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Linking knowledge with attitude: a cross-sectional study of public knowledge and attitude towards sleep disturbances and dementia

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ABSTRACT

Objectives Sleep disturbances increase the risk of dementia; however, there is insufficient information regarding this. We aimed to investigate public knowledge on the relationship between sleep disturbances and dementia, as well as attitudes towards improving sleep quality and obtaining knowledge on dementia.

Design and setting A cross-sectional web-based questionnaire was administered between May and October 2019.

Participants All participants provided informed consent and were able to respond to the survey.

Primary outcomes Factors associated with the knowledge that sleep disturbances are risk factors for dementia and proportions of individuals with this knowledge; attitudes towards improving sleep quality and obtaining knowledge about dementia.

Results Of the 3329 eligible samples, 72.57% correctly recognised that sleep disturbances increased the risk of dementia. In total, 92.97% of participants were willing to take at least one measure to improve sleep quality, and the percentages of those adopting these measures are as follows: 78.73% would lead a regular life, 67.88% would engage in strengthening exercise, 28.84% would undergo psychotherapy and 19.41% would take medication. The awareness regarding sleep disturbances increasing the risk of dementia was the only factor associated with the willingness to improve sleep quality in all four categories of measures. Almost all participants (95.25%) were willing to take at least one measure to acquire knowledge about dementia, with the following participants displaying higher willingness to obtain knowledge about dementia: female, had contact with dementia and considered sleep disturbances to increase the risk of dementia.

Conclusions Our findings indicate an association between people's knowledge and attitudes, suggesting the importance of disseminating knowledge about sleep disturbances and dementia to achieve dementia prevention in future.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ In this cross-sectional study, nearly three-fourths of the participants correctly recognised sleep disturbance as a risk factor for dementia.

⇒ Almost all participants were willing to take at least one measure to improve sleep quality and obtain knowledge about dementia.

⇒ The knowledge that sleep disturbances increase the risk of dementia was the only factor associated with the willingness to improve sleep quality in all four categories of measures, indicating the necessity of disseminating knowledge about sleep disturbances and dementia.

⇒ Limitations include online surveys, self-designed questionnaires, self-reported sleep disturbances and mental health problems.

being the most common.[1–3] Sleep disturbances largely affect the endocrine, immune and cardiovascular systems and increase the risk of obesity,[4] diabetes,[4–6] cardiovascular diseases[5 7 8] and cancer.[9] A growing body of evidence implies that disturbed sleep contributes to impairments in cognitive performance, including mild cognitive impairment and dementia.[10–12] Medicines for sleep disturbances are related to adverse effects, such as cognitive impairment and possibly dementia,[13 14] although the causal association between benzodiazepine use and dementia remains controversial.[15] Thus, preventing sleep disturbance could prevent or delay the progression of dementia.[16]

Sleep disturbance is a risk factor for dementia, but its dissemination and recognition among the general public remains unclear. Attitudes predict behaviour,[17] and attitude towards improving sleep disturbances and obtaining knowledge may guide and shape people's behaviour for regulating sleep disturbances and reducing the risk of dementia. Consequently, it is important to

INTRODUCTION

Sleep disturbance is a common and significant health problem. The prevalence of sleep disturbances varies with age, with sleep apnoea, insomnia and restless legs syndrome

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prompt the general public's attitude towards improving sleep quality and obtaining knowledge about dementia. However, to the best of our knowledge, no existing studies have investigated people's knowledge and their attitudes towards sleep disturbances and dementia.

We aimed to investigate factors associated with the knowledge that sleep disturbances are risk factors for dementia and dissemination of this knowledge among the general public. Moreover, we intended to explore the factors associated with public attitudes towards improving sleep quality and obtaining knowledge about dementia.

MATERIALS AND METHODS

Study design and participants

This cross-sectional, web-based study was conducted between 27 May 2019 and 6 October 2019. A self-designed survey was disseminated through WeChat, a social media outlet that is widely used in China. Participation in the study was voluntary, and the information collected was anonymous. All the participants met the following criteria: (1) WeChat users; (2) voluntary to participate in the survey and (3) provided informed consent. The detailed survey process was introduced in our previous paper.[18] In total, 3436 participants submitted the questionnaire, and 3329 questionnaires with full available data were analysed. The whole process followed Strengthening the Reporting of Observational Studies in Epidemiology guidelines.

Questionnaire content

The questionnaire was written in Chinese and the items used in this study could be briefly categorised as follows: (1) basic sociodemographic information, including sex, age, education levels, type of job, income, type of residence and whether the respondent had contact with anyone who lived with dementia; (2) sleep-related factors, such as shift work, sleep duration in the past 1 month, self-reported sleep quality in the past 1 month and self-reported diagnosis of sleep disturbances, neurological or psychiatric disorders; (3) knowledge about sleep disturbances and risk of dementia, investigated using the question 'Do you think poor sleep will increase the risk of dementia?' and perception of sleep medicine and risk of dementia, investigated using the question, 'Do you think taking sleeping pills will increase the risk of dementia?'; (4) attitudes towards improving sleep quality in case of sleep disturbances, with a multiple-choice question 'If you have sleep disturbances, what kind of methods would you use to improve your sleep quality?' The questions had the following response options: regular lifestyle/ strengthening exercise/psychotherapy/medication/ others (please fill in)/not willing; and willingness to take a drug to improve sleep quality and reduce the risk of/ or prevent dementia and (5) attitudes towards obtaining knowledge about dementia, with the following multiple-choice question 'How do you obtain knowledge about dementia?' The questions had the following response

options: television and internet (eg, WeChat, Weibo, online video)/books, magazines or newspaper/lecture on medication, or doctor consultation service/others (please fill in)/unwillingness. Detailed information is listed in Online supplemental Data of a previous study (https://bmcpublichealth.biomedcentral.com/articles/ 10.1186/s12889-020-09665-7).

Statistical analysis

Descriptive statistics were used to present demographic data. The proportion of participants with the knowledge that sleep disturbances increase the risk of dementia was calculated and reported as the percentage of cases in different sociodemographic populations. χ^2 tests were used to compare the differences between groups. To explore factors potentially associated with the knowledge that sleep disturbances increase the risk of dementia, multiple logistic regression analyses were performed, and adjusted odds ratios (AORs) and 95% confidence intervals (CIs) were presented. Like the aforementioned statistical analysis, factors associated with participants' attitudes towards ameliorating sleep disturbances, willingness to take medicines to improve sleep quality and dementia, and knowledge about dementia were explored using multiple logistic regression analyses, with AORs and 95% CIs presented. Two-sided Wald tests were performed to determine whether the ORs in the regression models were statistically significant. The level of significance was set at $p<0.05$. All statistical analyses were performed using SPSS statistical software V.22 (IBM Corp).

Patient and public involvement statement

Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

RESULTS

Characteristics of participants

Table 1 presents participants' characteristics. Data from 3329 eligible samples were included in the final analysis, with a participation rate of 96.89% (3329 of 3426 participants). The average age was 39.23±12.50 years, ranging from 15 to 97 years. Regarding sleep-related characteristics, the majority of the participants had no shift work (77.38%), 6–8 hours of sleep per night in the past month (64.73%), self-reported very good or good sleep quality in the past month (61.79%), and no diagnosis of sleep disturbances or neurological or psychiatric disorders (74.62%).

In total, 72.57%. of participants correctly recognised sleep disturbances as risk factors for dementia. The proportions of participants who recognised that sleep disturbances increase the risk of dementia stratified by demographic and sleep-related characteristics were significant as follows: sex, age, education levels, type of job, income levels, type of residence, contact with dementia, shift work and sleep duration.

Table 1 Proportions of participants recognising that sleep disturbances increase the risk of dementia stratified by demographic and sleep-related characteristics

	Total No.	Participants who recognise sleep disturbances as risk factors for dementia (No., %)	Participants who did not recognise sleep disturbances as risk factors for dementia (No., %)	P value
Overall	3329	2416 (72.57)	913 (27.43)	
Sex				< 0.001
Men	1150	791 (68.78)	359 (31.22)	
Women	2179	1625 (74.58)	554 (25.42)	
Age (years)				<0.001
<40	1840	1498 (81.41)	342 (18.59)	
40–65	1383	871 (62.98)	512 (37.02)	
≥65	106	47 (44.34)	59 (55.66)	
Education level (years)				<0.001
Primary school or illiteracy (≤ 6)	57	29 (50.88)	28 (49.12)	
Middle or high school (6–12)	614	355 (57.82)	259 (42.18)	
College or university (12–16)	1667	1235 (74.09)	432 (25.91)	
Postgraduate (≥16)	991	797 (80.42)	194 (19.58)	
Type of job				<0.001
Nonmanual	2574	1970 (76.53)	604 (23.47)	
Manual	403	272 (67.49)	131 (32.51)	
Retired	352	174 (49.43)	178 (50.57)	
Income groups (yuan/month)				0.021
0–2000	362	259 (71.55)	103 (28.45)	
2000–5000	975	674 (69.13)	301 (30.87)	
5000–10 000	1229	919 (74.78)	310 (25.22)	
>10 000	763	564 (73.92)	199 (26.08)	
Type of residence				0.001
City	2887	2128 (73.71)	759 (26.29)	
Town	289	189 (65.40)	100 (34.60)	
Rural area	153	99 (64.71)	54 (35.29)	
Dementia contact				0.005
Yes	1100	835 (75.91)	265 (24.09)	
No	1669	1173 (70.28)	496 (29.72)	
Unclear	560	408 (72.86)	152 (27.14)	
Shift work				<0.001
Yes	753	626 (83.13)	127 (16.87)	
No	2576	1790 (69.49)	786 (30.51)	
Sleep duration in the past 1 month (hours)				0.037
6–8	2155	1594 (73.97)	561 (26.03)	
<6	976	688 (70.49)	288 (29.51)	
>8	198	134 (67.68)	64 (32.32)	
Self-reported sleep quality in the past 1 month				0.153
Very good/pretty good	2057	1475 (71.71)	582 (28.29)	
Very bad/pretty bad	1272	941 (73.98)	331 (26.02)	
Self-reported diagnosis of sleep disturbances, neurological or psychiatric disorders				0.160
At least one	845	629 (74.44)	216 (25.56)	
None	2484	1787 (71.94)	697 (28.06)	

Factors associated with the knowledge that sleep disturbances increased the risk of dementia

Table 2 presents the factors associated with knowledge that sleep disturbances increase the risk of dementia. In the multivariate analysis, female sex, less than 40 years of age, high educational levels, non-manual job and contact with dementia were associated with more likelihood of recognising that sleep disturbances are risk factors

Table 2 Factors associated with the knowledge that sleep disturbances increase the risk of dementia

Factors	AOR	95% CI	P value
Sex			<0.001
Men	1		
Women	1.47*	1.24 to 1.75	
Age (years)			<0.001
<40	1		
40–65	0.46*	0.39 to 0.56	
≥ 65	0.35*	0.22 to 0.56	
Education level (years)			<0.001
Primary school or illiteracy (≤6)	1		
Middle or high school (6–12)	1.33	0.75 to 2.35	
College or university (12–16)	1.92*	1.07 to 3.46	
Postgraduate (≥16)	2.45*	1.32 to 4.53	
Type of job			<0.001
Nonmanual	1		
Manual	0.86	0.65 to 1.13	
Retired	0.55*	0.41 to 0.74	
Income groups (yuan/month)			0.858
0–2000	1		
2000–5000	0.95	0.71 to 1.27	
5000–10 000	0.99	0.74 to 1.33	
>10 000	0.90	0.65 to 1.25	
Type of residence			0.348
City	1		
Town	0.83	0.62 to 1.09	
Rural area	0.86	0.58 to 1.26	
Dementia contact			<0.001
Yes	1		
No	0.65*	0.54 to 0.78	
Unclear	0.83	0.65 to 1.06	
Shift work			<0.001
Yes	1		
No	0.57*	0.46 to 0.71	
Sleep duration in the past 1 month (hours)			0.082
6–8	1		
<6	1.07	0.88 to 1.30	
>8	0.71*	0.51 to 0.99	
Self-reported sleep quality in the past 1 month			0.999
Very good/pretty good	1		
Very bad/pretty bad	1.00	0.83 to 1.20	
Self-reported diagnosis of sleep disturbances, neurological or psychiatric disorders			0.005
At least one	1		
None	0.76*	0.62 to 0.92	

* indicates statistically significant.
AOR, adjusted odds ratio; CI, confidence interval.

of dementia; participants with different residences or income levels had no significant differences in understanding sleep disturbances as a risk factor for dementia.

Participants who did not perform shift work (AOR 0.57, 95% CI 0.46 to 0.71) were less aware that sleep disturbances increased the risk of dementia compared with those who performed shift work. Compared with individuals with average sleep duration (6–8 hours), participants with longer sleep duration (>8 hours: AOR 0.71, 95% CI 0.51 to 0.99) exhibited worse understanding of the relationship between sleep disturbances and dementia, while short sleepers (<6 hours) had a better understanding of this relationship. Additionally, respondents without self-reported diagnosis of sleep disturbances or neurological or psychiatric disorders (AOR 0.76, 95% CI 0.62 to 0.92) demonstrated less understanding of sleep disturbances with the risk of dementia. Sleep quality did not significantly affect the understanding of sleep disturbances with the risk of dementia.

Proportion and factors associated with participants willing to take measures to improve sleep quality

Almost all participants (92.97%) were willing to take at least one measure to improve sleep quality if they were diagnosed with sleep disturbances, whereas 1.74% and 5.30% of participants showed a negative attitude towards improving sleep quality if they were diagnosed with sleep disturbances. The participants' measures to improve sleep quality were as follows: 78.73% would lead a regular life, 67.88% would engage in strengthening exercises, 28.84% would undergo psychotherapy and 19.41% would take medication.

Factors associated with participants' willingness to take measures to improve sleep quality were further explored and presented in table 3. A strong association was found between knowledge that sleep disturbances increase the risk of dementia and willingness to improve sleep quality (AOR 0.22, 95% CI 0.13 to 0.38). Compared with participants who believed that sleep disturbances increased the risk of dementia, those who did not regard sleep disturbances to increase the risk of dementia or who remained uncertain displayed less willingness regarding all four measures, including adopting a regular lifestyle (AOR 0.52, 95% CI 0.36 to 0.73, vs AOR 0.79, 95% CI 0.63 to 0.99), performing strengthening exercise (AOR 0.45, 95% CI 0.33 to 0.63, vs AOR 0.77, 95% CI 0.63 to 0.94), going for psychotherapy (AOR 0.57, 95% CI 0.37 to 0.86, vs AOR 0.75, 95% CI 0.60 to 0.94) and taking medication (AOR 0.53, 95% CI 0.34 to 0.83, vs AOR 0.70, 95% CI 0.54 to 0.89) to improve sleep quality. Additionally, individuals who did not consider sleep medicine to increase the risk of dementia displayed a lower willingness to improve sleep quality than those who regarded sleep medicine as a risk factor for dementia (AOR 0.56, 95% CI 0.32 to 0.98). Other demographic or sleep-related factors were not significantly associated with participants' willingness to ameliorate sleep disturbances in all four measures.

Factors associated with the participants' willingness to take medicines that could improve sleep quality and reduce the risk of dementia were also explored. Participants who did not regard sleep medicine to increase the

Table 3 Factors associated with participants' attitudes for taking measures to improve sleep disturbances

Factors	Willingness to improve sleep quality		Regular life		Strengthened exercise		Psychotherapy		Medication	
	AOR	95% CI	AOR	95% CI	AOR	95% CI	AOR	95% CI	AOR	95% CI
Sex (ref: male)	1.19	0.80 to 1.78	1.02	0.85 to 1.24	0.91	0.77 to 1.08	1.62*	1.36 to 1.92	1.21	0.99 to 1.47
Age (ref: <40 years)										
40–65 years	0.95	0.61 to 1.49	0.51*	0.42 to 0.63	1.00	0.83 to 1.20	0.87	0.72 to 1.04	1.36*	1.10 to 1.67
≥65 years	1.55	0.56 to 4.32	0.96	0.57 to 1.63	0.70	0.44 to 1.12	0.59	0.31 to 1.12	1.68	0.98 to 2.90
Education level (ref: primary school or illiteracy ≤6)										
Middle or high school (6–12)	0.79	0.26 to 2.42	1.58	0.89 to 2.80	1.05	0.60 to 1.84	2.07	0.85 to 5.07	1.77	0.72 to 4.34
College or university (12–16)	1.34	0.41 to 4.32	2.62*	1.44 to 4.74	1.87*	1.06 to 3.32	3.02*	1.23 to 7.41	2.16	0.87 to 5.35
Postgraduate (≥16)	2.32	0.64 to 8.37	2.62*	1.40 to 4.91	2.49*	1.37 to 4.53	3.06*	1.23 to 7.62	1.99	0.79 to 5.02
Type of job (ref: nonmanual)										
Manual	1.02	0.57 to 1.84	0.70*	0.52 to 0.93	0.87	0.67 to 1.13	0.77	0.58 to 1.03	0.90	0.65 to 1.24
Retired	0.57	0.31 to 1.02	0.71*	0.52 to 0.96	0.76	0.57 to 1.02	0.50*	0.35 to 0.72	0.97	0.69 to 1.38
Income groups (ref: 0–2000 yuan/month)										
2000–5000 yuan/month	0.88	0.49 to 1.59	1.08	0.80 to 1.47	0.84	0.64 to 1.10	0.94	0.70 to 1.25	0.96	0.69 to 1.33
5000–10000 yuan/month	1.30	0.68 to 2.48	1.18	0.86 to 1.62	1.02	0.77 to 1.33	1.15	0.87 to 1.53	1.05	0.76 to 1.45
>10000 yuan/month	1.05	0.51 to 2.16	1.03	0.73 to 1.45	1.07	0.79 to 1.45	1.05	0.77 to 1.43	1.19	0.84 to 1.69
Type of residence (ref: city)										
Town	0.77	0.44 to 1.35	0.81	0.60 to 1.10	0.77*	0.58 to 1.00	0.73	0.54 to 1.00	0.85	0.60 to 1.20
Rural area	0.88	0.40 to 1.92	1.14	0.75 to 1.74	0.88	0.61 to 1.27	1.31	0.87 to 1.96	1.19	0.75 to 1.89
Dementia contact (ref: yes)										
No	1.15	0.74 to 1.78	1.09	0.89 to 1.33	0.83*	0.69 to 0.98	0.80*	0.67 to 0.96	0.88	0.72 to 1.08
Unclear	0.71	0.43 to 1.18	0.97	0.75 to 1.26	0.78*	0.62 to 0.98	0.89	0.70 to 1.12	1.03	0.79 to 1.34
Shift work (ref: yes)	0.79	0.48 to 1.31	0.67*	0.53 to 0.85	1.02	0.84 to 1.23	0.82*	0.68 to 0.98	0.77*	0.62 to 0.95
Sleep duration in the past 1 month (ref: 6–8 hours)										
<6	0.91	0.60 to 1.39	0.78*	0.64 to 0.96	0.82*	0.69 to 0.99	1.21	1.00 to 1.45	1.10	0.89 to 1.36
>8	0.80	0.37 to 1.73	0.60*	0.42 to 0.86	0.98	0.71 to 1.37	1.12	0.80 to 1.56	1.03	0.70 to 1.53
Self-reported sleep quality in the past 1 month (ref: very good/pretty good)	0.65*	0.43 to 0.97	0.80*	0.66 to 0.97	0.76*	0.65 to 0.90	1.01	0.85 to 1.20	0.96	0.79 to 1.17
Self-reported diagnosed sleep disturbances, neurological or psychiatric disorders (ref: at least one)	1.00	0.66 to 1.52	1.47*	1.21 to 1.79	0.98	0.82 to 1.17	0.57*	0.47 to 0.68	0.46*	0.38 to 0.57
Do you think sleep disturbances increase risk of dementia? (ref: yes)										
No	0.22*	0.13 to 0.38	0.52*	0.36 to 0.73	0.45*	0.33 to 0.63	0.57*	0.37 to 0.86	0.53*	0.34 to 0.83
Unclear	0.89	0.55 to 1.46	0.79*	0.63 to 0.99	0.77*	0.63 to 0.94	0.75*	0.60 to 0.94	0.70*	0.54 to 0.89
Do you think sleep medicine increase risk of dementia? (ref: yes)										
No	0.56*	0.32 to 0.98	0.64*	0.48 to 0.85	0.82	0.64 to 1.07	1.12	0.87 to 1.45	2.76*	2.11 to 3.61
Unclear	0.75	0.48 to 1.16	0.85	0.69 to 1.04	0.86	0.72 to 1.03	0.97	0.81 to 1.16	1.49*	1.21 to 1.83

*indicates statistically significant.
AOR, adjusted odds ratio; CI, confidence interval.

Table 4 Factors associated with the willingness of participants to obtain knowledge about dementia

Factors	Television and internet		Books, magazines or newspaper		Lecture on medication, or doctor consultation service		Willingness to obtain knowledge about dementia	
	AOR	95% CI	AOR	95% CI	AOR	95% CI	AOR	95% CI
Sex (ref: male)	1.42*	1.18 to 1.72	1.48*	1.27 to 1.73	1.63*	1.40 to 1.90	2.19*	1.55 to 3.09
Age (ref: <40 years)								
40–65 years	0.81*	0.65 to 0.99	1.55*	1.30 to 1.84	1.17	0.99 to 1.39	1.38	0.93 to 2.06
≥65 years	0.62	0.37 to 1.03	1.15	0.71 to 1.84	0.78	0.48 to 1.27	0.83	0.34 to 2.02
Education level (ref: primary school or illiteracy≤6)								
Middle or high school (6–12)	1.97*	1.12 to 3.47	2.62*	1.38 to 4.97	0.88	0.50 to 1.56	1.95	0.81 to 4.66
College or university (12–16)	3.38*	1.89 to 6.07	4.75*	2.48 to 9.09	1.45	0.81 to 2.58	2.43	0.97 to 6.10
Postgraduate (≥16)	3.41*	1.84 to 6.31	4.54*	2.33 to 8.83	1.60	0.88 to 2.90	3.12*	1.16 to 8.40
Type of job (ref: nonmanual)								
Manual	0.72*	0.54 to 0.96	0.93	0.72 to 1.20	0.98	0.76 to 1.26	1.34	0.76 to 2.33
Retired	0.69*	0.50 to 0.95	0.65*	0.49 to 0.86	0.86	0.65 to 1.15	0.85	0.43 to 1.68
Income groups (ref: 0–2000 yuan/month)								
2000–5000 yuan/month	1.24	0.92 to 1.67	1.03	0.80 to 1.33	1.13	0.88 to 1.46	1.80*	1.09 to 2.98
5000–10 000 yuan/month	1.47*	1.08 to 2.00	1.15	0.89 to 1.48	1.48*	1.15 to 1.91	2.02*	1.20 to 3.40
>10 000 yuan/month	1.07	0.77 to 1.50	0.97	0.73 to 1.28	1.16	0.88 to 1.54	1.39	0.80 to 2.41
Type of residence (ref: city)								
Town	0.83	0.61 to 1.23	0.94	0.73 to 1.23	0.97	0.74 to 1.26	0.59*	0.36 to 0.98
Rural area	0.83	0.66 to 1.05	0.78	0.54 to 1.13	1.28	0.89 to 1.84	0.48*	0.26 to 0.87
Dementia contact (ref: yes)								
No	0.80*	0.65 to 0.99	0.72*	0.61 to 0.85	0.62*	0.52 to 0.73	0.49*	0.32 to 0.76
Unclear	0.79	0.60 to 1.03	0.66*	0.53 to 0.82	0.60*	0.49 to 0.75	0.52*	0.30 to 0.88
Shift work (ref: yes)	0.83	0.66 to 1.05	0.62*	0.52 to 0.75	0.56*	0.47 to 0.68	0.79	0.50 to 1.23
Sleep duration in the past 1 month (ref: 6–8 hours)								
<6	0.89	0.72 to 1.09	0.93	0.78 to 1.11	1.09	0.92 to 1.30	0.89	0.60 to 1.30
>8	0.91	0.63 to 1.34	0.93	0.68 to 1.26	1.01	0.75 to 1.37	0.84	0.43 to 1.64
Self-reported sleep quality in the past 1 month (ref: very good/pretty good)	0.94	0.77 to 1.15	0.82*	0.69 to 0.96	0.80*	0.68 to 0.94	0.78	0.54 to 1.11
Self-reported diagnosed sleep disturbances, neurological or psychiatric disorders (ref: at least one)	1.02	0.83 to 1.26	0.90	0.76 to 1.07	0.92	0.78 to 1.09	1.14	0.79 to 1.65
Do you think sleep disturbances increase risk of dementia? (ref: yes)								
No	0.44*	0.31 to 0.62	0.71*	0.51 to 0.98	0.74	0.53 to 1.03	0.32*	0.19 to 0.54
Unclear	0.68*	0.54 to 0.85	0.83	0.68 to 1.00	0.70*	0.58 to 0.84	0.79	0.51 to 1.22
Do you think sleep medicine increase risk of dementia? (ref: yes)								
No	1.09	0.79 to 1.48	0.90	0.71 to 1.15	1.00	0.78 to 1.27	0.99	0.57 to 1.70
Unclear	0.98	0.80 to 1.21	0.97	0.82 to 1.15	0.97	0.82 to 1.14	0.96	0.65 to 1.42

*indicates statistically significant.
AOR, adjusted odds ratio; CI, confidence interval.

risk of dementia demonstrated at least twice the willingness to take medicines that simultaneously relieved sleep disturbances and dementia (AOR 2.23, 95% CI 1.67 to 3.00). The detailed results of the multivariate analysis are shown in online supplemental table 1.

Proportions and factors associated with participants who were willing to take measures to obtain knowledge about dementia

Almost all participants (95.25%) were willing to take at least one measure to increase their knowledge on dementia, while very few (4.75%) were unwilling to learn about dementia. The percentages of participants who were willing to undertake measures to obtain knowledge about dementia were as follows: 80.35% through television and the internet, 59.14% through books, magazines or newspapers, and 52.81% through lectures on medication or doctor consultation services.

The factors associated with participants' willingness to take measures to obtain knowledge about dementia are presented in table 4. Female participants had contact with dementia and displayed a higher willingness to obtain knowledge about dementia in all categories of measures. Compared with participants who considered sleep disturbances to increase the risk of dementia, participants who did not consider this exhibited less willingness to obtain knowledge about dementia through television and the internet (AOR 0.44, 95% CI 0.31 to 0.62), as well as books, magazines or newspapers (AOR 0.71, 95% CI 0.51 to 0.98). Participants who were not clear about the relationship between sleep disturbances and the risk of dementia were less willing to obtain knowledge about dementia on television and the internet (AOR 0.68, 95% CI 0.54 to 0.85), as well as lectures on medication or doctor consultation services (AOR 0.70, 95% CI 0.58 to 0.84). Participants' willingness to take measures to obtain knowledge about dementia was not influenced by their perception of sleep medicines and the risk of dementia.

DISCUSSION

Overall, approximately three-fourths of the general population recognises sleep disturbances as risk factors for dementia. Almost all participants had a positive attitude towards improving sleep quality and obtaining knowledge about dementia. The awareness regarding sleep disturbances increasing the risk of dementia was the only factor that could independently influence participants' willingness to improve their sleep quality and obtain knowledge about dementia. Additionally, factors such as sleep quality and knowledge that sleep medicine and risk of dementia would largely affect participants' desire to alleviate sleep disturbances; factors including sex and dementia contact would also influence attitudes towards all categories of measures of obtaining knowledge about dementia. The findings reveal the current status of public awareness of sleep disturbances and dementia and could aid population-targeted health education.

Sleep disturbances are widely identified as risk factors for dementia[10 11]; however, it remains unclear whether they have been adequately disseminated and recognised by the general public. A meta-analysis suggested that most studies focused on factors such as mental health, physical activity, hypertension, smoking and air pollution to increase the risk of dementia.[19] To the best of our knowledge, this study is the first to investigate public awareness of sleep disturbances and the risk of dementia. Currently, 72.57% of participants correctly recognise sleep disturbance as a risk factor for dementia; lesser proportion of participants consider alcohol or smoking as risk factors for dementia.[18] Several sociodemographic characteristics, including female sex, young age, high education levels and contact with patients with dementia, were associated with a better understanding of sleep disturbance as a risk factor for dementia, which is partially consistent with previous surveys conducted in China.[20 21] Additionally, sleep-related factors such as shift work, sleep duration and previous diagnosis of psychiatric disorders were independently associated with knowledge that sleep disturbances increase the risk of dementia. These findings suggest the need to develop different approaches for populations with different sleep-related statuses to disseminate knowledge about dementia.

Almost all participants were willing to practice at least one measure to improve their sleep quality and to obtain knowledge about dementia. Among the four measures in the questionnaire, leading a regular life and performing strengthening exercises were chosen by most participants, while undergoing psychotherapy or medication was accepted by only a small portion of participants (29% and 19%, respectively). The general public had a high willingness to improve their sleep quality if they were diagnosed with sleep disturbances; however, medical refusal was also observed in the general public. The poor medication adherence could be because of concerns about side effects, high financial burden and inadequate health literacy.[22 23] Therefore, more measures should be implemented to improve the public understanding of medical therapy.

Several factors are associated with the willingness to improve sleep quality, comprising only the participants who knew that sleep disturbances increased the risk of dementia; they demonstrated a higher willingness to practice all measures to improve sleep quality and obtain knowledge about dementia. The results suggest that knowledge of sleep disturbance plays a vital role in people's attitudes towards relieving sleep disturbances as well as obtaining knowledge about dementia, which is similar to findings that link knowledge with attitudes.[24] Additionally, perception of sleep pills and risk of dementia also influence people's attitudes towards improving sleep quality, especially taking medicines. Although the relationship between sleep medicines and the risk of dementia remains ambiguous, sleep medicines are advocated when individuals are diagnosed with sleep disturbances. The current findings suggest that more efforts

are required to disseminate knowledge about dementia and the related risk factors.

Participants with self-reported good sleep quality displayed more willingness to improve sleep quality when they faced sleep-related problems, which suggests that more information for improving sleep quality should be disseminated among participants with poor sleep quality. Additionally, female participants who had contact with dementia also showed better attitudes towards obtaining knowledge on dementia. Thus, different approaches are required for different epidemiological and sleep-stratified populations to promote their willingness to improve sleep quality and obtain knowledge on dementia.

This study provided information regarding the public knowledge on sleep disturbances and the risk of dementia, attitudes towards improving sleep quality and willingness to obtain knowledge on dementia. There was an association between awareness that sleep disturbances increase the risk of dementia and positive attitudes towards improving sleep quality as well as obtaining knowledge about dementia; thus, disseminating dementia knowledge is required among the general public. This study had several limitations. First, this was an online survey, and we used a convenience sampling method. This online study was conducted among internet users who were young and highly educated; thus, the study sample may be limited. Second, the questionnaires were self-designed and not sufficiently validated. Third, sleep disturbances and mental disorders were based on the respondents' self-reports rather than clinical diagnoses. Finally, additional information, such as types of sleep disturbances and occupations, was not included in this study.

CONCLUSION

We demonstrated that most people recognised sleep disturbance as a risk factor for dementia and exhibited a positive attitude towards improving sleep quality as well as obtaining knowledge about dementia. Moreover, our findings indicate an association between people's knowledge and attitudes, suggesting the importance of disseminating knowledge about sleep disturbances and dementia to achieve dementia prevention in future.

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Supplementary Table 1. Factors associated with the willingness of participants to take medicines that could improve sleep quality and reduce the risk of dementia.

	AOR	95% CI
Sex		
Men	1	
Women	1.20*	1.02-1.41
Age (years)		
< 40	1	
40-65	1.00	0.83-1.19
≥ 65	0.78	0.48-1.26
Education level (years)		
Primary school or illiteracy (≤ 6)	1	
Middle or high school (6-12)	0.87	0.49-1.57
College or university (12-16)	1.05	0.58-1.89
Postgraduate (≥ 16)	1.05	0.57-1.94
Type of job		
Nonmanual	1	
Manual	0.86	0.67-1.12
Retired	1.03	0.76-1.39
Income groups (yuan/month)		
0-2000	1	
2000-5000	0.91	0.69-1.20
5000-10000	0.93	0.71-1.23
> 10000	0.87	0.65-1.17
Type of residence		
City	1	
Town	1.02	0.78-1.35
Rural area	0.81	0.56-1.17
Dementia contact		
Yes	1	
No	0.74*	0.62-0.88
Unclear	0.75*	0.60-0.94
Shift work		
Yes	1	
No	0.65*	0.54-0.80
Sleep duration in the past one month (hours)		
6-8	1	
< 6	0.97	0.81-1.16
> 8	1.03	0.74-1.42
Self-reported sleep quality in the past one month		
Very good/Pretty good	1	
Very bad/Pretty bad	0.78*	0.66-0.93

Self-reported diagnosis of sleep disturbances, neurological or psychiatric disorders		
At least one	1	
None	0.62*	0.51-0.74
Do you think sleep disturbances increase risk of dementia?		
Yes	1	
No	0.45*	0.32-0.63
Unclear	0.69*	0.57-0.85
Do you think sleep medicine increase risk of dementia?		
Yes	1	
No	2.23*	1.67-3.00
Unclear	1.11	0.93-1.32