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Identification of comprehensive geriatric assessment-based risk factors for insomnia in elderly Chinese hospitalized patients

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Abstract

Objective: Insomnia is a common problem in older persons and is associated with poor prognosis from a functional or clinical perspective. The purpose of this study was to investigate the prevalence of insomnia and identify comprehensive geriatric assessment (CGA) based clinical factors associated with insomnia in elderly hospitalized patients.

Methods: Standardized face-to-face interviews were conducted and CGA data were collected from 356 Chinese hospitalized patients aged 60 years or older. Insomnia was defined as self-reported sleep poor quality according to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-V). Multivariate logistic regression analysis was applied to assess the association between patient clinical factors together with domains within the CGA and insomnia.

Results: Among the 365 patients, insomnia was found in 48.31% of the participants. Difficulty in initiating sleep (DIS), early morning awakening (EMA), difficulty in maintaining sleep (DMS), and snoring were found in 33.99%, 9.55%, 13.48%, and 1.69% of patients, respectively. Significant associations were found between insomnia and several covariates: female gender ($P = 0.034$), depression ($P = 0.001$), activities of daily living (ADL) ($P = 0.034$), instrumental activities of daily living (IADL; $P = 0.009$), falling ($P = 0.003$), chronic pain ($P = 0.001$), and poor nutritional status ($P = 0.038$). According to the results of the adjustment multivariate logistic regression analysis, female sex (odds ratio [OR] = 2.057, confidence interval [CI] = 1.179-3.588, $P = 0.011$), depression (OR = 1.889, CI = 1.080-3.304, $P = 0.026$), and chronic pain (OR = 1.779, CI = 1.103-2.868, $P = 0.018$) were significant independently predictors associated with insomnia.

Conclusions: Our study revealed that female sex, depression, and chronic pain were independently predictors of insomnia in hospitalized patients. Early identification of elderly patients with these risk factors using the CGA may improve the quality of life and treatment outcomes.

KEYWORDS
comprehensive geriatric assessment, elderly, hospitalized, insomnia

1 | INTRODUCTION

The world population is aging, as we are currently faced with an unprecedented rise in the number of older adults.[1] Individuals of ≥ 65 years of age is increasing in numbers globally, and by 2050, the global population aged ≥ 65 years is predicted to reach over 1 billion.[2] By 2030, the China's elderly population will be expected to approximate at 400 million, becoming the country that has the highest population of elderlies in the world.[3] In this rapidly expanding older portion of the national population, one of the major changes that commonly accompany the aging process is an often-profound disruption of an individual's daily sleep-wake cycle. Epidemiological studies show that approximately 50% of all older adults have complaints of significant sleep disturbances.[4,5]

Insomnia is one of the most common sleep disorders in the elderly. The prevalence of insomnia in the elderly population is high and there is a wide variation in reports from different parts of the world from 6% to 62.1%.[6] In a small hospital-based study in northern India, researchers reported insomnia in 32% of the elderly population with multiple comorbidities. It has been reported that insomnia in 10.4%[7] of the elderly Chinese community population and 49.7% of the Chinese individuals in the rural areas in Anhui province.[8] According to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-V), insomnia is defined as reported dissatisfaction with sleep quantity or quality and associated with difficulty with sleep initiation, maintenance, or early morning awakening (EMA), and that causes clinically significant distress or impairment, occurs at least 3 nights per week for 3 months, occurs despite adequate opportunity for sleep, and is not better explained by another disorder or substance abuse.[9] Physiological changes in sleep occur with the aging process, such as an increase in the proportion of stage I sleep (shallow sleep), increased wake frequency and night-time sleep fragmentation, a decrease in the proportion of stage III and IV sleep (deep sleep), lower rapid eye movement sleep (REM sleep) latency, and reduced sleep efficiency.[10] Unfortunately, the changes in sleep patterns seen in the elderly almost always have a negative impact on daily functioning and often cause distress, mood changes, quality of life impairment, and increased medical and societal costs.[11] Some studies indicated that persistent insomnia was associated with a variety of psychiatric disorders, especially depression, anxiety disorders, and substance abuse in individuals.[12-14]

With the rapid growth of the aging population in China, sleep problems are receiving more attention. There have been several studies conducted on insomnia in older adults in China. These publications focused mostly on the prevalence of insomnia in older adults.[12,15,16] However, some important information, such as the prevalence in hospitalized patients, psychiatric disorders, mental disorders, functional capabilities, marital status, and education level, were not available or were incomplete. Therefore, the factors related to insomnia in elderly people remain unclear. Thus, further research focusing on the risk factors associated with insomnia among elderly patients is needed.

The Comprehensive Geriatric Assessment (CGA), which was first used in the United Kingdom in the late 1930s,[17] is a multidisciplinary, systematic procedure addressing the physical, psychological, functional, and social conditions of older persons to create a tailored care and treatment plan (CTP).[18] The CGA has been shown to benefit hospitalized elderly patients and it can provide detailed information about the sociodemographic, behavioral, clinical, functional, and cognitive aspects of older patients.[19] Our hypothesis is that the CGA should be a benefit and convenient for screening the risk factors associated with insomnia. The aim of this study was designed to investigate the prevalence of insomnia in elderly hospitalized patients and to identify the CGA-based clinical factors associated with insomnia.

2 | MATERIALS AND METHODS

2.1 | Participants

A retrospective study was conducted at the First Hospital of Lanzhou University in China. A total of 405 elderly patients (60 years and above) who presented in the First Hospital of Lanzhou University, China, during the period of the study (January 2014 to September 2016) took part in this study. Subjects were excluded if they had severe problems with vision, hearing, or speaking, and receiving end-of-life care. Of those who did not participate in the present study, 21 refused to participate, and 28 had ineffective questionnaires or incomplete information. A final total of 356 hospitalized patients were recruited for this study. Ethics approvals for all protocols used in this study were obtained through the First Hospital of Lanzhou University and all the patients signed an informed consent form before commencement.

2.2 | CGA and clinical data

All individuals have their CGA evaluated by well-trained geriatricians and nurses through standardized face-to-face interviews.[20] The participants' baseline demographic data were collected using a standardized questionnaire, surveying their age, gender, educational history, smoking and alcohol history, marital status (yes or no [single / divorced / widowed]), living arrangements (alone or with others), occupational income, and history of chronic illness (hypertension, diabetes, cerebrovascular disease, chronic obstructive pulmonary disease, coronary heart disease, cancer, and heart failure). Other questionnaire data recorded were: body pain over the past 4 weeks (ranging from 0 to 10, where 0 is no pain and 10 the most severe pain imaginable); the number of falls over the past year; self-reported sleep quality; and polypharmacy, which included the number of medications, polypharmacy appropriateness, and drug-drug interactions. A monthly income of 2000 RMB or less was defined as a low income.

The CGA consists of several domains. Functional status was measured with the Activities of Daily Living (ADL) index and the Instrumental Activities of Daily Living (IADL) scale.[9] Cognitive status was evaluated with the Mini-Mental State Examination (MMSE). Significant cognitive impairment was defined as an MMSE score of < 20 for illiterate subjects or subjects with only a primary education

TABLE 1 Demonstrates the basic and clinical characteristics and comprehensive geriatric assessment (CGA) data of study participants by insomnia status

Demographic characteristics % or mean ± SD	Total (n = 356)	No insomnia (n = 184)	Insomnia (n = 172)	P value
Gender				
Female	173 (0.49)	79 (0.43)	94 (0.55)	0.034[*]
Male	183 (0.51)	105 (0.57)	78 (0.45)	
Age, y	76.28 ± 7.74	75.73 ± 7.79	76.85 ± 7.76	0.172
60-74	142 (0.40)	80 (0.43)	62 (0.36)	0.161
75-84	166 (0.47)	83 (0.45)	83 (0.48)	0.595
> 85	48 (0.13)	21 (0.12)	27 (0.16)	0.278
Work status				
Farmer	8 (0.02)	4 (0.02)	4 (0.02)	0.923
Retired	320 (0.90)	167 (0.91)	152 (0.88)	0.491
No work	26 (0.07)	12 (0.06)	15 (0.09)	0.549
Working	2 (0.01)	1 (0.01)	1 (0.01)	0.962
Marital status				
Married	212 (0.59)	113 (0.61)	98 (0.57)	0.450
Single	3 (0.01)	3 (0.02)	0 (0.00)	0.249
Widow	141 (0.40)	68 (0.37)	74 (0.43)	0.279
Living arrangement, n (%)				
Living with others	304 (0.85)	159 (0.86)	145 (0.84)	0.653
Living alone	52 (0.15)	25 (0.14)	27 (0.16)	
Monthly income				
< 2000 RMB	35 (0.10)	16 (0.10)	19 (0.09)	0.481
2000 RMB+	321 (0.90)	168 (0.90)	153 (0.91)	
Place of residence				
Rural areas	8 (0.02)	4 (0.03)	4 (0.02)	0.923
Urban areas	348 (0.98)	180 (0.97)	168 (0.98)	
Education				
Illiterate	43 (0.12)	21 (0.12)	23 (0.13)	0.630
Primary or high school	224 (0.63)	113 (0.61)	110 (0.64)	0.662
College or university	89 (0.25)	50 (0.27)	39 (0.23)	0.391
Smoking	63 (0.18)	36 (0.20)	27 (0.16)	0.405
Alcohol	28 (0.08)	14 (0.08)	14 (0.08)	0.853
Hypertension	230 (0.65)	119 (0.65)	111 (0.65)	0.978
Diabetes	120 (0.34)	60 (0.33)	60 (0.35)	0.656
Coronary disease	88 (0.25)	43 (0.23)	45 (0.26)	0.623
Hyperlipemia	52 (0.15)	29 (0.16)	23 (0.13)	0.551
COPD	40 (0.11)	19 (0.10)	21 (0.12)	0.617
Cancer	11 (0.03)	5 (0.03)	6 (0.03)	0.765
Heart failure	10 (0.03)	4 (0.02)	6 (0.03)	0.531
GDS mean score	3.49 ± 3.03	2.90 ± 2.73	4.11 ± 3.21	0.001[*]
Number of patients with GDS ≥ 5	102 (0.29)	34 (0.18)	68 (0.40)	0.000[*]
BMI, kg/m^2	23.55 ± 3.65	23.77 ± 3.25	23.32 ± 4.03	0.245
Chronic illnesses, > 5	150 (0.42)	78 (0.42)	72 (0.42)	0.919
Polypharmacy, > 5 prescribed drugs	212 (0.60)	108 (0.59)	104 (0.60)	0.747

(Continues)

TABLE 1 (Continued)

Demographic characteristics % or mean ± SD	Total (n = 356)	No insomnia (n = 184)	Insomnia (n = 172)	P value
ADL	92.75 ± 16.13	94.44 ± 14.28	90.79 ± 17.85	0.034[*]
IADL	5.83 ± 2.53	6.16 ± 2.41	5.46 ± 2.61	0.009[*]
Constipation	113 (0.32)	50 (0.27)	63 (0.37)	0.068
Fall	68 (0.19)	24 (0.13)	44 (0.26)	0.003[*]
Chronic pain	198 (0.56)	86 (0.47)	112 (0.65)	0.001[*]
Chronic pain	2.53 ± 2.82	2.14 ± 2.80	2.96 ± 2.78	0.006[*]
MMSE mean score	23.55 ± 5.62	23.90 ± 5.27	23.19 ± 5.97	0.236
Cognitive impairment	186 (0.52)	97 (0.53)	89 (0.52)	0.916
MNA	11.54 ± 2.60	11.99 ± 2.28	11.06 ± 2.82	0.001[*]
Malnutrition/at risk of malnutrition	135 (0.38)	60 (0.33)	75 (0.44)	0.038[*]

Abbreviations: ADL, activity of daily living; BMI, body mass index; COPD, chronic obstructive pulmonary disease; GDS, Geriatric Depression Scale; IADL, instrumental activities of daily living; MMSE, mini-mental state examination; MNA, mini nutritional assessment.
*P value < 0.05.

and a score of < 24 for highly educated subjects. Depression was defined as a score of > 5 on the 15-question short form of the Geriatric Depression Scale (GDS). Nutritional status was explored with the Mini Nutritional Assessment Short-Form (MNA-SF). The maximum score on the MNA-SF was 14. Malnourished patients scored < 8, and patients at risk of malnutrition scored between 8 and 11.[21] For those participants unable to stand independently, the calf circumference was used as a substitute for the body mass index (BMI) score, as proposed by Kaiser et al.[22] BMI was calculated as the patient's weight in kilograms divided by the square of the patient's height in centimeters.

2.3 | Insomnia assessment

Insomnia was defined as self-reported sleep poor quality according to the DSM-V (American Psychiatric Association, 2013),[9] targeting the 3 basic forms of sleep disturbances that lasted at least 3 nights per week for 3 months. To assess insomnia, the following question was asked: "During the past 3 months, have you ever been bothered by insomnia at least 3 nights per week?" Participants chose one or several of the following answers: not at all, difficulty in initiating sleep (DIS), difficulty in maintaining sleep (DMS), early morning awakening (EMA), and snoring.

2.4 | Statistical analysis

Statistical analyses were performed using IBM SPSS for the Mac software package, version 22.0 (IBM Corporation). Basic descriptive statistics were calculated to determine the sample characteristics. Continuous variables were presented as the mean ± standard deviation (SD), and categorical variables were presented as frequencies and proportions. The demographic and clinical characteristics of patients of both genders with and without insomnia were compared. The chi-square test of association was used to examine the significance of the

association between variables. Odds ratios (ORs) were calculated to evaluate the magnitude of the impact of significant variables. Logistic regression models in which using insomnia was used as the independent variable were fitted to estimate the ORs to assess the association of various variables with insomnia. Even if not significantly different in the univariate analysis, all of the above-mentioned variables were entered into the multivariate logistic regression models for insomnia because each variable could affect the other variable. A binary logistic regression with adjustment for sex and all other confounding variables were carried out to identify predictors associated with insomnia. A P value < 0.05 was considered statistically significant.

3 | RESULTS

3.1 | Patient characteristics

Among the 356 participants, the average age was 76.28 ± 7.74 years; 183 participants were men, and 173 (48.60%) were women. Table 1 demonstrates the basic characteristics of the study participants by insomnia status. Most patients were either married (59.55%) or widowed (39.61%), and the majority lived with others (family or relatives; 85.39%) in urban areas (97.75%). Only 17.70% of the participants smoked, and 7.87% consumed alcohol or had a history thereof. Almost half of the patients (42.13%) reported that they were previously diagnosed with more than five chronic diseases. Moreover, 230 patients (64.61%) were hypertensive, and 120 (33.71%) were diabetic. Forty patients (11.24%) had chronic obstructive pulmonary disease, 11 patients (3.09%) had cancer, and 10 patients (2.81%) had heart failure. Insomnia was found in 48.31% of the participants. DIS, EMA, DMS, and snoring were found in 33.99%, 9.55%, 13.48%, and 1.69% of the patients, respectively. Significant associations were found between insomnia and several covariates: female gender (P = 0.034), depression (P = 0.001), ADL (P = 0.034), IADL (P = 0.009), fall history (P = 0.003), chronic pain (P = 0.001), and poor nutritional status (P = 0.038).

TABLE 2 Demonstrates the basic and clinical characteristics and comprehensive geriatric assessment (CGA) data of study participants by gender and insomnia status

Demographic characteristics % or mean ± SD	Women			Men		
	No insomnia n = 79	Insomnia n = 94	P value	No insomnia n = 105	Insomnia n = 78	P value
Age, y	75.45 ± 7.33	73.73 ± 6.75	0.114	78.55 ± 7.77	77.24 ± 8.19	0.275
Work status						
Farmer	2 (0.03)	4 (0.04)	0.689	2 (0.02)	0 (0)	0.508
Retired	69 (0.87)	76 (0.81)	0.302	98 (0.93)	76 (0.98)	0.305
No work	8 (0.10)	14 (0.15)	0.371	4 (0.04)	1 (0.01)	0.396
Working	0 (0)	0 (0)		1 (0.01)	1 (0.01)	1.000
Living arrangement						
Living with others	66 (0.84)	75 (0.80)	0.561	93 (0.89)	70 (0.90)	0.802
Living alone	13 (0.16)	19 (0.20)		12 (0.11)	8 (0.10)	
Marital status						
Married	38 (0.48)	45 (0.48)	0.976	75 (0.71)	53 (0.68)	0.628
Single	2 (0.03)	0 (0.00)	0.207	1 (0.01)	0 (0.00)	0.381
Widow	39 (0.49)	49 (0.52)	0.761	29 (0.28)	25 (0.32)	0.518
Monthly income						
< 2000 RMB	10 (0.13)	18 (0.19)	0.302	6 (0.06)	1 (0.01)	0.241
2000 RMB+	69 (0.87)	76 (0.81)		99 (0.94)	77 (0.09)	
Place of residence						
Rural areas	2 (0.03)	4 (0.04)	0.689	2 (0.02)	0 (0.00)	0.508
Urban areas	77 (0.97)	90 (0.96)		103 (0.98)	78 (1.00)	
Education						
Illiterate	18(0.23)	22 (0.23)	0.923	3 (0.03)	1 (0.01)	0.636
Primary or high school	48 (0.61)	59 (0.63)	0.875	65 (0.62)	51 (0.66)	0.645
College or university	13 (0.16)	13 (0.14)	0.673	37 (0.35)	26 (0.33)	0.875
Smoking	1 (0.01)	2 (0.03)	0.665	35 (0.33)	25 (0.32)	0.875
Alcohol	0 (0.00)	2 (0.02)	0.501	14 (0.13)	13 (0.17)	0.535
Hypertension	50 (0.63)	60 (0.64)	0.942	69 (0.66)	51 (0.65)	0.963
Diabetes	24 (0.30)	29 (0.31)	0.947	36 (0.34)	31 (0.40)	0.535
Coronary disease	14 (0.18)	21 (0.22)	0.569	29 (0.28)	24 (0.31)	0.742
Hyperlipemia	21 (0.27)	19 (0.20)	0.367	8 (0.08)	4 (0.05)	0.561
Stroke	28 (0.35)	23 (0.25)	0.133	44 (0.42)	33 (0.42)	0.956
COPD	6 (0.08)	5 (0.05)	0.552	12 (0.11)	16 (0.21)	0.091
Cancer	2 (0.03)	2 (0.02)	0.860	3 (0.03)	4 (0.05)	0.462
Heart failure	2 (0.03)	4 (0.04)	0.689	2 (0.02)	3 (0.04)	0.652
GDS mean score	3.00 ± 2.63	4.096 ± 3.19	0.016*	2.86 ± 2.82	4.13 ± 3.24	0.005*
Number of patients with GDS ≥ 5	17 (0.22)	36 (0.38)	0.021*	17 (0.16)	32 (0.41)	0.000*
BMI, kg/m^2	23.62 ± 3.41	23.25 ± 3.99	0.523	23.88 ± 3.14	23.40 ± 4.10	0.370
Chronic illnesses, > 5	27 (0.34)	30 (0.32)	0.871	51 (0.48)	42 (0.54)	0.458
Polypharmacy, > 5 prescribed drugs	41 (0.52)	53 (0.56)	0.646	67 (0.64)	51 (0.65)	0.877
ADL	93.33 ± 14.67	88.08 ± 22.89	0.021*	96.20 ± 13.33	93.06 ± 11.77	0.158
IADL	6.44 ± 2.48	5.86 ± 2.55	0.431	5.95 ± 2.34	4.97 ± 2.61	0.341
Constipation	15 (0.19)	33 (0.35)	0.026*	35 (0.33)	30 (0.38)	0.533

(Continues)

TABLE 2 (Continued)

Demographic characteristics % or mean ± SD	Women			Men		
	No insomnia n = 79	Insomnia n = 94	P value	No insomnia n = 105	Insomnia n = 78	P value
Fall	12 (0.15)	24 (0.26)	0.132	12 (0.11)	20 (0.26)	0.017[*]
Chronic pain	40 (0.51)	68 (0.72)	0.004[*]	46 (0.44)	44 (0.56)	0.102
MMSE mean score	24.61 ± 4.74	23.58 ± 5.95	0.196	22.95 ± 5.80	22.86 ± 5.99	0.923
Cognitive impairment						
MNA	11.77 ± 2.44	11.06 ± 2.87	0.085	12.15 ± 2.15	11.05 ± 2.79	0.003[*]
Malnutrition/at risk of malnutrition						

Abbreviations: ADL, activity of daily living; BMI, body mass index; COPD, chronic obstructive pulmonary disease; GDS, Geriatric Depression Scale; IADL, instrumental activities of daily living; MMSE, mini-mental state examination; MNA, mini nutritional assessment.

*P value < 0.05.

Table 2 shows the basic and clinical characteristics, as well as CGA data, for the elderly patients in our study by gender and insomnia status. Significantly more female patients with insomnia than female patients without insomnia suffered from depression (P = 0.021), lower ADL scores (P = 0.021), constipation (P = 0.026), and chronic pain (P = 0.004). Moreover, significantly more male patients with insomnia than male patients without insomnia also suffered from depression (P = 0.001), a recent fall (P = 0.017), and poor nutritional status (P = 0.003).

Table 3 illustrates that compared with male patients, significantly more female patients were widowed (P = 0.001), housemakers (P = 0.000), of low income (P = 0.000), and illiterate (P = 0.000). Furthermore, significantly more female patients than elderly male patients suffered from hyperlipidemia (P = 0.000), chronic pain (P = 0.014), and cognitive impairment (P = 0.033).

3.2 | Multivariate logistic regression analysis

According to the results of the binary logistic regression analysis with adjustment for sex and all other confounding variables, Table 4 shows the factors that were significantly associated with insomnia. These factors included female gender (OR = 2.057, CI = 1.179-3.588, P = 0.011), depression (OR = 1.889, CI = 1.080-3.304, P = 0.026), and chronic pain (OR = 1.779, CI = 1.103-2.868, P = 0.018) were independently predictors of insomnia.

4 | DISCUSSION

In our study, a high number (48.31%) of sleep disturbances was found in the elderly hospitalized patients who had at least one symptom of sleep complaints of DIS, EMA, and DMS. We have identified three factors; female, depression, and chronic pain as significantly associated on multivariate analysis with insomnia. To our knowledge, this is the first study to investigate the relationship between insomnia and all domains of the CGA in the elderly patients. This study is valuable in terms of exploring the factors related to insomnia in hospitalized older patients, as identified by the CGA.

The prevalence of insomnia was higher in women than in men in the present study (54.34% vs 42.62%, P = 0.034). In agreement with our study, previous studies also found that female gender was associated with insomnia.[23] An important factor contributing to this difference is that insomnia can occur in association with hormonal changes that are unique to women, such as those related to menopause or the late luteal phase of the menstrual cycle. Additionally, women are more likely to suffer from major depression and anxiety disorders, which are also associated with insomnia.[24] Similar with other studies, our study also found no association between insomnia and age.[23,25] Although it was dissimilar to some studies, which reported that with age the prevalence of insomnia increased accordingly.[26]

Persistent insomnia affects both physical and mental health.[27] Insomnia increases the risk of mortality, falling down,[28] and depression,[27] and decreases the quality of life[29] in elderly individuals. Depression and insomnia are common psychiatric disorders among elderly people and are reported to be related to several social and health factors.[14] It is reported that insomnia can be a precursor or risk factor of depression and that depression can result in insomnia.[30] Thus, depression and insomnia are independent risk factors for each other. Furthermore, depression is associated with frequent arousals and early morning awakenings that may exacerbate already disrupted age-related sleep patterns.[15]

In agreement with the results of our study, previous studies also found that pain was the predominant factor associated with insomnia.[31] The disruption of sleep can aggravate pain and inflammatory processes, reduce endogenous pain inhibitory responses, and dampen mood and the perception of well-being.[32] Many medical conditions are associated with sleep disruption; these tend to be painful conditions, such as cancers, angina, renal failure, fibromyalgia, arthritis, and musculoskeletal strains. The experimental induction of painful stimuli during sleep can induce micro-arousal and increase wakefulness in otherwise healthy, normal sleeping subjects.[33] Furthermore, accumulating evidence shows that sleep

TABLE 3 Demographic characteristics of the study population according to gender

Demographic characteristics % or mean ± SD	Females n = 173	Males n = 183	P value
Age, y	74.66 ± 7.104	77.8 ± 8.021	0.000*
60-74	86 (0.50)	56 (0.31)	0.000*
75-84	74 (0.43)	92 (0.50)	0.168
> 85	13 (0.07)	35 (0.19)	0.002*
Living arrangement			
Living with others	141(0.82)	163 (0.89)	0.051
Living alone	32 (0.18)	20 (0.11)	
Marital status			
Married	83 (0.48)	128 (0.70)	0.000*
Single / divorced	2 (0.01)	1 (0.01)	0.614
Widow	88 (0.51)	54 (0.29)	0.000*
Work status			
Farmer	6 (0.03)	2 (0.01)	0.164
Retired	145 (0.83)	174 (0.95)	0.000*
No work	22 (0.13)	5 (0.03)	0.000*
Working	0 (0.00)	2 (0.01)	0.499
Monthly income			
< 2000 RMB	28 (0.16)	7 (0.04)	0.000*
2000 RMB+	145 (0.84)	176 (0.96)	
Place of residence			
Rural areas	6 (0.03)	2 (0.01)	0.164
Urban areas	167 (0.97)	181 (0.99)	
Education			
Illiterate	40 (0.23)	4 (0.02)	0.000*
Primary or high school	107 (0.62)	116 (0.63)	0.827
College or university	26 (0.15)	63 (0.34)	0.000*
Smoking	3 (0.02)	60 (0.33)	0.000*
Alcohol	2 (0.01)	26 (0.14)	0.000*
Hypertension	110 (0.64)	120 (0.66)	0.740
Diabetes	53 (0.31)	67 (0.37)	0.262
Coronary disease	35 (0.20)	53 (0.29)	0.065
Hyperlipemia	40 (0.23)	12 (0.07)	0.000*
COPD	11 (0.06)	28 (0.15)	0.010*
Cancer	4 (0.02)	7 (0.04)	0.544
Heart failure	6 (0.03)	4 (0.02)	0.533
Number of patients with GDS ≥ 5	53 (0.31)	49 (0.27)	0.482
BMI, kg/m^2	23.42 ± 3.72	23.67 ± 3.57	0.516
Chronic illnesses, > 5	57 (0.33)	93 (0.51)	0.001*
Polypharmacy, > 5 prescribed drugs	94 (0.54)	118 (0.64)	0.053

(Continues)

TABLE 3 (Continued)

Demographic characteristics % or mean ± SD	Females n = 173	Males n = 183	P value
ADL	94.51 ± 12.57	91.09 ± 18.75	0.046*
IADL	6.14 ± 2.53	5.54 ± 2.49	0.026*
Constipation	48 (0.27)	65 (0.36)	0.139
Fall	36 (0.21)	32 (0.17)	0.500
Chronic pain	108 (0.62)	90 (0.49)	0.014*
MMSE	22.90 ± 5.89	24.17 ± 5.30	0.033*
Malnutrition/at risk of malnutrition	68 (0.39)	67 (0.37)	0.662
Difficulty in initiating sleep	67 (0.39)	54 (0.30)	0.074
Early morning awakening	20 (0.12)	23 (0.13)	0.871
Difficulty in maintaining sleep	18 (0.10)	16 (0.09)	0.719
Snoring	4 (0.02)	2 (0.01)	0.437

Abbreviations: ADL, activity of daily living; BMI, body mass index; COPD, chronic obstructive pulmonary disease; GDS, Geriatric Depression Scale; IADL, instrumental activities of daily living; MMSE, mini-mental state examination.
*P value < 0.05.

deprivation and selective sleep disruption (in particular, slow wave sleep) for no less than three consecutive nights can decrease the pain threshold, amplify negative mood, and produce somatic symptoms mimicking those of fibrositis.[34] Consistent with our research findings, Hidalgo et al reported that there was no statistically significant association that had been found between insomnia and dependence in carrying out basic or instrumental activities.[35] In contrast, some other studies reported that insomnia symptoms were linked to the functional limitations in ADL and related behaviors.[20]

Some limitations to our study must be acknowledged. First, the study group was very heterogeneous in terms of the different diseases and different stages that the subjects faced. This heterogeneity needs to be taken into account when generalizing our findings. The question on their sleep disturbance when patients were in a clear condition of "frailty" (at the hospital) could have affected their perceived sleep quality. Further, this may have exacerbated the results about the prevalence of insomnia in the sample considered. As for the type of question that refers to "insomnia," participants may have been influenced in their answers. In addition, as the present study was a single-institution study, there was the potential for bias. Second, the relatively small number of patients enrolled in this study is also a potential limitation. Third, our results may have some unknown weaknesses because it is known that self-reports (personal statements) may not be as accurate as other methods of data collection.

In conclusion, a significant number of elderly hospitalized patients have insomnia. Our study revealed female sex, depression, and chronic pain were independently predictors of insomnia in

TABLE 4 The risk factors associated with insomnia in the multivariate analysis

Variable	Categories	Multivariate analysis		
		OR	95% CI	P value
Female	Yes or no	2.057	1.179-3.588	0.011[*]
Age, y	≥ 75 or < 75	1.179	0.698-1.992	0.538
Single/widow	Yes or no	0.917	0.524-1.603	0.760
Living alone	Yes or no	1.015	0.475-2.169	0.969
Illiterate	Yes or no	0.946	0.422-2.122	0.893
Smoking	Yes or no	1.252	0.623-2.516	0.529
Alcohol	Yes or no	1.380	0.590-3.228	0.458
Hypertension	Yes or no	0.859	0.506-1.457	0.573
Diabetes	Yes or no	1.061	0.627-1.798	0.824
CAD	Yes or no	1.056	0.603-1.848	0.850
Stroke	Yes or no	0.764	0.451-1.292	0.315
COPD	Yes or no	1.318	0.617-2.812	0.476
GDS	> 5 or ≤ 5	1.889	1.080-3.304	0.026[*]
Chronic illnesses	> 5 or ≤ 5	1.227	0.699-2.156	0.476
Polypharmacy	> 5 or ≤ 5	1.123	0.629-2.003	0.695
ADL, dependent	Yes or No	1.676	0.916-3.065	0.094
IADL	≥ 7 vs < 7	1.611	0.895-2.901	0.112
Constipation	Yes or no	1.107	0.664-1.844	0.697
Fall	Yes or no	1.660	0.903-3.052	0.103
Chronic pain	Yes or no	1.779	1.103-2.868	0.018[*]
MMSE, MCI	≥ 26 or < 26	1.502	0.896-2.516	0.122
MNA	> 12 or ≤ 12	0.967	0.872-1.072	0.520

Abbreviations: ADL, activity of daily living; CAD, coronary artery disease; CI, confidence interval; COPD, chronic obstructive pulmonary disease; GDS, Geriatric Depression Scale; IADL, instrumental activities of daily living; MCI, mild cognitive impairment; MMSE, mini-mental state examination; MNA, mini nutritional assessment; OR, odds ratio.
*P value < 0.05.

hospitalized elderly patients. The CGA provided detailed information about the sociodemographic, behavioral, clinical, functional, and cognitive aspects of older patients and was found to be especially useful for assessing insomnia-associated factors. Early identification of elderly patients with these risk factors of insomnia using the CGA that may improve their quality of life and treatment outcomes.

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CONFLICTS OF INTEREST

Nothing to disclose.

AUTHOR CONTRIBUTIONS

Liu supervised the project and designed the workflow and performed the statistical analysis. Shao, Lai, Zhou, and Ren performed material preparation and data collection. Liu wrote the first draft. Sun prepared the figures. All authors commented on the manuscript. All authors read and approved the final manuscript.

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