±3.62	18.16	<0.001
Insomnia disorder (n=2,430)					
All		150 (6.2)	2,280 (93.8)	-	-
Gender				8.25	0.004
Male	758 (31.2)	31 (4.1)	727 (95.9)		
Female	1,672 (68.8)	119 (7.1)	1,553 (92.9)		
Age (yr, mean±SD)	59.28±13.45	61.82±12.53	59.11±13.50	2.39	0.017
Ethnicity				1.50	0.221
Hans	2,256 (92.8)	143 (6.3)	2,113 (93.7)		
Others	174 (7.2)	7 (4.0)	167 (96.0)		
Education				4.99	0.173
Illiteracy	574 (23.6)	31 (5.4)	543 (94.6)		

Elementary	819 (33.7)	45 (5.5)	774 (94.5)		
Middle school	712 (29.3)	56 (7.9)	656 (92.1)		
Senior high school or above	325 (13.4)	18 (5.5)	307 (94.5)		
Married Status				3.38	0.184
Unmarried	75 (3.1)	1 (1.3)	74 (98.7)		
Married	2,072 (85.3)	133 (6.4)	1,939 (93.6)		
Others	283 (11.6)	16 (5.7)	267 (94.3)		
Monthly income				2.73	0.255
≤1000 RMB	1,003 (41.3)	53 (5.3)	950 (94.7)		
1001 RMB-	1,252 (51.5)	87 (6.9)	1,165 (93.1)		
7001 RMB-	175 (7.2)	10 (5.7)	165 (94.3)		
Living alone				0.19	0.667
Yes	252 (10.4)	14 (5.6)	238 (94.4)		
No	2,178 (89.6)	136 (6.2)	2,042 (93.8)		
Region				21.01	<0.001
Urban	414 (17.0)	46 (11.1)	368 (88.9)		
Rural	2,016 (83.0)	104 (5.2)	1,912 (94.8)		
Chronic disease				0.11	0.739
Yes	1,183 (48.7)	75 (6.3)	1,108 (93.7)		
No	1,247 (51.3)	75 (6.0)	1,172 (94.0)		
AIS	9.99±3.09	11.15±3.87	9.91±3.02	4.76	<0.001

Note: AIS means the scores of Athens Insomnia Scale (AIS).

Table 3: Logistic analysis for the factors associated with sleep-related healthcare utilization among adults with any insomnia symptoms or insomnia disorder [aOR (95% CI)]

Variables	Any insomnia symptoms	Insomnia disorder
Observation	10,718	2,430
Male	0.44 (0.31, 0.62)***	0.56 (0.37, 0.85)**
Age (yr, mean±SD)	1.02 (1.01, 1.04)***	1.01 (1.00, 1.04)**
Hans	1.87 (0.92, 3.77)	1.88 (0.85, 4.16)
Education (Ref.= Senior high school or above)		
Illiteracy	0.66 (0.39, 1.13)	0.91 (0.47, 1.80)
Elementary	0.88 (0.56, 1.39)	1.07 (0.58, 1.97)
Middle school	1.22 (0.81, 1.83)	1.61 (0.92, 2.84)
Married Status (Ref.= Others)		
Unmarried	0.20 (0.03, 1.51)	0.42 (0.05, 3.43)
Married	1.04 (0.62, 1.76)	1.38 (0.71, 2.68)
Monthly income (Ref.= 7001RMB-)		
≤1000 RMB	1.11 (0.58, 2.11)	1.13 (0.52, 2.44)
1001 RMB-	1.57 (0.88, 2.79)	1.45 (0.72, 2.92)
Living alone	0.98 (0.54, 1.78)	0.96 (0.47, 1.99)
Rural region	0.45 (0.32, 0.62)***	0.41 (0.27, 0.63)***
Chronic disease	1.11 (0.84, 1.48)	0.90 (0.64, 1.28)
AIS	1.23 (1.20, 1.26)***	1.13 (1.08, 1.19)***
Constant	0.002***	0.003***
R ²	0.158	0.078

Note: **, p<0.01; ***, p<0.001. aOR means adjusted odd ratio. AIS means the scores of Athens Insomnia Scale (AIS).

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6-7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6-7
Bias	9	Describe any efforts to address potential sources of bias	5
Study size	10	Explain how the study size was arrived at	N/A
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-7
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	7
		(b) Describe any methods used to examine subgroups and interactions	7
		(c) Explain how missing data were addressed	7
		(d) If applicable, describe analytical methods taking account of sampling strategy	N/A
		(e) Describe any sensitivity analyses	N/A
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7
		(b) Give reasons for non-participation at each stage	6
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	15
		(b) Indicate number of participants with missing data for each variable of interest	N/A
Outcome data	15*	Report numbers of outcome events or summary measures	15
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	15-19
		(b) Report category boundaries when continuous variables were categorized	7
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	N/A
Discussion			
Key results	18	Summarise key results with reference to study objectives	8
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	10
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	10
Generalisability	21	Discuss the generalisability (external validity) of the study results	10
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	11

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Sleep-Related Healthcare Utilization Prevalence among Adults with Insomnia Symptoms in Hebei, China: A Population-Based Cross-Sectional Study

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4 **Sleep-Related Healthcare Utilization Prevalence among Adults with Insomnia Symptoms in**
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6 **Hebei, China: A Population-Based Cross-Sectional Study**
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Sleep-Related Healthcare Utilization Prevalence among Adults with Insomnia Symptoms in Hebei, China: A Population-Based Cross-Sectional Study

Abstract

Objective: This study investigated sleep-related healthcare utilization's prevalence and associated factors among adults with different insomnia symptoms.

Design & setting: This was a population-based study with a cross-sectional design conducted in Hebei province, China.

Participants: Participants were community residents aged 18 years and above, and we analyzed a total of 21,376 valid questionnaires.

Primary and secondary outcome measures: The Athens Insomnia Scale (AIS) was used to evaluate the participants' insomnia symptoms. Variables such as sleep-related healthcare utilization, chronic disease, living alone, and social-demographic were assessed for all the participants.

Results: For adults with any insomnia symptoms, only 2.1% of them used sleep-related healthcare in the last year. Even for the adults with insomnia, the prevalence of sleep-related healthcare use was only 6.2%. Sleep-related healthcare utilization's prevalence among adults with sleep induction, night awakenings, earlier awakening, sleep duration, sleep quality, daytime well-being, daytime functioning, or daytime sleepiness were 3.1%, 2.9%, 3.6%, 3.4%, 3.9%, 4.9%, 4.6%, or 2.8%, respectively. The factors associated with sleep-related healthcare utilization among adults with insomnia were: male ($aOR=0.52$, $p<0.01$), younger age ($aOR=1.02$, $p<0.01$), rural region ($aOR=0.45$, $p<0.001$) and AIS score ($aOR=1.23$, $p<0.001$). These same factors were also associated with sleep-related healthcare utilization among the adults with insomnia symptoms.

Conclusions: Sleep-related healthcare utilization's prevalence among adults with insomnia symptoms is very low. It was found that rural young males with insomnia symptoms tend not to use healthcare. As such, some policies and strategies should be made to promote the sleep-related healthcare utilization among rural young females with insomnia symptoms.

Strengths and limitations of this study

1. Only 2.1% of adults with any insomnia symptoms used healthcare last year, and the prevalence was only 6.2% among adults with insomnia ($AIS \geq 7$).
2. The rural young males tend not to use healthcare when they suffered insomnia symptoms, and they were the target populations to increase healthcare utilization's prevalence among adults with insomnia symptoms.
3. As a cross-sectional design, we cannot infer any causal relationship for the factors found that are associated with sleep-related healthcare utilization.
4. All insomnia symptoms were evaluated by the participants' self-report, and the recall bias cannot be avoided.
5. Sleep-related healthcare utilization was evaluated by one question on the healthcare-seeking of people with sleep problems.

Sleep-Related Healthcare Utilization Prevalence among Adults with Insomnia Symptoms in Hebei, China: A Population-Based Cross-Sectional Study

Introduction

Insomnia is one of the most prevalent sleep problems in general population. Previous international epidemiological studies indicated that insomnia's prevalence varied from 4.7% to 37.2% in different countries because of the varying criteria of insomnia [1, 2]. In China, a meta-analysis study reported that insomnia's prevalence was about 15% in general population [3]. Additionally, insomnia's far-reaching negative impacts contain a multitude of emotional, social, physical problems, such as depression [4], hypertension [5], suicidal behaviors [6], and so on [7, 8]. As such, insomnia is an important public health problem in China and some other countries in the world [9, 10].

Although it is hard for us to accurately evaluate professional sleep-related healthcare utilization's effect on insomnia among general populations, professional sleep-related healthcare utilization is one of the best ways of dealing with the insomnia problems. One of the reasons is that insomnia's treatment is varied. These treatments include medicine, herbal, psychological intervention, behavior therapy, and so on [11]. However, healthcare utilization is the best and the most professional way to select an appropriate treatment. Besides, grasping sleep-related healthcare utilization's prevalence among adults with insomnia symptoms is very important for us to understand insomnia's current situation. It is also one of several important public health aspects of insomnia. Finally, analyzing the associated factors of sleep-related healthcare utilization can inform us of the target populations to control, and it will help us manage insomnia problems.

In the recent decades, insomnia's impact on healthcare utilization and health had been identified in the different countries [12, 13]. However, sleep-related healthcare utilization's prevalence among people with insomnia symptoms was less reported, especially in population-based studies. Previous telephone or postal surveys in Canada and Australia reported that medical care consultation's prevalence among people with insomnia symptoms were about 13% [14-16]. A second analysis of the primary care record or health insurance record in United Kingdom and Chinese Taiwan reported that insomnia's health-seeking prevalence were 4.2% and 19%, respectively [17, 18]. Although all these studies gave us important information about the healthcare utilization's prevalence factors among people with insomnia symptoms and its associated factors, a population-based face-to-face study urgently needs to be conducted. This is in consideration of the various findings, low response rate for

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3 telephone or postal surveys, and the weakness of the second analysis in the previous studies
4 especially in the Chinese mainland.
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8 Since sleep-related healthcare utilization's prevalence among adults was a fundamental and
9 important work for insomnia prevention, grasping such prevalence is vital for us to understand
10 insomnia' situation. We conducted this population-based study to investigate the sleep-related
11 healthcare utilization's prevalence among adults with different insomnia symptoms. This was
12 likewise performed to analyze its associated factors. The study's findings are helpful for us to
13 understand the situation of sleep-related healthcare utilization among adults with different insomnia
14 symptoms. These can provide some valuable information for us to make some health policies to
15 control and manage insomnia.
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23 **Participants and Methods**

24 **Participants**

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28 This is a cross-sectional study conducted in Hebei province, China. Hebei is a province located
29 in northern China. It is economically prosperous in both industry and agriculture. A multistage
30 stratified cluster sampling was used to select the community residents in Hebei. First, five cities
31 (Shijiazhuang, Baoding, Xingtai, Zhangjiakou, Qinhuangdao) were randomly selected from all the
32 11 cities in Hebei. Second, we randomly selected three counties and one district in each selected city.
33 Third, one township or sub-district was randomly selected from each county or district. Fourth, we
34 randomly selected one village (community) in each selected township (sub-district). In total, we
35 selected 15 villages and five communities to conduct the study's survey. All adults aged 18 years and
36 above were interviewed in the current study. We collected a total of 21,376 valid questionnaires in
37 this study.
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46 **Interviewing procedures**

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49 The interview was conducted from June to August 2018. Before conducting the survey, all
50 interviewers were trained well to fully understand the research and questionnaire. A face-to-face
51 interview was scheduled by one interviewer for all the participants upon their agreement with written
52 informed consent form. The interview would be scheduled at the participants' home. To ensure the
53 quality of the interview, all the questionnaires were checked by different reviewers on each interview
54 day. Moreover, the questionnaires with missing data were revisited or called on the next day.
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Patient and public involvement

The public was also not involved in the design, or conducting, or reporting, or dissemination plans of the research.

Measures

Sleep-related healthcare utilization

Sleep-related *healthcare utilization* was evaluated through the question: “Have you ever seen a doctor because of sleep problems in the last year?” The participant may answer “yes” or “no.” The participants who chose answer “yes” were seen as using healthcare. On the other hand, and the participants who chose “no” were seen as not using healthcare in the data analysis.

Insomnia status

Insomnia status was evaluated using the Chinese version of the Athens Insomnia Scale (AIS). It is a valid instrument based on the ICD-10 (International Classification of Diseases-10) criteria worldwide [19, 20]. Higher scores mean more severe insomnia symptoms. It contained eight symptoms besides sleep induction, night awakenings, earlier awakening, sleep duration, sleep quality, daytime well-being, daytime functioning, and daytime sleepiness. Each symptom should occur at least three times a week during the last month so that the participant may be assessed as one with insomnia symptoms (The score ≥ 1). The Chinese version of the AIS also proved to be a reliable and valid instrument. Moreover, the optimal cut-off point was a total score ≥ 7 for the insomnia disorder’s diagnosis [21]. In this study, we analyzed the factors associated with healthcare utilization among adults with insomnia symptoms (total AIS score ≥ 1) and adults with an insomnia disorder (total AIS score ≥ 7).

Living alone

Living alone was evaluated by the question: “How many persons have lived together with you (not including yourself)?” The answer “0” was considered as living alone (1). All other answers were analyzed as not living alone (0).

Chronic disease

Chronic disease was assessed using the diagnostic conditions of the 13 self-reported questions

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4 about chronic diseases in the last year. These questions asked whether they were diagnosed with
5 chronic diseases concerning the respiratory system, cerebrovascular disease, immune system disease,
6 skin complaint, hypertension, diabetes, thyroopathy, gastritis, anemia, anaphylactic rhinitis, cancer, or
7 other chronic diseases. The answers were wither “yes” or” no.” The subjects with all negative
8 responses were to have no chronic diseases.
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13 *Social-demographic variables*

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16 Gender was measured by “male” (1) or “female” (0). Age was calculated through the
17 participants’ date of birth. Ethnicity was evaluated by “Han” (1) or “others” (0). Education level was
18 assessed by the academic degree with the following options: “elementary school,” “middle school,”
19 “senior high school,” or “above.” Married status was evaluated through one question about the
20 participants’ married status. The possible answers were: “never married,” “married,” “divorced,”
21 “widowed,” “deuterogamist,” or “others.” We recoded the small percentage of the last four answers
22 into “unmarried” (1), “married” (2), and “others” (3). Monthly income was assessed through one
23 question about their monthly family income. The possible answers were: “no income,” “below 1000
24 RMB” (7 RMB≈1 dollar), “1001 RMB–3000 RMB,” “3001 RMB–7000 RMB,” “7001 RMB–10000
25 RMB,” “10001 RMB–20000 RMB,” or “above 20000 RMB.” We recoded the small percentages in
26 the last classification into “below 1000 RMB” (1), “1001 RMB–7000 RMB” (2) or “above 7000
27 RMB” (3). Region was assessed by asking the region where the participants lived, and the answers
28 were “urban region” (0) or “rural region” (1).
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39 **Statistical methods**

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42 Data analysis was conducted using IBM SPSS Statistics for Windows version 24.0 (web
43 version). Descriptive statistics were reported as means and standard deviations for continuous
44 variables, and percentages for categorical variables. Student's t-test or Chi-square test was performed
45 to compare the means or proportions between sleep-related healthcare utilization or not. Binary
46 logistic regression with enter method was performed to examine the factors associated with sleep-
47 related healthcare utilizations. Missing data was deleted from the data analysis. All significance tests
48 were two-tailed. Finally, a p-value of 0.05 or lower would be considered statistically significant.
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55 **Results**

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58 We interviewed a total of 21,376 community residents in Hebei province, China. The sample’s
59 descriptions were listed in the second column of Table 1. The remaining parts of Table 1 analyzed
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3 the prevalence of the participants who used healthcare. The results found that there were 10,718
4 (50.1%) adults who reported insomnia symptoms. Contrarily, 2,430 adults (11.4%) can be
5 categorized to have an insomnia disorder. The prevalence of each insomnia symptoms ranged from
6 10.5% to 28.9%. Single analyses supported that self-reported healthcare utilization was associated
7 gender ($p<0.001$), age ($p<0.001$), education ($p=0.007$), married status ($p<0.001$), monthly income
8 ($p<0.028$), living alone ($p<0.003$), region ($p<0.001$), chronic disease ($p<0.001$) and all eight kinds of
9 insomnia symptoms (all $p<0.001$). In this table, we analyzed sleep-related healthcare utilization's
10 prevalence among adults with different insomnia symptoms. For adults with any insomnia
11 symptoms, only 2.1% of them used sleep-related healthcare in the last year. Even for the adults with
12 insomnia, the prevalence of sleep-related healthcare use was only 6.2%. Sleep-related healthcare
13 utilization's prevalence among adults with sleep induction, night awakenings, earlier awakening,
14 sleep duration, sleep quality, daytime well-being, daytime functioning, and daytime sleepiness were
15 3.1%, 2.9%, 3.6%, 3.4%, 3.9%, 4.9%, 4.6%, and 2.8%, respectively.

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Table 2 showed the results of the single analysis between social-demographic variables and
sleep-related healthcare utilization among adults with insomnia symptoms and insomnia disorder.
For the adults with insomnia symptoms, the associated factors were gender ($\chi^2=40.44, p<0.001$),
age ($t=6.02, p<0.001$), married status ($\chi^2=12.41, p=0.002$), region ($\chi^2=17.89, p<0.001$), chronic
disease ($\chi^2=20.70, p<0.001$), and AIS score ($t=18.16, p<0.001$). For the adults with insomnia
disorder, the associated factors were gender ($\chi^2=8.25, p=0.004$), age ($t=2.39, p=0.017$), region (χ^2
 $=21.01, p<0.001$), and AIS score ($t=4.76, p<0.001$).

In Table 3, the binary logistic regressions with enter method were conducted to analyze the
factors associated with sleep-related healthcare utilization among adults with insomnia symptoms
and insomnia disorder. The results showed that the factors associated with sleep-related healthcare
utilization among adults with insomnia symptoms were male (aOR=0.44, $p<0.001$), age (aOR=1.02,
 $p<0.001$), rural region (aOR=0.45, $p<0.001$), and AIS score (aOR=1.23, $p<0.001$). The factors
associated with sleep-related healthcare utilization among adults with insomnia disorder were male
(aOR=0.56, $p<0.01$), age (aOR=1.01, $p<0.01$), rural region (aOR=0.41, $p<0.001$), and AIS score
(aOR=1.13, $p<0.001$).

Discussion

We found that only 2.1% of the adults with insomnia symptoms in this study used sleep-related
healthcare. The prevalence was also only 6.2% even for the adults with insomnia disorders (AIS \geq 7).

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4 Sleep-related healthcare utilization's decreased ranking for different insomnia symptoms was
5 daytime well-being, daytime functioning, sleep quality, earlier awakening, sleep duration, sleep
6 induction, night awakenings, and daytime sleepiness. The findings also indicated that people who
7 were male, younger age, and living in a rural region tend not to use healthcare when they
8 experienced insomnia symptoms. Considering insomnia symptoms' serious prevalence and
9 healthcare utilization's importance for insomnia symptoms, all the findings are worthy of more
10 attention.
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16 Our first finding was about insomnia symptoms' prevalence among adults (age ≥ 18 years old).
17 About half of the subjects (50.1%) reported insomnia symptoms. One in ten of subjects (11.4%) were
18 in a higher risk of insomnia disorder ($AIS \geq 7$). This prevalence is higher than the findings in United
19 Kingdom and Korea [22, 23]. However, it is similar with the findings in the United States [24]. The
20 possible reasons may be the different criterion and number of insomnia symptoms evaluated in
21 different studies. In some studies, only three important kinds of insomnia symptoms (i.e., difficulty
22 initiating sleep, difficulty maintaining sleep, and early morning awakening) were assessed [25, 26].
23 Insomnia symptoms' evaluation did not meet the frequentness of diagnostic criteria for insomnia
24 (more than three nights a week in some studies) [27, 28]. Both made our findings differ from other
25 studies. For insomnia disorders' prevalence, our findings were similar with other studies [29, 30].
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34 One of the major findings in this study is on sleep-related healthcare utilization's prevalence
35 among the adults with insomnia symptoms in a given year. The result showed that it was in a very
36 low level (2.1%) even for adults with insomnia disorders ($AIS \geq 7$). Moreover, the prevalence was
37 also in a low level (6.2%). The sleep-related healthcare utilization's prevalence among adults with
38 insomnia symptoms was similar to some previous findings [18, 31]. However, it was lower than the
39 findings in Australia and Canada [15, 16]. One of the possible reasons may be that many people do not
40 see insomnia symptoms as medical problems. Furthermore, they lack awareness on healthcare
41 utilization for insomnia symptoms. The other reason may be the high-level utilization of
42 complementary and alternative medicine, which was found in previous studies [32, 33].
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51 We also analyzed the sleep-related healthcare utilization's prevalence among the adults with
52 different insomnia symptoms. Our studies supported that adults with daytime functioning and well-
53 being symptoms have the highest sleep-related healthcare utilization's prevalence. We found that the
54 prevalence was the lowest among adults with daytime sleepiness and night awakening symptoms.
55 This also reminded us that it was not ideal considering the higher prevalence, burden, and negative
56 influence of other insomnia symptoms [34, 35]. The reason may be explained by the different insomnia
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3 symptoms' seriousness which people experienced. More adults felt that the symptoms of functioning
4 and well-being are more serious than other insomnia symptoms in their daily lives.
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8 This study suggested that rural young males did not use sleep-related healthcare when they
9 suffered from insomnia symptoms, after controlling the AIS scores. For the gender differences, the
10 females tended to use sleep-related healthcare when they suffered insomnia symptom. This was also
11 supported in previous study [36]. One of the reasons may be the associations of inflammatory
12 markers, cardiovascular diseases, and insomnia are stronger in females than in males [37-39]. We also
13 found that younger adults do not use sleep-related healthcare when they experienced insomnia
14 symptoms. These findings were also similar with previous findings [15]. Comparing this finding with
15 older adults, the younger ones may be more careless about their insomnia symptoms. This may
16 reduce their medical-seeking behavior. The rural adults with insomnia symptoms were also in a
17 lower level of healthcare utilization. However, this may be explained by their scarce accessibility to
18 healthcare [40]. The association between AIS and healthcare utilization is also easy to understand. A
19 higher AIS score means more severe insomnia symptoms, and it can promote the sleep-related
20 healthcare utilization for the adults.
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31 This study also has some limitations, which should be considered when we interpret these
32 results. First, as a cross-sectional design, all the factors were collected at a certain time. Thus, we
33 cannot infer any causal relationship for the factors found that are associated with sleep-related
34 healthcare utilization. Second, all insomnia symptoms were evaluated by the participants' self-report
35 in 2018. The recall bias cannot be avoided, and the results may also change in current years. This
36 may produce some influence on the results. Third, sleep-related healthcare utilization was evaluated
37 by one question on the healthcare-seeking of people with sleep problems. Since there is a variety of
38 sleep problems, the sleep-related healthcare utilization's prevalence may be overrated in this study.
39 Finally, the factors associated with sleep-related healthcare utilization analyzed in this study are
40 limited since there are many factors associated with healthcare utilization. However, we achieved a
41 large sample size of 21,376 community residents based on a population-based study. Moreover, our
42 findings provided sleep-related healthcare utilization's prevalence and associated factors among
43 people with insomnia symptoms. This is one of several important public health aspects of insomnia.
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54 **Conclusions**

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57 In conclusion, the sleep-related healthcare utilization's prevalence among adults with insomnia
58 symptoms was at a very low level. Considering insomnia's high prevalence and burden in China, we
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3 should realize the importance of controlling insomnia. Some policies and strategies should be made
4 to promote sleep-related healthcare utilization among adults with insomnia symptoms. This study
5 also suggested that rural young males do not use healthcare when they suffered from insomnia
6 symptoms. Thus, some research about the policies about their health education are urgently needed
7 to deal with the sleep-related healthcare utilization's situation among adults with insomnia
8 symptoms.
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15 **Funding statement**

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17 This work was supported by the National Natural Science Foundation of China (71603149 and
18 71974114).
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22 **Competing interests**

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24 All the authors declared that they have no conflicts of interest.
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28 **Author's contribution**

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30 All authors read and approved the final manuscript. LS analyzed the data and wrote the draft,
31 KL and LZ commented on the manuscript. YZ designed the study and commented on the draft of this
32 manuscript.
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37 **Data sharing statement**

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39 Data are available upon reasonable request from the corresponding author.
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43 **Acknowledgments**

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45 We would like to thank all the subjects for their participation in this study.
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49 **Ethics statement**

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51 The study protocol was approved by the Institutional Review Board (IRB) of Hebei Provincial
52 Mental Health Center before data collection (No. 201805). Written informed consent was obtained
53 from all the participants.
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Table 1: Sample description and single analysis between social-demographic variables, insomnia symptoms and sleep-related healthcare utilization (n=21,376)

Variables	Total	Sleep-related healthcare utilization		t/χ^2	p
		Yes, n (%)	No, n (%)		
All	21,376 (100.0)	242 (1.1)	21,134 (98.9)	-	-
Gender				67.60	<0.001
Male	9,839 (46.0)	48 (0.5)	9,791 (99.5)		
Female	11,537 (54.0)	194 (1.7)	11,343 (98.3)		
Age (yr, mean±SD)	50.85±16.30	60.75±13.03	50.74±16.30	9.52	<0.001
Ethnicity				1.51	0.219
Hans	20,094 (94.0)	232 (1.2)	19,862 (98.8)		
Others	1,282 (6.0)	10 (0.8)	1,272 (99.2)		
Education				12.15	0.007
Illiteracy	2,691 (12.6)	42 (1.6)	2,649 (98.4)		
Elementary	5,264 (24.6)	71 (1.3)	5,193 (98.7)		
Middle school	8,274 (38.7)	88 (1.1)	8,166 (98.9)		
Senior high school or above	5,147 (24.1)	41 (0.8)	5,106 (99.2)		
Married Status				23.14	<0.001
Unmarried	1,548 (7.2)	3 (0.2)	1,545 (99.8)		
Married	18,487 (86.5)	211 (1.1)	18,276 (98.9)		
Others	1,341 (6.3)	28 (2.1)	1,313 (97.9)		
Monthly income				7.17	0.028
≤1000 RMB	5,367 (25.1)	77 (1.4)	5,290 (98.6)		
1001 RMB-7001 RMB-	13,961 (65.3)	149 (1.1)	13,812 (98.9)		
7001 RMB-	2,048 (9.6)	16 (0.8)	2,032 (99.2)		
Living alone				8.73	0.003
Yes	1,193 (94.4)	24 (2.0)	1,169 (98.0)		
No	20,183 (5.6)	218 (1.1)	19,965 (98.9)		
Region				17.10	<0.001
Urban	5,100 (23.9)	85 (1.7)	5,015 (98.3)		
Rural	16,276 (76.1)	157 (1.0)	16,119 (99.0)		
Chronic disease				64.83	<0.001
Yes	5,589 (26.1)	118 (2.1)	5,471 (97.9)		
No	15,787 (73.9)	124 (0.8)	15,663 (99.2)		
Sleep induction				302.86	<0.001
Yes	6,180 (28.9)	192 (3.1)	5,988 (96.9)		
No	15,196 (71.1)	50 (0.3)	15,146 (99.7)		
Night awakenings				227.81	<0.001
Yes	6,131 (28.7)	175 (2.9)	5,956 (97.1)		
No	15,245 (71.3)	67 (0.4)	15,178 (99.6)		
Earlier awakening				218.24	<0.001
Yes	3,397 (15.9)	122 (3.6)	3,275 (96.4)		
No	17,979 (84.1)	120 (0.7)	17,859 (99.3)		

1						
2						
3	Sleep duration				262.40	<0.001
4	Yes	4,394 (20.6)	151 (3.4)	4,243 (96.6)		
5	No	16,982 (79.4)	91 (0.5)	16,891 (99.5)		
6	Sleep quality				411.41	<0.001
7	Yes	4,693 (22.0)	183 (3.9)	4,510 (96.1)		
8	No	16,683 (78.0)	59 (0.4)	16,624 (99.6)		
9	Daytime well-being				316.66	<0.001
10	Yes	2,252 (10.5)	110 (4.9)	2,142 (95.1)		
11	No	19,124 (89.5)	132 (0.7)	18,992 (99.3)		
12	Daytime functioning				370.24	<0.001
13	Yes	2,948 (13.8)	136 (4.6)	2,812 (95.4)		
14	No	18,428 (86.2)	106 (0.6)	18,322 (99.4)		
15	Daytime sleepiness				123.34	<0.001
16	Yes	4,154 (19.4)	115 (2.8)	4,039 (97.2)		
17	No	17,222 (80.6)	127 (0.7)	17,095 (99.3)		
18	Any insomnia symptoms				193.78	<0.001
19	Yes	10,718 (50.1)	229 (2.1)	10,489 (97.9)		
20	No	10,658 (49.9)	13 (0.1)	10,645 (99.9)		
21	Insomnia disorder				622.38	<0.001
22	Yes	2,430 (11.4)	150 (6.2)	2,280 (93.8)		
23	No	18,946 (88.6)	92 (0.5)	18,854 (99.5)		
24	AIS	2.15±3.39	8.17±5.04	2.09±3.30	28.25	<0.001

Note: AIS means the scores of Athens Insomnia Scale (AIS).

Table 2: Single analysis between social-demographic variables and sleep-related healthcare utilization among adults with insomnia symptoms and insomnia disorder

Variables	Sleep-related healthcare utilization			t/χ^2	p
	Total	utilization			
		Yes, n (%)	No, n (%)		
Any insomnia symptoms (n=10,718)					
All	10,718 (100.0)	229 (2.1)	10,489 (97.9)	-	-
Gender				40.44	<0.001
Male	4,289 (40.0)	45 (1.0)	4,244 (99.0)		
Female	6,429 (60.0)	184 (2.9)	6,245 (97.1)		
Age (yr, mean±SD)	54.51±15.43	60.57±12.31	54.37±15.47	6.02	<0.001
Ethnicity				0.76	0.383
Hans	557 (5.2)	9 (1.6)	548 (98.4)		
Others	10,161 (94.8)	220 (2.2)	9,941 (97.8)		
Education				1.92	0.589
Illiteracy	1,738 (16.2)	41 (2.4)	1,697 (97.6)		
Elementary	3,023 (28.2)	66 (2.2)	2,957 (97.8)		
Middle school	3,859 (36.0)	85 (2.2)	3,774 (97.8)		
Senior high school or above	2,098 (19.6)	37 (1.8)	2,061 (98.2)		
Married Status				12.41	0.002
Unmarried	493 (4.6)	1 (0.2)	492 (99.8)		
Married	9,342 (87.2)	201 (2.2)	9,141 (97.8)		
Others	883 (8.2)	27 (3.1)	856 (96.9)		
Monthly income				1.15	0.563
≤1000 RMB	3334 (31.1)	72 (2.2)	3262 (97.8)		
1001 RMB-7001 RMB-	6526 (60.9)	143 (2.2)	6383 (97.8)		
8001 RMB-	858 (8.0)	14 (1.6)	844 (98.4)		
Living alone				1.46	0.227
Yes	765 (7.1)	21 (2.7)	744 (97.3)		
No	9,953 (92.9)	208 (2.1)	9,745 (97.9)		
Region				17.89	<0.001
Urban	2,413 (22.5)	78 (3.2)	2,335 (96.8)		
Rural	8,305 (77.5)	151 (1.8)	8,154 (98.2)		
Chronic disease				20.70	<0.001
Yes	3,767 (35.1)	113 (3.0)	3,654 (97.0)		
No	6,951 (64.9)	116 (1.7)	6,835 (98.3)		
AIS	4.30±3.70	8.63±4.78	4.20±3.62	18.16	<0.001
Insomnia disorder (n=2,430)					
All		150 (6.2)	2,280 (93.8)	-	-
Gender				8.25	0.004
Male	758 (31.2)	31 (4.1)	727 (95.9)		
Female	1,672 (68.8)	119 (7.1)	1,553 (92.9)		
Age (yr, mean±SD)	59.28±13.45	61.82±12.53	59.11±13.50	2.39	0.017
Ethnicity				1.50	0.221
Hans	2,256 (92.8)	143 (6.3)	2,113 (93.7)		
Others	174 (7.2)	7 (4.0)	167 (96.0)		
Education				4.99	0.173
Illiteracy	574 (23.6)	31 (5.4)	543 (94.6)		

Elementary	819 (33.7)	45 (5.5)	774 (94.5)		
Middle school	712 (29.3)	56 (7.9)	656 (92.1)		
Senior high school or above	325 (13.4)	18 (5.5)	307 (94.5)		
Married Status				3.38	0.184
Unmarried	75 (3.1)	1 (1.3)	74 (98.7)		
Married	2,072 (85.3)	133 (6.4)	1,939 (93.6)		
Others	283 (11.6)	16 (5.7)	267 (94.3)		
Monthly income				2.73	0.255
≤1000 RMB	1,003 (41.3)	53 (5.3)	950 (94.7)		
1001 RMB-	1,252 (51.5)	87 (6.9)	1,165 (93.1)		
7001 RMB-	175 (7.2)	10 (5.7)	165 (94.3)		
Living alone				0.19	0.667
Yes	252 (10.4)	14 (5.6)	238 (94.4)		
No	2,178 (89.6)	136 (6.2)	2,042 (93.8)		
Region				21.01	<0.001
Urban	414 (17.0)	46 (11.1)	368 (88.9)		
Rural	2,016 (83.0)	104 (5.2)	1,912 (94.8)		
Chronic disease				0.11	0.739
Yes	1,183 (48.7)	75 (6.3)	1,108 (93.7)		
No	1,247 (51.3)	75 (6.0)	1,172 (94.0)		
AIS	9.99±3.09	11.15±3.87	9.91±3.02	4.76	<0.001

Note: AIS means the scores of Athens Insomnia Scale (AIS).

Table 3: Logistic analysis for the factors associated with sleep-related healthcare utilization among adults with any insomnia symptoms or insomnia disorder [aOR (95% CI)]

Variables	Any insomnia symptoms	Insomnia disorder
Observation	10,718	2,430
Male	0.44 (0.31, 0.62)***	0.56 (0.37, 0.85)**
Age (yr, mean±SD)	1.02 (1.01, 1.04)***	1.01 (1.00, 1.04)**
Hans	1.87 (0.92, 3.77)	1.88 (0.85, 4.16)
Education (Ref.= Senior high school or above)		
Illiteracy	0.66 (0.39, 1.13)	0.91 (0.47, 1.80)
Elementary	0.88 (0.56, 1.39)	1.07 (0.58, 1.97)
Middle school	1.22 (0.81, 1.83)	1.61 (0.92, 2.84)
Married Status (Ref.= Others)		
Unmarried	0.20 (0.03, 1.51)	0.42 (0.05, 3.43)
Married	1.04 (0.62, 1.76)	1.38 (0.71, 2.68)
Monthly income (Ref.= 7001RMB-)		
≤1000 RMB	1.11 (0.58, 2.11)	1.13 (0.52, 2.44)
1001 RMB-	1.57 (0.88, 2.79)	1.45 (0.72, 2.92)
Living alone	0.98 (0.54, 1.78)	0.96 (0.47, 1.99)
Rural region	0.45 (0.32, 0.62)***	0.41 (0.27, 0.63)***
Chronic disease	1.11 (0.84, 1.48)	0.90 (0.64, 1.28)
AIS	1.23 (1.20, 1.26)***	1.13 (1.08, 1.19)***
Constant	0.002***	0.003***
R ²	0.158	0.078

Note: **, p<0.01; ***, p<0.001. aOR means adjusted odd ratio. AIS means the scores of Athens Insomnia Scale (AIS).

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of cross-sectional studies

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6-7
Data sources/measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6-7
Bias	9	Describe any efforts to address potential sources of bias	5
Study size	10	Explain how the study size was arrived at	N/A
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-7
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	7
		(b) Describe any methods used to examine subgroups and interactions	7
		(c) Explain how missing data were addressed	7
		(d) If applicable, describe analytical methods taking account of sampling strategy	N/A
		(e) Describe any sensitivity analyses	N/A
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7
		(b) Give reasons for non-participation at each stage	6
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	15
		(b) Indicate number of participants with missing data for each variable of interest	N/A
Outcome data	15*	Report numbers of outcome events or summary measures	15
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	15-19
		(b) Report category boundaries when continuous variables were categorized	7
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	N/A
Discussion			
Key results	18	Summarise key results with reference to study objectives	8
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	10
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	10
Generalisability	21	Discuss the generalisability (external validity) of the study results	10
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	11

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.