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Analysis of Impact Factors Affecting Sleep Quality among Community-Dwelling Elderly Individuals in The Chinese Community in Shanghai

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ABSTRACT

Context: Insomnia is prevalent among elderly individuals and has become a public health problem receiving increasing concern. Low sleep quality is related to a number of negative health outcomes.

Objective: This research aims to investigate the sleep status of community-dwelling elderly individuals (aged 60 years or older) in Shanghai, China, to explore the impact factors affecting sleep quality.

Methods: One street in Shanghai city was randomly selected, and 50% of the elderly residents were randomly selected as participants for a total number of 9,616 people. Investigations were conducted by indoor surveys through home doctors and paper questionnaires. For statistical analysis, univariate and multivariate regression analysis and the Spearman correlation model were performed using SAS 9.4 to analyze the effects of the impact factors on the sleep quality of elderly individuals.

Results: Sleep quality is greatly affected by physical pain in both the elderly individual and the individual's spouse. Healthy elderly people tend to have better sleep quality, and the more chronic diseases an elderly individual suffers, the worse their sleep quality is. In addition, the physical pain of a cohabiting spouse is one of the most significant impact factors influencing sleep quality.

Conclusion: We suggest that community-dwelling elderly people maintain moderate outdoor activities and a healthy mental state, which will improve their sleep quality.

Keywords
Insomnia, Sleeping quality, Pain, Community-dwelling elderly.

Key message
This article describes a cross-sctional study that describes the sleep status of community-dwelling Chinese elderlys, and the impact factors affecting their sleep quality. The results indicate that sleep quality is greatly affected by physical pain in both the elderly individual and their spouse.

Introduction
Insomnia, a type of sleep disorder, is prevalent among elderly individuals and has become a public health problem receiving increasing concern. According to a report on sleep quality in a group of elderly Brazilian individuals by Hara et al. [1], the prevalence rate of mid-stage insomnia among respondents was 29.1%. Canham et al. [2] analyzed HRS data and discovered that among 6,027 elderly people, 37.6% suffer from insomnia, and the rate was higher for Turkish elderly people, reaching 51%. A

multinational cross-sectional study showed that the prevalence of self-reported sleep disorders among 16,680 elderly people ranged from 9.1% (in China) to 37.7% (in India) [3]. Insomnia is also widespread among the elderly Chinese population. Wang et al. [4] reported on the insomnia situation of the homebound elderly in 4 cities in Hubei, China, and the results showed that the prevalence rate of insomnia was 37.5%, and the most common type of sleep disorder was difficulty maintaining sleep. Dai et al. [5] reported on the self-reported insomnia prevalence rate in rural areas in China, and the results showed that the prevalence rate of insomnia was 7.6%, while the prevalence rates of difficulty in starting and maintaining sleep and waking up too early were 5.7%, 7.2%, and 6.8%, respectively.

Low sleep quality is related to a number of negative health outcomes, including depression, chronic disease, pain, etc. For example, Jaussent et al. [6] found that among community-dwelling elderly people, baseline insomnia symptoms and daytime sleepiness can increase the risk of depression independently. Fung et al. [7] analyzed a group of elderly males with an average age of 75.1. The results showed that there was a significant relationship between reduced slow-wave sleep and the risk of hypertension [7]. Syauqy et al. [8] found that among middle-aged and elderly Taiwanese individuals, those with shorter or longer sleeping hours and insomnia symptoms also showed metabolic syndrome indicators, including higher waist circumference, higher blood pressure, lower HDL cholesterol, higher triglycerides, higher fasting blood sugar and higher C-reactive protein levels. Roncoroni et al. [9] analyzed the self-reported sleeping quality of a group of elderly American Hispanic individuals and discovered that people with sleep disorders showed a higher rate of high blood pressure and physical pain and a lower self-assessed rate of happiness. Paudel et al. [10] found that within a group of elderly female individuals, reduced sleeping efficiency and shorter sleep duration are related to a higher risk of hospitalization.

Multiple factors influence insomnia in elderly individuals. Ma et al. [11] analyzed the factors influencing elderly insomnia among 3,045 community-living people aged 60 years or older from Anhui, China. The results showed that elderly individuals with unreliable income, less social contact, less social capital and less solitude were more likely to suffer from insomnia [11]. Zou et al. [12] conducted cross-sectional research in communities in Chongqing, China and discovered that dangerous factors that can lead to insomnia in individuals aged 60 years or older include coronary heart disease, dizziness, chronic pain, anorexia, malnutrition, depression and cognitive decline. Dao-Tran and Seib [13] found that overweight and poor physical health are contributing factors of sleep disorders among elderly Vietnamese individuals. A review by Smagula et al. [14] showed that depression and illness are risk factors for sleep disorders in females.

This research aims to investigate the sleep status of community-dwelling elderly individuals aged 60 years or older in Shanghai, China, analyze the factors influencing sleep status among elderly couples, and propose specifically targeted suggestions.

Methods
Method and Tools
The respondents were community-dwelling elderly individuals aged 60 years or older. The sampling method adopted two-stage sampling. Stage 1 was random sampling, in which 1 community in Shanghai (Jiangning Street Community, Jing'An District) was randomly selected; Stage 2 is cluster sampling, in which 50% of the elderly people living in the selected community were randomly selected as the respondent sample. The research included household surveys that were conducted by family doctors from Aug. to Oct. 2019, and all paper questionnaires from the surveys were collected before Nov. 2019, adding up to 9,616 respondents in total. Figure 1 shows the detailed sampling procedure. The investigation was conducted through paper questionnaires given by family doctors from Jiangning Street Community Health Center. The survey mainly covers general information, including name; gender; education level; living conditions; chronic diseases; physical conditions, including ADL scores, sleeping conditions, and physical pain; and emotions (i.e., anger, agitation, etc.).
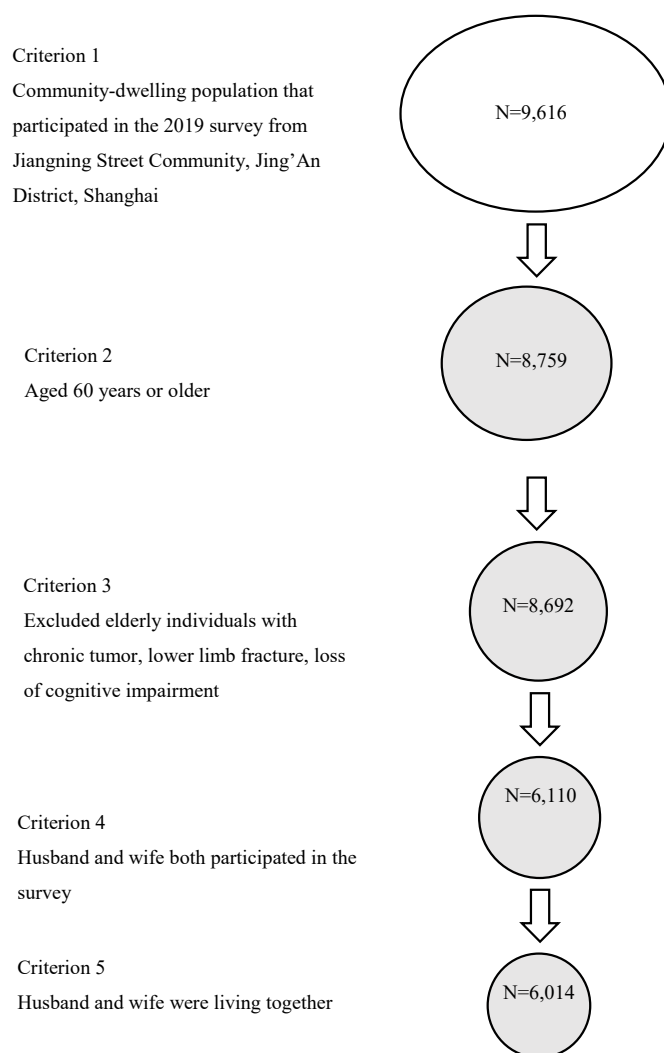

Criterion 1
Community-dwelling population that participated in the 2019 survey from Jiangning Street Community, Jing'An District, Shanghai

N=9,616

Criterion 2
Aged 60 years or older

N=8,759

Criterion 3
Excluded elderly individuals with chronic tumor, lower limb fracture, loss of cognitive impairment

N=8,692

Criterion 4
Husband and wife both participated in the survey

N=6,110

Criterion 5
Husband and wife were living together

N=6,014

Figure 1: Sampling procedure.

This research adopted SAS 9.4 for univariate and multivariate regression analysis of the factors influencing sleep status, and the Spearman correlation model was used to analyze the influence of factors on improvements in the sleep status of elderly individuals. P<0.05 was regarded as statistically significant. Univariate analysis included 8,692 respondents (Criteria 1, 2, and 3), and multivariate analysis included 6,014 respondents (Criteria 1, 2, 3, 4, and 5).

Quality control

Before questionnaires were distributed, all family doctors who participated in the survey were trained by the research team so that they were fully familiar with the survey content. The investigation procedure adopted 3 levels of quality control. Level 1 consisted of self-examination by family doctors who distributed questionnaires and ensured that the respondents' questions and answers matched. Level 2 consisted of a second quality control step conducted by investigators from Jiangning Street Community Health Center who mainly determined whether any information was missing; disqualified questionnaires were sent back for re-examination or to obtain supplementary information. Level 3 consisted of a spot-check of all the collected questionnaires and was conducted by research team members.

Data entry and collation

After the survey was conducted, the research team entered the data and created a preliminary database. To reduce cases of missing and incorrect data during the data entry procedure, team members collated the data to ensure its accuracy, which included (1) correcting or deleting obvious entry errors, i.e., negative values; and (2) supplementing missing data and filling the blanks where data are missing with "NA".

Results

Basic information

In total, 8,692 elderly individuals aged 60 years or older participated in this survey, with 4,276 (49.19%) male and 4,416 (50.81%) female participants. Table 1 shows the basic information of the participants. Most (56.6%) of the elderly individuals were aged 60-69 years; elderly individuals with a senior high school degree comprised the highest proportion (44.56%); over 90% of the elderly individuals were non-solitary. According to ADL scoring, most elderly (89.63%) had normal activities of daily living, over half (64.62%) suffered from at least 1 chronic disease, and about half (51.81%) regarded their sleep quality as fair.

Univariate analysis of the factors influencing sleep quality

Based on the univariate logistic regression model, gender, age, ADL, number of chronic diseases, and physical pain of a respondent or a respondent's spouse were all factors that influenced sleep quality (Table 2). The results show that the sleep quality of females was slightly lower than that of males (OR=1.151, 95% CI: 1.061-1.248). With aging, sleeping quality declines significantly. Compared to the low-age group (60-69 years), the high-age group (80 years or older) and mid-age group (70-79 years) showed OR values for sleep disorders of 3.837 (95% CI: 3.344-4.402) and 1.596 (95% CI: 1.455-1.750), respectively. As the level of disability increased,

sleep quality declined significantly as well. Elderly individuals with chronic diseases had lower sleep quality compared to healthy elderly individuals, and their sleep quality declined as the number of chronic diseases increased. The elderly individual's physical pain condition also had a substantial influence on their sleep quality (OR=8.591, 95% CI: 6.079-12.142). Notably, the physical pain condition of the spouse also had a relatively strong influence on the sleeping quality of the elderly individual.

Table 1: General information.

General Information		Number of population (percentage)
Gender	Male	4276 (49.19%)
	Female	4416 (50.81%)
Age	60-69	4920 (56.6%)
	70-79	2660 (30.6%)
	80 or above	1112 (12.79%)
Education Level	Illiterate	34 (0.39%)
	Primary school	389 (4.5%)
	Junior high	2845 (32.9%)
	Senior high	3853 (44.56%)
	College or above	1526 (17.65%)
Living Condition	Solitary	636 (7.32%)
	Non-solitary	8049 (92.68%)
ADL	Normal (20)	7791 (89.63%)
	Mild disability (12.1-19.9)	763 (8.78%)
	Moderate disability (8.1-12)	104 (1.2%)
	Severe disability (0-8)	34 (0.39%)
Sleep Condition	Very poor	191 (2.2%)
	Poor	264 (3.04%)
	Fair	4498 (51.81%)
	Good	3326 (38.31%)
	Very good	403 (4.64%)
Chronic Diseases	None (0)	3075 (35.38%)
	1	4365 (50.22%)
	2	988 (11.37%)
	3 or above	264 (3.04%)

Table 2: Univariate analysis of factors influencing sleep quality.

Sleep Quality		OR	95% CI	P-value
Gender (high sleep quality)	Male	1	-	-
	Female	1.151	1.061-1.248	0.0007
Age (high sleep quality)	60-69	1	-	-
	70-79	1.596	1.455-1.750	<0.0001
	80 or above	3.837	3.344-4.402	<0.0001
ADL (high sleep quality)	Normal (20)	1	-	-
	Mild disability (12.1-19.9)	3.244	2.771-3.798	0.0001
	Moderate disability (8.1-12)	11.803	7.986-17.444	<0.0001
	Severe disability (0-8)	16.641	8.604-32.189	<0.0001
Chronic diseases (high sleeping quality)	No	1	-	-
	Yes	1.671	1.535-1.820	<0.0001
Number of chronic diseases (high sleeping quality)	None (0)	1	-	-
	1	1.337	1.223-1.461	<0.0001
	2	3.350	2.888-3.885	<0.0001
	3 or above	8.701	6.662-11.363	<0.0001

Physical pain of respondent (high sleeping quality)	No	1	-	-
	Yes	8.591	6.079-12.142	<0.0001
Physical pain of the spouse (high sleeping quality)	No	1	-	-
	Yes	4.406	2.764-7.024	<0.0001

Multivariate analysis of the factors influencing sleep quality

After we incorporated the variables with statistically significant correlations in the univariate regression model into the multivariate logistic regression model (Table 3), the results showed that female sex (OR=1.161, 95% CI: 1.048-1.286), high age (80 years or above) (OR=2.074, 95% CI: 1.701-2.528), severe disability (OR=7.069, 95% CI: 2.095-23.857), chronic disease (OR=7.340, 95% CI: 2.300-23.419), pain of self (OR=2.650, 95% CI: 1.624-4.324) and pain of spouse (OR=2.039, 95% CI: 1.258-3.304) were factors that influenced sleep quality.

Table 3: Multivariate analysis of factors influencing sleep quality.

Sleep Quality		OR	95% CI	P-value
Gender (high sleep quality)	Male	1	-	-
	Female	1.161	1.048-1.286	0.0042
Age (high sleep quality)	60-69	1	-	-
	70-79	1.473	1.315-1.649	0.738
	80 or above	2.074	1.701-2.528	<.0001
ADL (high sleep quality)	Normal (20)	1	-	-
	Mild disability (12.1-19.9)	1.913	1.546-2.366	0.1898
	Moderate disability (8.1-12)	2.673	1.386-5.158	0.7647
	Severe disability (0-8)	7.069	2.095-23.857	0.0239
Chronic diseases (high sleep quality)	No	1	-	-
	Yes	7.340	2.300-23.419	0.0008
Number of chronic diseases (high sleep quality)	None (0)	1	-	-
	1	0.159	0.050-0.506	<.0001
	2	0.333	0.102-1.083	0.5674
	3 or above			
physical pain of oneself (high sleep quality)	No	1	-	-
	Yes	2.650	1.624-4.324	<.0001
physical pain of the spouse (high sleep quality)	No	1	-	-
	Yes	2.039	1.258-3.304	0.0038

Factors that improve the sleep condition of elderly individuals

To investigate the factors that improve the sleep quality of elderly individuals, this research adopted the Spearman correlation model to analyze the correlation between the elderly individual's outdoor activity frequency, mental state (anger or agitation, crying for no reason, unrealistic fear or excessive worry) and sleep quality. The results show that sleep quality declined as outdoor activity frequency decreased and negative emotion frequency increased (Table 4). Therefore, moderate outdoor activities and maintaining a healthy mental state can help improve sleep quality in elderly people.

Table 4: Correlation analysis.

Sleep Condition	Correlation Index	P-value
Outdoor activity frequency	-0.23736	<.0001
Outdoor activity frequency (last year)	-0.09320	<.0001
Anger or agitation	-0.14617	<.0001
Crying for no reason	-0.09369	<.0001
Unrealistic fear or excessive worry	-0.10770	<.0001

Discussion

Effect of pain on sleep

Univariate and multivariate analysis of our data show that the physical pain of an elderly individual and the pain of the spouse both significantly influence the sleep quality of the elderly individual (OR=8.591, 4.406, 2.650, 2.039). A literature review reached a similar conclusion that physical pain will cause a negative effect on sleep quality. Tone Blagestad assessed the sleep quality of elderly patients suffering from chronic pain, and the results showed that chronic pain was related to a longer time spent in bed and lower sleep quality, including delayed sleep and low sleep efficiency [15]. Eslami et al. [16] analyzed the relationship between pain level and sleep disorder among community-dwelling elderly individuals with an average age of 78.22 years and discovered that higher pain levels led to worse sleep disorders. Pain, stress and comorbidities were significantly related to sleep disorders in a group of elderly individuals without depression symptoms [16]. Kishimoto et al. [17] evaluated 3,732 Japanese community-dwelling elderly individuals aged 65 years or older, and the results showed that elderly individuals with slight or severe pain were more likely to suffer from sleep disorders than those without self-reported pain symptoms. Dragioti et al. [18] assessed the insomnia severity scale of community-dwelling elderly individuals and discovered that scales in the non-pain group were significantly lower than those in the chronic and subacute pain groups.

Effect of chronic disease on sleep

Research shows that, compared to elderly individuals suffering from chronic diseases, healthier elderly individuals have better sleep quality and that suffering from a greater number of chronic diseases worsens the sleep quality of elderly individuals. Foley et al. [19] evaluated the relationship between chronic disease and sleep disorder among 1,506 community-dwelling elderly individuals. The results showed that depression, heart disease, physical pain, and memory problems were significantly related to insomnia symptoms [19]. Smagula et al. [20] evaluated 10,335 Singaporean community-dwelling elderly individuals and reached a similar conclusion. The results showed that a history of stroke, diabetes, cancer and hip fracture were related to longer sleep duration [20]. Reis. [21] discovered that obesity, hypertension, gastrointestinal disease and hypercholesterolemia were significantly related to short sleep duration among a Portuguese population with an average age of 56.7 years. Resnick et al. [22] suggested that the adverse effects of diabetes on respiratory control might lead to sleep disorders to some extent.

Mutual effects of cohabiting elderly couples' living habits

Research shows that physical pain of an elderly individual's cohabiting spouse is one of the significant influencing factors of the individual's own sleeping condition. When spouses live together, the living habits of husbands and wives mutually influence each other. Harada et al. [23] conducted a study on 72 middle-aged and elderly couples in Japan and found that the sedentary behavior of an individual significantly affected the sedentary behavior of the individual's spouse; the husband's moderate-to-heavy levels of physical activity and walking steps significantly affected the wife's sleep quality. Cobb et al. [24] explored longitudinal changes in physical exercise in 3,261 middle-aged and elderly couples, and the results showed that when the physical exercise index of the wife increased by 1 standard deviation, the physical exercise index of the husband correspondingly increased by 0.09 standard deviation. When the wife's leisure index increased by 1 standard deviation, the husband's leisure index correspondingly increased by 0.08 standard deviation [25]. Falba and Sindelar [26] evaluated the interaction of multiple lifestyles, including smoking, drinking, exercise, cholesterol check, flu vaccine, etc., among middle-aged and elderly couples. The main finding was that one spouse changing from an unhealthy lifestyle to a healthy lifestyle was related to the other spouse's positive behavior [26]. Muller and Shaikh [27] explored the relationship between spouse retirement and individual health behavior in 19 European countries and found that the frequency and intensity of alcohol consumption increased significantly with spouse retirement, while moderate physical activity decreased significantly.

Conclusion

From our research, we found that physical pain (including pain of the individual and of the cohabiting spouse) and chronic disease (whether an individual is sick and the number of diseases) are the major factors influencing the sleep quality of community-dwelling elderly individuals in Shanghai, China. In addition, we also found a decreasing trend of frequent outdoor activity and low-frequency negative mood states associated with cases of poor sleep quality. Therefore, we suggest that community-dwelling elderly individuals maintain a moderate degree of outdoor activities and maintain a healthy mental state to improve sleep quality.

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