



Original article

Prevalence and risk factors for insomnia in community-dwelling elderly in northern Taiwan

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ABSTRACT

Background/Purpose: To determine the prevalence and risk factors for insomnia among community-dwelling elderly in northern Taiwan.

Materials and methods: A cross-sectional survey was conducted among 1358 elderly people (601 men, 44.3%; and 757 women, 55.7%) who had received a senior-citizen health examination between March 2009 and November 2009. Responses to a clinical questionnaire on insomnia (Chinese version of the Athens insomnia scale), mental health (brief symptom rating scale), and 14 physical symptoms were measured.

Results: Insomnia syndrome was found in 41% of individuals; it was more common in women than in men (63.3.0% vs. 36.7%). Multivariate models showed that aging [≥ 80 years old, odds ratio (OR) = 0.67, 95% confidence interval (CI): 0.46–0.93], living with family (OR = 0.51, 95% CI: 0.35–0.76), and perceived good health status (OR = 0.58 and 0.71, $p < 0.05$) were associated with a decreased risk of insomnia. Meanwhile, female gender (OR = 1.70, 95% CI: 1.37–2.12), receipt of medication for chronic diseases (OR = 1.64, 95% CI: 1.29–2.08), high brief symptom rating scale score (1.45, 95% CI: 1.32–1.86), perceived poor health status (OR = 1.92 and 1.80, $p < 0.05$), and total physical symptoms (OR = 1.34, 95% CI: 1.08–1.70) were associated with an increased risk of insomnia.

Conclusion: The results indicate that the aging process itself is not responsible for the increased prevalence of insomnia often reported in older people. Instead, physical symptoms, receipt of medication for chronic diseases, mental health status, living status, and perceived level of well-being affected the risk of insomnia.

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1. Introduction

Insomnia is a common, although under-recognized, problem in the elderly population. It is often a symptom of other health conditions.^{1,2} The causes of insomnia in the elderly are divided into four groups: (1) physical diseases or symptoms, such as long-term pain, bladder or prostate problems, joint diseases such as arthritis or bursitis, and gastroesophageal reflux; (2) environmental/behavioral factors; (3) use of drugs, such as caffeine, alcohol, or prescription medications for chronic diseases; and (4) mental diseases or symptoms, such as anxiety, depression, loss of personal identity, or perceived poor health status.^{3,4}

The prevalence of insomnia, defined as chronic sleep disturbance, has been reported in as many as 50–70% of all people aged ≥ 65 years.^{5,6} In a previous study from Thailand, nearly 50% of patients over the age of 60 years had insomnia⁷; the factors most strongly associated with insomnia were poor perceived health status and the presence of depression.⁷ Another survey, completed a decade ago by the National Institute on Aging in the US, found that 42% of 9000 patients aged ≥ 65 years reported difficulty with both sleep initiation and maintenance.⁸ Sleep complaints in that study were associated with a number of respiratory symptoms, physical disability, use of nonprescription medications, depressive symptoms, and poor self-perceived health status.⁸

Elderly patients with insomnia frequently complain of fatigue, mood changes (e.g., depression or irritability), difficulty concentrating, and impaired daytime functioning.^{3,9,10} One statewide study of Michigan nursing home residents found that untreated

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insomnia was associated with a substantial increase (up to 50%) in the risk of future falls, even after adjustment for functional level, cognitive ability, resource utilization, and medical status.¹¹ Somatic comorbidities associated with aging are known to be risk factors for insomnia and depression. Therefore, chronic insomnia further increases the burden on medically ill elderly patients and their caregivers.^{5,12}

Given these facts, insomnia in elderly patients merits clinical attention and research³; in fact, in recent years insomnia has been the subject of increased investigation due to its psychobiological, clinical, and therapeutic importance. In dealing with insomnia patients, physicians should look for the underlying causes of sleep problems, and treat those conditions.¹³ The aim of this study was to evaluate the relationship between insomnia in elderly patients and the variables of physical functioning, mood disorder (depression and anxiety symptoms), perceived level of well-being, and social support.

2. Materials and methods

2.1. Study population

This study recruited elderly individuals (aged ≥ 65 years) who underwent a health examination between March 2009 and November 2009 at one of several medical centers in Taipei City. Data were collected using a questionnaire, which was administered by an interviewer in a face-to-face session in an effort to avoid errors made while completing the questionnaire. A total of 1799 elderly individuals underwent physical examinations in the study hospitals, and questionnaires were completed for 1399 individuals. After excluding 41 individuals who provided incomplete questionnaires, data from 1358 individuals were included in our data analysis (response rate, 1358/1799 = 75.5%). All individuals provided written informed consent. Our study was approved by the Institutional Review Board of our hospital and was issued a research project number (09MMHISO11).

2.2. Measurement of body mass index

Height and weight were measured for each participant during the physical examination. Body mass index (BMI), the standard measure of obesity in the literature, was calculated as weight in kilograms divided by the square of the height in meters (kg/m^2). A BMI of $< 18.5 \text{ kg}/\text{m}^2$ was defined as underweight, a BMI between $18.5 \text{ kg}/\text{m}^2$ and $< 24 \text{ kg}/\text{m}^2$ was defined as normal weight, and a BMI of $24\text{--}27 \text{ kg}/\text{m}^2$ was defined as overweight.¹⁴

2.3. Questionnaires

2.3.1. Insomnia syndrome

The Chinese version of the Athens Insomnia Scale (CAIS) is a self-reported instrument designed to screen for insomnia symptoms. The CAIS diagnostic criterion for primary insomnia is insomnia occurring at a frequency of three or more times per week over the preceding month. The CAIS-5 uses items 1–5 of the Athens Insomnia Scale (night-time symptoms) for screening and diagnosing insomnia in clinical practice and has satisfactory reliability and validity. The Cronbach's α of internal consistency for these assessments reached 0.82–0.84, and the correlation coefficients of test–retest reliability were 0.84–0.86. The correlation coefficients between the CAIS and Insomnia Self-Assessment Inventory were 0.72–0.76. The suggested CAIS-5 cut-off point for insomnia in the ethnic Chinese population is 5 (area under the curve = 0.90, $p < 0.01$).¹⁵

2.3.2. Brief Symptom Rating Scale

Mental health was screened using the Brief Symptom Rating Scale (BSRS-5). This self-rated questionnaire requires respondents to report whether they had felt tense, blue, irritated, inferior, or had trouble falling asleep in the past week. Responses were rated on a scale from 0 to 4, with 0 being “not at all” and 4 being “extremely”. Total scores ranged from 0 to 20, and the individuals were divided into four groups according to their scores: “no symptoms” (score 0–5), “mild” (score 6–9), “moderate” (score 10–14), and “severe” (score ≥ 15).^{16,17}

Internal consistency (Cronbach's α) coefficients of the BSRS-5 were 0.77–0.90. The test–retest reliability coefficient was 0.82. Concurrent validity coefficients between the sum score of the BSRS-5 and the General Severity Index of the BSRS-50 were 0.87–0.95. When a score of six or more was used as the cut-off score for psychiatric cases, the rate of accurate classification of the BSRS-5 was 76.3% (78.9% sensitivity, 74.3% specificity, 69.9% positive predictive value, and 82.3% negative predictive value).¹⁶

2.3.3. Physical symptoms

Physical symptoms were evaluated based on the geriatric syndrome that has been established in the literature.¹⁸ In total, 14 symptoms were measured: (1) pain/soreness; (2) poor sleep quality; (3) low or depressed mood; (4) shortness of breath; (5) weakness of extremities; (6) fatigue and malaise; (7) poor appetite; (8) skin itch; (9) dizziness; (10) bloating, nausea, diarrhea, or constipation; (11) urinary frequency, incontinence, or difficulty; (12) blurred vision, myopia, or presbyopia; (13) difficulty hearing; and (14) dry mouth.

Individuals answered “yes” or “no” in response to a question regarding whether they experienced each of the symptoms.

2.3.4. Covariates

Detailed demographic histories, including gender, education level, living conditions, and receipt of medication for chronic disease, were taken during the visit. Education level was classified into one of the following five levels: illiterate, elementary school, junior high school, senior high school, and college or higher education. Living condition was defined as “single” or “living with family”.

In addition, lifestyle characteristics, including smoking history (current or former smokers vs. those who had never smoked) and alcohol consumption (0–3 drinks per week vs. ≥ 4 drinks per week), were measured by study-specific questionnaires.¹⁹ Physical activity was assessed by the Lipids Research Clinics Questionnaire and was analyzed as a categorical variable (sedentary vs. non-sedentary lifestyle).¹⁹

2.4. Statistical methods

SAS 9.0 (SAS Inc., Cary, NC, USA) and SPSS 17.0 (SPSS Inc., Chicago, IL, USA) software were used for statistical analyses. The numbers and percentages (n, %) were used to describe variables. Continuous variables such as age, BMI, and BSRS-5 score were reported as mean \pm standard deviation. Differences between those who did and did not have insomnia were analyzed using the Chi-square test and the independent-sample *t* test. Multivariate logistic regression was used to examine the relationships between different variables and the insomnia syndrome, with adjustment for covariates including BMI, smoking status (ever vs. never), alcohol consumption (0–3 drinks per week vs. ≥ 4 drinks per week), sedentary lifestyle (yes vs. no), and education level (literate vs. illiterate).

3. Results

Insomnia criteria were met for 41.4% ($n = 1358$) individuals. As shown in Table 1, insomnia was more common in women than in

Table 1
Characteristics of the individuals with and without insomnia ($n = 1358$).

Variable	Non-insomnia	Insomnia	<i>p</i> value ^a
	(796, 58.6%)	(562, 41.4%)	
	<i>n</i> (%)	<i>n</i> (%)	
Gender			
Male	395 (49.6)	206 (36.7)	<0.001**
Female	401 (50.4)	356 (63.3)	
Age (mean ± SD)	74.2 ± 5.7	73.5 ± 5.3	0.014 ^{b,*}
Age group (years old)			
65–69	180 (22.6)	143 (25.4)	0.065
70–74	264 (33.2)	206 (36.7)	
75–79	201 (25.3)	134 (23.8)	
≥80	151 (19.0)	79 (14.1)	
BMI (mean ± SD)	24.46 ± 3.3	24.60 ± 3.3	0.447 ^b
BMI group			
<18.5 (underweight)	21 (2.6)	19 (3.4)	0.855
18.5–24.0 (normal)	353 (44.3)	250 (44.5)	
24.0–27.0 (overweight)	273 (34.3)	193 (34.3)	
>27 (Obesity)	149 (18.7)	100 (17.8)	
Smoking status	42 (5.3)	18 (3.2)	0.066
Alcohol drinking	92 (11.6)	53 (9.4)	0.208
Sedentary lifestyle	73 (9.2)	68 (12.1)	0.095
Living conditions			
Single	50 (6.3)	65 (11.6)	0.001 ^{c,**}
With family	746 (93.7)	497 (88.4)	
Receipt of medication for chronic disease	508 (63.8)	418 (74.3)	<0.001**
Education level			
Illiterate	42 (5.3)	29 (5.2)	0.795
Elementary	238 (29.9)	172 (30.6)	
Junior high school	133 (16.7)	100 (17.9)	
Senior high school	200 (25.1)	147 (26.1)	
≥ College	183 (23.0)	114 (20.2)	
BSRS-5 score (mean ± SD)	1.24 ± 1.9	3.57 ± 3.6	<0.001 ^{b,**}
BSRS-5 group			
Normal (0–5)	762 (95.7)	442 (78.6)	<0.001**
Mild (6–9)	26 (3.3)	77 (13.7)	
Moderate (10–14)	8 (1.0)	33 (5.9)	
Severe (≥15)	0 (0.0)	10 (1.8)	
Compared with the same age, do you feel that your current health status is:			
Very good	60 (7.5)	21 (3.8)	<0.001**
Good	363 (45.5)	184 (32.8)	
Average	335 (42.1)	269 (47.8)	
Bad	26 (3.3)	62 (10.9)	
Very bad	2 (0.3)	14 (2.5)	
Unknown	10 (1.3)	12 (2.2)	
Compared with 1 year ago, do you feel that your current health status is:			
Better	32 (4.0)	14 (2.5)	<0.001**
The same	513 (64.5)	251 (44.7)	
Worse	241 (30.3)	294 (52.3)	
Unknown	10 (1.2)	3 (0.5)	

* $p < 0.05$, ** $p < 0.01$.

BSRS-5 = 5-item Brief Symptom Rating Scale.

^a Chi-square test.^b Student *t* test.^c Fisher's exact test. These data were compared with non-insomnia and insomnia groups.

men (63.3% vs. 36.7%, respectively, $p < 0.01$). On average, those with insomnia were older than those without insomnia (mean 74.2 years vs. 73.5 years). The other factors analyzed, including age group, BMI, BMI group, smoking status, alcohol consumption, sedentary lifestyle, and education level, were not significantly different between those with and without insomnia. Those without insomnia were more likely to live with their family, take fewer medications for chronic diseases, have lower BSRS-5 scores, and have a good perceived health status.

Table 2 shows the differences between those with and without insomnia for 14 physical symptoms. Physical symptoms were more common in those with insomnia than in those without, and the total number of physical symptoms was greater in those with insomnia.

Table 2
Physical symptoms of the individuals with and without insomnia ($n = 1358$).

Variable	Non-insomnia	Insomnia	<i>p</i> value
	(796, 58.6)	(562, 41.4)	
	<i>n</i> (%)	<i>n</i> (%)	
Pain/soreness	517 (65.0)	420 (74.7)	0.0001**
Poor sleep quality	337 (42.3)	494 (87.9)	<0.001**
Low or depressed mood	254 (31.9)	323 (57.5)	<0.001**
Easily short of breath	241 (30.3)	238 (42.3)	<0.001**
Weakness of extremities	269 (33.8)	269 (47.9)	<0.001**
Fatigue and malaise	301 (37.8)	302 (53.7)	<0.001**
Poor appetite	175 (22.0)	209 (37.2)	<0.001**
Skin itch	337 (42.4)	280 (49.8)	0.007**
Dizziness	300 (37.7)	318 (56.4)	<0.001**
Bloating/nausea/diarrhea/constipation	308 (38.7)	303 (53.9)	<0.001**
Urinary frequency/incontinence/difficulty	312 (39.2)	280 (49.8)	<0.001**
Blurred vision/myopia/presbyopia	586 (73.6)	476 (84.7)	<0.001**
Hard of hearing	323 (40.6)	289 (51.3)	<0.001**
Dry mouth	338 (42.5)	322 (57.2)	<0.001**
Total symptoms	9.99 ± 2.1	12.00 ± 1.5	<0.001 ^{a,**}

* $p < 0.05$, ** $p < 0.01$.^a Independent *t* test, others: Chi-square test.

In the multivariate logistic regression models (Table 3), we adjusted for BMI, smoking status (ever vs. never), alcohol consumption (0–3 drinks per week vs. ≥4 drinks per week), sedentary lifestyle (yes vs. no), and education level (literate vs. illiterate). The results showed that age [≥80 years old, odds ratio (OR) = 0.67, 95% confidence interval (CI): 0.46–0.93], living with family (OR = 0.51, 95% CI: 0.35–0.76), and good perceived health status (OR = 0.58 and 0.71 compared with 1 year ago and compared with the same age, 95% CI: 0.33–0.95; 0.55–0.96, respectively) were associated with a decreased risk of insomnia. Meanwhile, female gender (OR = 1.70, 95% CI: 1.37–2.12), receipt of medication for chronic diseases (OR = 1.64, 95% CI: 1.29–2.08), high BSRS score (OR = 1.45,

Table 3Odds ratios of variables according to groups of individuals with and without insomnia by multivariable logistic regression.^a

Variable	Odds ratio	95% confidence interval	<i>p</i> value
Gender (ref.: male)			
Female	1.70	1.37–2.12	0.006**
Living status (ref.: single)			
Living with family	0.51	0.35–0.76	0.007**
Receipt of medication for chronic disease (ref.: no)			
Yes	1.64	1.29–2.08	<0.001**
Age (ref: 65–69 y/o)			
70–74	0.98	0.74–1.31	0.902
75–79	0.84	0.62–1.14	0.267
≥80	0.67	0.46–0.93	0.019*
BSRS score (continuous variable)	1.45	1.32–1.86	<0.001**
Compared with the same age, do you feel that your current health status is: (ref.: average)			
Very good and good	0.71	0.55–0.96	0.014*
Very bad and bad	1.92	1.08–3.08	0.016*
Compared with 1 year ago, do you feel that your current health status is (ref.: the same):			
Better	0.58	0.33–0.95	0.035*
Worse	1.80	1.25–2.32	<0.001**
Total physical symptoms (continuous variable)	1.34	1.08–1.70	<0.001**

* $p < 0.05$, ** $p < 0.01$.

BSRS-5 = 5-item Brief Symptom Rating Scale.

Adjusted covariates included body mass index, smoking status (ever/never), alcohol consumption (0–3 drinks per week vs. ≥4 drinks per week), and education level (literate/illiterate).

^a Multivariable logistic regression comparing groups with and without insomnia.

95% CI: 1.32–1.86), poor perceived health status (OR = 1.92 and 1.80 compared with 1 year ago and compared with same age, 95% CI: 1.25–2.32; 1.08–3.08, respectively), and total physical symptoms (OR = 1.34, 95% CI: 1.08–1.70) were associated with an increased risk of insomnia.

4. Discussion

In our study, 41.4% ($n = 562$, total = 1358) of the participants living in northern Taiwan met the criteria for insomnia syndrome. Epidemiological data have demonstrated that as many as 40% of individuals over the age of 60 years may experience insomnia, frequent awakening, and disrupted sleep.^{5–8} A study conducted in one district of metropolitan Taipei showed that nearly half of the elderly people reported insomnia and poor sleep quality.²⁰

A common misconception of clinicians and the public is that this increased prevalence of insomnia is a normal and expected phenomenon of aging; however, insomnia is often the result of medical and psychosocial comorbidities in this population.²¹ There are many factors affecting the risk of insomnia in elderly individuals.

4.1. Influence of age on insomnia

In our study models, after we adjusted for covariates, we found that aging was associated with a decreased risk of insomnia in elderly people living in northern Taiwan. ORs of different age groups, including 70–74-year-olds, 75–79-year-olds, and ≥ 80 years old, compared to 65–69-year olds, were shown to decrease progressively (OR = 0.98 \rightarrow 0.84 \rightarrow 0.67, 95% CI: 0.46–0.93); a statistically significant difference was found in the group ≥ 80 years. Our result is compatible with that of a previous 3-year longitudinal study involving 6800 older people, which concluded that the aging process itself was not responsible for incident insomnia.²² Other factors such as chronic disease, physical disability, depressed mood, poor perceived health status, and widowhood, explained the insomnia.²² According to a 2003 survey by the National Sleep Foundation, older age in itself is not associated with sleep difficulty. Rather, the survey data suggested that, among adults aged 55–84 years, those who had mental or physical illnesses were more likely to suffer from insomnia.²³ Therefore, age itself is not a contributing factor for insomnia in healthy elderly people.²⁴

4.2. Influence of gender on insomnia

Female gender is another strong risk factor for insomnia; women are more likely than men to experience insomnia throughout their lives, and aging increases this risk.²⁵ Our multivariate logistic regression models confirmed this effect, with female gender being associated with an increased risk of insomnia (OR = 1.70, 95% CI: 1.37–2.12).

4.3. Living situation

Living situation, such as living alone, living in a geriatric care facility, or being separated, divorced, or widowed, can have a substantial influence on sleep-wake patterns,^{26,27} and it may also increase the risk of insomnia in older adults.^{28,29} We found that, similar to results from Western countries, living with family was associated with a decreased risk of insomnia (OR = 0.51, 95% CI: 0.35–0.76).

4.4. Physical diseases and chronic illnesses

Factors such as physical diseases and chronic illnesses are known to be significantly associated with poorer sleep and symptoms of

insomnia.^{8,30} The relationship between sleep and health, however, can be bidirectional. Dew et al. observed that insomnia predicted fewer future social activities at follow-up, and higher chronic medical burden after 1 year.³¹ A previous study has shown that, among the population with insomnia, a physical illness was reported in approximately one-third of elderly people, compared with that in <10% of individuals aged 15–24 years.²⁴

In our study, we measured 14 physical symptoms that had been identified in a previous study to differ between people with and without insomnia. These physical symptoms were more frequent, and the total number of physical symptoms was higher, in those with insomnia than in those without insomnia. In the multivariate logistic regression models, receipt of medication for chronic diseases (OR = 1.64, 95% CI: 1.29–2.08), poor perceived health status (OR = 1.80 and 1.92 for compared with 1 year ago and compared with same age, 95% CI: 1.25–2.32; 1.08–3.08, respectively, $p < 0.05$), and total physical symptoms (OR = 1.34, 95% CI: 1.08–1.70) were associated with an increased risk of insomnia. Meanwhile, good perceived health status was associated with a decreased risk of insomnia (OR = 0.58 and 0.71, $p < 0.05$).

4.5. Mental disorders

The association between mental disorders and insomnia symptoms has been widely demonstrated in younger populations, but the association is less clear in geriatric care.²⁸ However, the effect of psychological factors on sleep quality in the elderly should not be overlooked in favor of other factors, such as physical health status. Major life changes that accompany aging, such as retirement and bereavement, also have an impact on insomnia symptoms.²⁹

In our study, we did not use the routine questionnaire for measuring depression. Rather, we used the BSR5 to screen for early mental health problems.^{16–18} The results showed that mild, moderate, and severe mental symptoms were more frequent in those with insomnia than in those without. In the multivariate logistic regression models, a high BSR5 score was associated with an increased risk of insomnia (OR = 1.45, 95% CI: 1.32–1.86).

4.6. Methodological limitations

There are several limitations in the present study. First, this was a survey, as the aging population lives in several parts of the northern metropolitan area, and may not be representative of the entire elderly population. The prevalence of insomnia may be overestimated for some elderly individuals who may go to a medical center to receive physical examinations on their own because they may pay more attention to their health and insomnia than other elderly individuals. Second, the measurement of insomnia, physical symptoms, and mental health were established by self-report rather than clinical diagnosis. Even though we used face-to-face interviews, some recall bias was difficult to avoid. Finally, as mentioned, the design of the present study was cross-sectional, which consequently rules out a reliable separation of primary insomnia from insomnia secondary to another disorder or condition. Thus, there is a strong need for large-scale longitudinal studies to identify the nature and direction of the relationship between insomnia and its many comorbidities and correlates.

In conclusion, in our study, we found that the aging process in itself is not responsible for the increased prevalence of insomnia often reported in older people. Instead, physical symptoms, receipt of medication for chronic diseases, mental health status, living status, and perceived level of well-being affected the risk of insomnia. Being active, decreasing somatic symptoms, maintaining a good emotional state, and having a satisfying social life are protective factors against insomnia at any age.

Incorporating a brief sleep history into a routine medical check-up can be helpful in detecting insomnia. Direct inquiry is important, because more than half the patients who believe they have chronic insomnia have never discussed their problem with a physician. Effective treatments for insomnia are available and, in some patients, improvement in sleep leads to improvement in quality of life.

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