Insomnia in Indonesia Older Adults: The Role of Mental Health, Sociodemographic Status, and Physical Function

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Background and Objective   Insomnia can cause impairment in physical, mental, and social functioning, which contributes to considerable healthcare and social challenges. This study aims to investigate various potential associated factors of insomnia among older adults in Indonesia.

Methods   Publicly available data of the fifth wave of the Indonesia Family Life Survey (IFLS-5) was taken cross-sectionally from 2014 to 2015 with a multistage stratified sampling method. This data included 4236 Indonesian older adults aged of 60 and older from all over Indonesia. Numerous social demographic and wellbeing variables that were gathered through assessments and surveys were examined. The evaluation of despair and its contributing components was done using multivariate logistic regression.

Results   Older adults with low education (adjusted odds ratio [AOR]: 1.73, 95% confidence interval [CI]: 1.16−2.60), poor subjective economic status (AOR: 1.52, 95% CI: 1.13−2.05), having low life satisfaction (AOR: 1.46, 95% CI: 1.14−1.87), being self-perceived as unhealthy (AOR: 2.26, 95% CI: 1.80−2.84) or lonely (AOR: 1.77, 95% CI: 1.34−2.35), physically dependent measured by Activity Daily Living (AOR: 1.46, 95% CI: 1.01−1.96), having arthritis (AOR: 1.40, 95% CI: 1.04−1.85) and depression (AOR: 4.14, 95% CI: 3.21−5.33) are associated to insomnia.

Conclusions   Depression has the strongest association to insomnia in elderly. Involving older adults in cognitive and social activities, providing supports for lonely individuals, improving their physical function, prompt treatment of arthritis and symptomatic pain may reduce the risk for insomnia. Early detection and providing mental services including social activities to depressed older adults may also decrease the risk of insomnia.

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Keywords   Older adults; Insomnia; Indonesia; Risk factors; Sleep disturbance.

INTRODUCTION

Insomnia is described as a sleep disorder typified by unhappiness with the quality or amount of sleep in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5). The indications of insomnia must show at least 3 nights per week for at least 3 months [1]. Insomnia symptoms can be difficulty in initiating sleep, maintaining sleep, or early awakenings with the inability to return to sleep [2]. It affects the quality of life negatively, regardless of age and sex. Insomnia can cause impairment in physical, mental, and social functioning, which contributes to considerable healthcare and social challenges [2].

The prevalence of insomnia varies among studies. Older adults, people aged 60 years

and over, who reported insomnia symptoms ranged from 40%−75%, while the prevalence of insomnia ranged from 3%−40% in those over 60 years [2-4]. Aging causes homeostatic and circadian rhythm changes that regulate sleep and wake cycles to diminish, thus increasing the risk of insomnia [2]. Poor sleep quantity or quality in older adults can cause daytime sleepiness and fatigue associated with multiple health, psychological, and social problems [3]. Previous studies showed that older adults with no or little education, with low socioeconomic status, low social capital or engagement, who were living alone, and reporting low spirituality were more likely to report insomnia. Older adults with insomnia also experienced a higher number of chronic health conditions, falls, depression, and cognitive impairment [2,3,5].

Indonesia as the country with the fourth largest population in the world has an estimated 16 million older adults, around 6.1% of the total population. Due to its critical role in sustaining both mental and physical health, sleep has gained particular attention. Yet, the prevalent sleep issues within older persons are made worse by age-related health concerns. This poses many challenges to the country, to maintain healthy aging of the older population and prevent various detrimental effects that result from aging, including insomnia. Poor sleep quality has also been linked to occupational limits in older persons, according to earlier research [6,7]. It is possible that the sleep quality has an impact on cognitive function, which in turn has an impact on one's capacity to carry out everyday tasks. There have not been much study undertaken on the relationship among poor sleep, Activity of Daily Living (ADL), and emotional stress. The results show that ADL may function as a mediator. This study aims to investigate various potential predictors of insomnia, in the hope of providing information for other researchers, clinicians, psychologists, social workers and other formal stakeholder, and anyone that provides care directly or indirectly to older adults, so that action to modify those predictors can be taken.

METHODS

Study Designs and Participants

Publicly available data of the fifth wave of the Indonesia Family Life Survey (IFLS-5) were used. IFLS-5 was taken cross-sectionally from 2014 to 2015 with a multistage stratified sampling method, involving individuals, families, households, and communities. This data included 4236 Indonesian older adults aged 60 and older from different areas in Indonesia.

Ethical Approval

The IFLS surveys and protocols underwent scrutiny and endorsement by Institutional Review Boards (IRBs) in both the United States at RAND Corporation and in Indonesia at the University of Gadjah Mada (UGM) for IFLS-3, IFLS-4, and IFLS-5. The IRBs ensured that all prerequisites for consent concerning older adults were fulfilled and sanctioned prior to commencing the work (available at https://www.rand.org/well-being/social-and-behavioral-policy/data/FLS/IFLS.html).

Measurements

We followed method used by Pengpid et al. [8] and Peng et al. [9].

Insomnia

Insomnia was assessed using 5 items from the Patient-Reported Outcomes Measurement Information System (PROMIS) on sleep disturbance and sleep impairment measures with a total score of 40 [10]. Insomnia was assigned to participants with a score higher or equal to 21.

Sociodemographic characteristics

Age, sex, relationship status, education, place of residence, region, and subjective financial standing were sociodemographic characteristics. Age was classified into 1) 60−69 years, 2) 70−79 years, and 3) ≥80 years. Marital status was classified into 1) married or coinhabiting and 2) never married, separated, widowed, or divorced. Educational status was classified into high educational status if the participant finished education at least on the high school level and low educational status if they finished below that level. The region was classified into 1) Sumatra, 2) Java, and 3) other regions. Subjective economic status was assessed using the question "Please picture a six-step ladder with the lowest people at the bottom and the wealthiest ones at the top. Which financial level are you now at?" with options ranging from poorest (step 1) to richest (step 6), which was classified into poor (step 1 and 2), medium (step 3 and 4), and rich (step 5 and 6). Tobacco use was assessed using questions "Have you ever smoked cigar/cigarettes, smoked self-enrolled cigarettes, smoked a pipe, or chewed tobacco?" with options 1) no and 2) yes, and "Do you still have the habit or have you quit?" with option 1) quit and 2) still have. Tobacco use was classified into 1) never or former and 2) current smoker.

Anthropometric measurements

Heights and bodyweight measurements were obtained using conventional equipment to compute body mass index (BMI), which was then categorised using the Asia Pacific Classification into 1) underweight, 2) normal, and 3) overweight/obese [11].

Sense of well-being and mental health

Life satisfaction was assessed using the question "Please, think about your life as a whole. How satisfied are you with it?" with options ranging from completely satisfied (1) to not at all satisfied (5). This variable was classified into 1) high life satisfaction (option 1 to 3) and 2) low life satisfaction (option 4 to 5). Subjective-health status was assessed using the question "Please,

think about your health. How satisfied are you with it?" with options ranging from very healthy (1) to unhealthy (4), which was classified into 1) healthy (option 1 and 2) and 2) unhealthy (option 3 and 4). Components from the preceding 12 months were used to measure social capital, including participating neighborhood events, volunteering, visiting community meetings, and engaging in religious activities. High social capital was assigned to the participant with participation in at least one of these activities. Loneliness was assessed using a question from the Center for Epidemiologic Studies Depression Scale, 10-item version (CES-D-10), which was "How often did you feel lonely in the past week?" with options ranging from rarely or none (1) to most of the time (4) [12]. Loneliness was classified into 1) no (option 1 to 2) and 2) yes (option 3 to 4). Depression was assessed using items from CES-D-10 with a score higher than 10 was classified into clinical depression [12].

Physical functioning

Functional dependency is assessed by 6 items from the Katz ADL index, which includes items such as feeding, continence, transference, toileting, dressing, and bathing [13]. The Lawton Instrumental Activity of Daily Living (IADL) has 6 components which are handling finance, taking medications, laundry, housekeeping, food preparation, and shopping. ADL and IADL were classified into independent and dependent with having difficulty in at least one of the items indicating dependency [14].

Physical activity was assessed using items from the International Physical Activity Questionnaire short version (IPAQ-S7S) from the question "Do you regularly engage in physical activity?" Classification of physical activity was done based on IPAQ protocol into low, moderate, and high [15]. Falls were assessed using the question "In the last two years, have you ever fallen?" with the classification of 1) no and 2) yes.

Chronic conditions

Chronic conditions were assessed by asking participants if they had received a diagnosis from a healthcare professional for various conditions such as hypertension, diabetes, tuberculosis, chronic pulmonary disease, heart disease, stroke, kidney disease, arthritis, cancer, or high cholesterol. These conditions were then grouped into either 1) "none" or 2) "one or more chronic illnesses." The study did not take into account the treatment status of the participants. Dementia was assessed using items from Telephone Survey of Cognitive Status (TICS) [8]. The items include awareness of date and day of the week, self-reported memory question, subtraction of 7s from 100, immediate and delayed word recall of 10 nouns with a total score of 34. A score below 8 was considered possible dementia.

Statistical Analysis

Frequency analyses were used for descriptive analyses of the sample. We performed binary logistic regression for bivariate analysis to examine the relationship between the dependent variable (insomnia, categorical variable) and each independent variable separately (categorical variable). Subsequently, we carried out multivariate analysis using multivariate logistic regression, focusing on the significant findings (p < 0.2) from the bivariate analysis to calculate the adjusted odds ratio. The results were presented with p values and 95% confidence interval (CI), and a p-value lower than 0.05 was considered significant. The analyses were done using IBM SPSS Statistics, version 22 (IBM Corp., Armonk, NY, USA).

RESULTS

Characteristics of Sample

A total sample of 4236 older adults was collected (Tables 1 and 2). Insomnia was found in 10.5% of participants. Most participants were in the 60−69 years old group (70.3%), followed by 70−79 years old (25.3%) and 4.4% of older adults with an age of 80 and older. The distribution of sex was equal, with slightly more females (50.3%) than males (49.7%). Most of the participants were married or coinhabiting (66.6%). Only 15% of older adults had high education. There were slightly more participants from urban areas (50.8%) and most of them lived on Java (78.2%), followed by Sumatra (12.6%) and other regions outside Sumatra and Java (9.1%). Participants with medium and poor subjective economic status comprised 39.9% and 33.7% of the total population, respectively. Dependent participants measured by ADL and IADL contributed 12.7% and 25.6% of the total population respectively, 33% were overweight/obese and 26% were underweight, 17.8% has low life satisfaction, 34.6% perceived themselves as unhealthy, and 17.7% had low social capital. Loneliness was reported in 11.8% of older adults, 33.5% were smokers, and 16.3% had depression. Almost half of the total participants have one or more chronic conditions (44.9%) (Tables 2 and 3), including arthritis (12.1%), hypertension (27.6%), diabetes (6.7%), tuberculosis (1.0%), chronic pulmonary disease (2.2%), cardiac disease (4.1%), stroke (2.4%), dementia (40.7%), kidney disease (1.5%), cancer (0.6%), and dyslipidemia (6.9%). A total of 47.2% participants had low physical activities, and 12% had experienced falls.

Factors Associated with Insomnia

Bivariate analyses showed that insomnia was significantly associated with being female, having low education, poor self-perceived socioeconomic status, low life satisfaction, being unhealthy, lonely, or dependent, and having one or more chronic conditions and depression (Table 4). Insomnia was not associated with age, marital status, residential status, living region, BMI, social capital, tobacco usage, physical activities, and falls in bivariate analysis (unadjusted).

Older adults with low educational status had 1.73 times (95%

Table 1. Characteristics of Indonesian participants aged 60 or older

Variables	Categories	Frequency (n = 4236)
Age	60−69 yrs	2976 (70.3)
	70−79 yrs	1074 (25.3)
	≥80 yrs	186 (4.4)
Sex	Male	2105 (49.7)
	Female	2131 (50.3)
Marital status	Married/coinhabiting	2820 (66.6)
	Never married/ separated/divorced/ widowed	1416 (33.4)
Education	High	634 (15.0)
	Low	3602 (85.0)
Residential status	Urban	2153 (50.8)
	Rural	2083 (49.2)
Region	Sumatra	535 (12.6)
	Java	3314 (78.2)
	Others	386 (9.1)
Subjective economic status	Rich	1120 (26.4)
	Medium	1690 (39.9)
	Poor	1426 (33.7)
ADL	Independent	3696 (87.3)
	Dependent	540 (12.7)
IADL	Independent	3153 (74.4)
	Dependent	1083 (25.6)
Body mass index	Underweight	1100 (26.0)
	Normal	1739 (41.0)
	Overweight/obese	1397 (33.0)
Life satisfaction	Yes	3481 (82.2)
	No	755 (17.8)
Subjective health status	Healthy	2770 (65.4)
	Unhealthy	1467 (34.6)
Social capital	High	3488 (82.3)
	Low	748 (17.7)
Loneliness	No	3736 (88.2)
	Yes	500 (11.8)
Tobacco use	Never/former	2816 (66.5)
	Yes	1420 (33.5)
Depression	No	3545 (83.7)
	Yes	691 (16.3)
Physical activities	High	950 (22.4)
	Moderate	1286 (30.4)
	Low	2000 (47.2)
Insomnia	No	3793 (89.5)
	Yes	443 (10.5)

Table 1. Characteristics of Indonesian participants aged 60 or older (continued)

Variables	Categories	Frequency (n = 4236)
Falls	No	3728 (88.0)
	Yes	508 (12.0)
Chronic condition	None	2333 (55.1)
	One or more	1904 (44.9)
Arthritis	No	3722 (87.9)
	Yes	514 (12.1)
Hypertension	No	3722 (72.4)
	Yes	514 (27.6)
Diabetes	No	3952 (93.3)
	Yes	285 (6.7)
Tuberculosis	No	4194 (99.0)
	Yes	42 (1.0)
Chronic pulmonary disease	No	4142 (97.8)
	Yes	95 (2.2)
Cardiac disease	No	4061 (95.9)
	Yes	175 (4.1)
Stroke	No	4133 (97.6)
	Yes	103 (2.4)
Dementia	No	2512 (59.3)
	Yes	1724 (40.7)
Kidney diseases	No	4172 (98.5)
	Yes	64 (1.5)
Cancer	No	4209 (99.4)
	Yes	27 (0.6)
Dyslipidemia	No	3946 (93.2)
	Yes	291 (6.9)

Values are presented as n (%). Percentages may not total 100% due to rounding.
ADL, Activity Daily Living; IADL, Instrumental Activity of Daily Living.

CI: 1.16−2.60) higher prevalence of insomnia (Table 4). Poor subjective economic status increased insomnia prevalence1.52 times (95% CI: 1.13−2.05). Being overweight/obese also increased the prevalence of insomnia by 1.31 times (95% CI: 1.02−1.70). Having low life satisfaction (AOR: 1.46, 95% CI: 1.14−1.87), being self-perceived as unhealthy (AOR: 2.26, 95% CI: 1.80−2.84), lonely (AOR: 1.77, 95% CI: 1.34−2.35), and dependent measured by ADL (AOR: 1.46, 95% CI: 1.01−1.96), all significantly increased prevalence of insomnia. Overall, having one or more chronic condition did not increased the prevalence of insomnia, however, additional analysis showed that older adults who had arthritis were also more likely to report insomnia (AOR: 1.40, 95% CI: 1.04−1.85) (Table 5). Depressed older adult had a 4.14 increased prevalence of insomnia (95% CI: 3.21−5.33) compared to older adults who did not have depression.

Table 2. Prevalence of insomnia in Indonesian older adults

Variables	Categories	Prevalence of insomnia	
		No (n = 3793)	Yes (n = 443)
Age	60−69 yrs	2651 (69.9)	325 (73.4)
	70−79 yrs	977 (25.8)	96 (21.7)
	≥80 yrs	164 (4.3)	22 (5.0)
Sex	Male	1908 (50.3)	198 (44.6)
	Female	1885 (49.7)	246 (55.4)
Marital status	Married/coinhabiting	2519 (66.4)	301 (67.8)
	Never married/ separated/divorced/ widowed	1274 (33.6)	143 (32.2)
Education	High	603 (15.9)	31 (7.0)
	Low	3190 (84.1)	412 (93.0)
Residential status	Urban	1932 (50.9)	221 (49.9)
	Rural	1861 (49.1)	222 (50.1)
Region	Sumatra	486 (12.8)	49 (11.1)
	Java	2971 (78.3)	343 (77.4)
	Others	336 (8.9)	51 (11.5)
Subjective economic status	Rich	1042 (27.5)	78 (17.6)
	Medium	1539 (40.6)	150 (33.9)
	Poor	1211 (31.9)	215 (48.5)
Body mass index	Underweight	976 (25.7)	125 (28.2)
	Normal	1573 (41.5)	166 (37.5)
	Overweight/obese	1244 (32.8)	152 (34.3)
Life satisfaction	Yes	3184 (83.9)	298 (67.1)
	No	609 (16.1)	146 (32.9)
Subjective health status	Healthy	2590 (68.3)	180 (40.5)
	Unhealthy	1203 (31.7)	264 (59.5)
Social capital	High	3137 (82.7)	351 (79.1)
	Low	656 (17.3)	93 (20.9)
Loneliness	No	3437 (90.6)	299 (67.5)
	Yes	356 (9.4)	144 (32.5)
Adl	Independent	3351 (88.3)	345 (77.9)
	Dependent	442 (11.7)	98 (22.1)
Iadl	Independent	2864 (75.5)	289 (65.2)
	Dependent	929 (24.5)	154 (34.8)
Tobacco use	Never/former	2528 (66.6)	288 (65.0)
	Yes	1265 (33.4)	155 (35.0)
Depression	No	3324 (87.6)	221 (49.9)
	Yes	269 (12.4)	222 (50.1)
Physical activities	High	846 (22.3)	103 (23.3)
	Moderate	1143 (30.1)	143 (32.3)
	Low	1803 (47.5)	197 (44.5)

Table 2. Prevalence of insomnia in Indonesian older adults (continued)

Variables	Categories	Prevalence of insomnia	
		No (n = 3793)	Yes (n = 443)
Falls	No	3348 (88.3)	380 (85.8)
	Yes	445 (11.7)	63 (14.2)
Chronic condition	None	2121 (55.9)	212 (47.7)
	One or more	1672 (44.1)	232 (52.3)

Values are presented as n (%). Percentages may not total 100% due to rounding.

Table 3. Prevalence of insomnia based on chronic diseases

Variables	Categories	Prevalence of insomnia	
		No	Yes
Arthritis	No	3368 (88.8)	354 (79.7)
	Yes	424 (11.2)	90 (20.3)
Hypertension	No	2767 (73.0)	300 (67.6)
	Yes	1025 (27.0)	144 (32.4)
Diabetes	No	3542 (93.4)	410 (92.3)
	Yes	251 (6.6)	34 (7.7)
Tuberculosis	No	3754 (99.0)	440 (99.3)
	Yes	39 (1.0)	3 (0.7)
Chronic pulmonary disease	No	3710 (97.8)	432 (97.3)
	Yes	83 (2.2)	12 (2.7)
Cardiac disease	No	3643 (96.0)	418 (94.4)
	Yes	150 (4.0)	25 (5.6)
Stroke	No	3702 (97.6)	431 (97.1)
	Yes	90 (2.4)	13 (2.9)
Dementia	No	2271 (59.9)	241 (54.3)
	Yes	1521 (40.1)	203 (45.7)
Kidney diseases	No	3733 (98.4)	439 (98.9)
	Yes	59 (1.6)	5 (1.1)
Cancer	No	3769 (99.4)	440 (99.3)
	Yes	24 (0.6)	3 (0.7)
Dyslipidemia	No	3535 (93.2)	411 (92.6)
	Yes	258 (6.8)	33 (7.4)

Values are presented as n (%).

DISCUSSIONS

Our research showed that the prevalence of insomnia was higher among low educated, unhealthy status, poor, overweight/obese, low self-satisfaction, lonely, dependent, and depressed older adults. Having arthritis was also increase the prevalence of insomnia. Insomnia was found in 10.5% of the total participants. This number was similar to the national survey in India, which was 12.7% in total, 13.2% among women, and 11.9%

Table 4. Multivariate logistic regression analysis of factors associated with insomnia in older adult

Variables	Categories	Bivariate analysis		Multivariate analysis	
		Unadjusted OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Age	60–69 yrs	Reference			
	70–79 yrs	0.80 (0.63–1.02)	0.074		
	≥80 yrs	1.08 (0.68–1.72)	0.741		
Sex	Male	Reference		Reference	
	Female	1.26 (1.03–1.54)	0.022	1.15 (0.93–1.43)	0.208
Marital status	Married/coinhabiting	Reference			
	Never married/separated/divorced/widowed	0.94 (0.76–1.16)	0.562		
Education	High	Reference		Reference	
	Low	2.50 (1.72–3.64)	<0.001	1.73 (1.16–2.60)	0.008
Residential status	Urban	Reference			
	Rural	1.04 (0.86–1.27)	0.673		
Region	Sumatra	Reference		Reference	
	Java	1.14 (0.83–1.56)	0.421	1.19 (0.84–1.66)	0.347
	Others	1.50 (0.90–2.27)	0.057	1.28 (0.81–2.00)	0.289
Subjective economic status	Rich	Reference		Reference	
	Medium	1.30 (0.98–1.73)	0.070	1.16 (0.86–1.56)	0.342
	Poor	2.37 (1.81–3.11)	<0.001	1.52 (1.13–2.05)	0.006
Body mass index	Underweight	1.21 (0.95–1.55)	0.122	1.08 (0.83–1.41)	0.581
	Normal	Reference		Reference	
	Overweight/obese	1.16 (0.92–1.46)	0.208	1.31 (1.02–1.70)	0.038
Life satisfaction	Yes	Reference		Reference	
	No	2.56 (2.06–3.17)	<0.001	1.46 (1.14–1.87)	0.003
Subjective health status	Healthy	Reference		Reference	
	Unhealthy	3.16 (2.58–3.86)	<0.001	2.26 (1.80–2.84)	<0.001
Social capital	High	Reference		Reference	
	Low	1.26 (0.99–1.61)	0.059	1.04 (0.79–1.36)	0.778
Loneliness	No	Reference		Reference	
	Yes	4.65 (3.71–5.83)	<0.001	1.77 (1.34–2.35)	<0.001
ADL	Independent	Reference		Reference	
	Dependent	2.15 (1.69–2.75)	<0.001	1.46 (1.01–1.96)	0.011
IADL	Independent	Reference		Reference	
	Dependent	1.64 (1.33–2.03)	<0.001	1.05 (0.80–1.32)	0.834
Tobacco use	Never/former	Reference			
	Yes	1.08 (0.88–1.33)	0.474		
Depression	No	Reference		Reference	
	Yes	7.13 (5.78–8.79)	<0.001	4.14 (3.21–5.33)	<0.001
Chronic condition	No	Reference		Reference	
	Yes	2.02 (1.57–2.59)	<0.001	1.05 (0.836–1.312)	0.688
Physical activities	High	Reference			
	Moderate	1.03 (0.79–1.35)	0.837		
	Low	0.90 (0.7–1.15)	0.390		
Falls	No	Reference		Reference	
	Yes	1.25 (0.94–1.67)	0.118	0.86 (0.63–1.18)	0.347

OR, odds ratio; CI, confidence interval; ADL, Activity Daily Living; IADL, Instrumental Activity of Daily Living.

Table 5. Multivariate logistic regression analysis of chronic condition and insomnia in older adult

Variables	Categories	Bivariate analysis		Multivariate analysis	
		Unadjusted OR (95% CI)	p-value	Adjusted OR (95% CI)*	p-value
Arthritis	No	Reference		Reference	
	Yes	2.020 (1.570−2.590)	<0.001	1.400 (1.040−1.850)	0.026
Hypertension	No	Reference		Reference	
	Yes	1.138 (1.024−1.265)	0.017	0.97 (0.76−1.23)	0.792
Diabetes	No	Reference			
	Yes	0.930 (0.771−1.121)	0.445		
Tuberculosis	No	Reference			
	Yes	1.204 (0.676−2.145)	0.528		
Chronic pulmonary disease	No	Reference			
	Yes	0.912 (0.668−1.246)	0.564		
Cardiac disease	No	Reference			
	Yes	0.827 (0.666−1.028)	0.087		
Stroke	No	Reference			
	Yes	1.220 (0.674−2.308)	0.512		
Dementia	No	Reference		Reference	
	Yes	1.255 (1.030−1.530)	0.024	1.020 (0.820−1.280)	0.867
Kidney diseases	No	Reference			
	Yes	1.230 (0.764−1.980)	0.395		
Cancer	No	Reference			
	Yes	0.953 (0.524−1.733)	0.875		
Dyslipidemia	No	Reference			
	Yes	0.955 (0.791−1.153)	0.630		

*Adjusted to sex, education, subjective economic status, life satisfaction, health status, loneliness, BMI, ADL, and depression.
OR, odds ratio; CI, confidence interval; BMI, body mass index; ADL, Activity Daily Living.

among men [16].

Age, marital status, and residential status were not found to be risk factors for insomnia in our study, but sex was. Studies by Dangol et al. [17] and Pengpid and Peltzer [16] also showed no significant association between sex and insomnia, however, difficulty in initiating sleep was more prevalent in females compared to males. Other studies showed that the risk of insomnia increased with age, being female, being divorced, widowed, or not married at all [4,5]. Study by Akberzie and Kataria [18] found that, the risk raised to 73% for adults above 65 years old. After menopause, levels of estrogen and progesterone vary, which has a significant impact on how well older women sleep. Women were found to be more at risk due to being more prone to depressive states, stressful events, and psychological distress [19]. A study by Pengpid and Peltzer [16] indicates that older adults who lived in urban areas were protected against insomnia compared to those living in rural areas.

Older adults with low education had raised the probability of insomnia in this research, which is similar to several other studies [4,17]. The possible mechanisms are having a better income which is associated with access to healthcare and medi-cation, having better skills at problem-solving, good networking, and a better position (with more control and less stress) in society, but after adjusting for several of these covariates, low education still independently increased the risk of insomnia [3]. Poor economic status was also an independent risk factor for insomnia in our study, concurrent with the result from Ma et al. [20]. Older adults with low life satisfaction were more likely to report insomnia in our study, which is similar to the Nepali study done by Khagi et al. [21]. However, the study by Pengpid and Peltzer [16] showed that there were no associations between both variables.

Being self-perceived as unhealthy increased older adults' risk of insomnia in our study, where 68.3% of self-perceived healthy older adults reported having no insomnia compared to only 31.7% of self-perceived unhealthy older adults. Although there is less proof, research have shown that the quality of sleep has a better correlation with medical status than does sleep length [22]. Nevertheless, only 2 research studies tried to evaluate the effects of sleep along with other major lifestyle variables in regards to health status. These investigations encompassed all of the significant modifiable risks found by the WHO, including

smoking, alcohol consumption, food, and physical activity [23,24]. Social capital did not show significant association in our study, but loneliness did increase the risk of insomnia independently. This may be explained by the mechanism of insomnia in loneliness not only be related to fewer social engagements, but that other mechanisms may play a significant role, such as psychological perception of loneliness [25]. Multiple studies have also shown that insomnia and loneliness are associated, even after adjusting for anxiety and depressive symptoms, and have a cyclical relationship (e.g., loneliness worsens insomnia and vice versa) [25,26]. Loneliness affected insomnia independently despite adjustment for depression and social capital. Mental health services and an increase in social and family engagements may alleviate the feeling of loneliness, thus decreasing the risk of insomnia [27].

We found that physical disability measured by ADL showed significant associations with insomnia, which is similar to several other studies [16,28]. The association between insomnia and physical disability may also be modified by the tools used in assessing insomnia. In a study by Chien and Chen [29], insomnia assessed by PSQI (which has wider definitions and criteria) showed a significant association with physical disability, but when stricter criteria based on DSM-IV or DSM-5 were used, the association was not found. A study by Spira et al. [30] showed that physical disabilities measured by ADL did not have a significant association with insomnia, but IADL did. The possible mechanism behind those findings was that disturbed sleep can lead to fatigue and daytime sleepiness, and then cause functional impairment, especially on complex tasks.

Insomnia was found to be more prevalent in older adults with depression and two meta-analyses also had similar results, with early insomnia specifically being more associated with depression [31,32]. In many demographics and medical contexts, medical problems like physical sickness, anxiety, and some serious sleep disorders like restless legs syndrome and obstructive sleep apnea are also linked to or comorbid with sleeplessness [33]. An enhanced activation of REM sleep pathways may provide an explanation for the link among poor sleep quality, depression, and anxiousness [34]. Results imply that ADL had a significant mediation influence on the association among poor sleep quality and emotional distress, which is in line with results from earlier research [35]. According to this research, the more severely older persons' observed sleep quality was poor, the more severely their bodily functions were restricted, and thus, the more severely their psychological discomfort was severe. Poor sleep has a negative impact on both the emotional and physical aspects of life, which is one plausible reason. ADL limits in older people make them less prone to be capable of taking care of and maintain oneself, which can have an adverse psychological effect. Older people's mental health was severely impacted by long-term adverse psychological experiences including remorse and worthlessness [36]. The interplay between depres-

sion, subjective health status, life satisfaction, and insomnia is complex and often bidirectional, with each factor influencing and being influenced by the others. The strong association between both variables may be related to the fact that difficulty to sleep is part of the depression assessment questions of the CES-D-10 we used. Numerous theories have been put forth to describe the data of how anxiety affects sleep, such as the control of inflammatory, the impact of environmental and social variables, and the role of biological and hereditary variables [32]. A study by Cheng et al. [37] found that in this overall population, the structural connectivities among the temporal cortex, angular gyrus, precuneus, cingulate cortex, and the lateral orbito-frontal cortex were linked with depressive problems scores. It is intriguing to investigate potential brain processes that might influence the link among depression and insomnia because there is a biological factor to the link. The anterior cingulate cortex has been identified as an area in which genetic mutations that control circadian rhythms are emotional dysregulation in depressive episodes and in which nerve cells raise their action during bedtime and disconnection from activities. It has also been demonstrated sleep deprivation impacts brain structures that are associated in emotion, such as the amygdala [38]. Arthritis was associated significantly with insomnia, which was similar to other study [39]. This association might be mediated by pain and physical limitations that are often found in people with arthritis.

Being underweight, tobacco use, engaging in physical activities, and experiencing falls did not show any significant association to insomnia after adjusting for other covariates in our study, while being overweight/obese did. Different from our findings, Pengpid and Peltzer [16] and Soysal et al. [40] showed that being underweight or malnutrition in older adults (but not obesity) was associated with insomnia. The meta-analysis by Chan et al. [41] also concluded that obesity did not have a significant odds ratio for insomnia. Regarding physical activities, studies by Endeshaw and Yoo [42] and Chen et al. [43] showed that engaging in physical activities improves sleep and decreased the risk of insomnia, which was different from our findings. The difference of our results might be explained by several factors. A study by Tsunoda et al. [44] showed that the increase of exercise intensity did not necessarily improved sleep quality of older adults. There are subjective and objective sleep measures and the relationship between these measures were only modest [45,46]. A study by Melancon et al. [46] showed that improvement in objectively measured sleep outcomes does not increase the subjective measure of the population of older adults. Over time, the natural shifts in sleep patterns that come with aging could lead older individuals to adjust how they perceive the quality of their sleep, often without acknowledging the disturbances in their sleep patterns [47]. Several mechanisms could play a role in these findings, e.g., 1) engaging in outdoor physical activities acts as photic stimuli for circadian timing system,

2) improves emotional function, and 3) increases the need for sleep due to energy stores depletion [42,43]. It may be that leisure (e.g., moderate exercise) or occupational physical activity (e.g., exhaustion and hard physical labour with poor nutrition) should be distinguished to show different effects on sleep. Chen et al. [48] showed that leisure-time acitivty, but not domestic or work-related physical activity, was associated with decreased risk of insomnia. Currently, it remains uncertain why engaging in physical activity as a recreational pursuit, rather than domestic or work-related tasks, demonstrates a predictive influence on insomnia. Engaging in leisure activities might elevate mood, offering a greater sense of enjoyment, satisfaction, and distraction from stress. Previous studies have suggested that increased participation in leisure activities correlates with enhanced well-being, improved quality of life, and reduced symptoms of depression [49]. Consequently, this may contribute to better sleep patterns.

The strength of our study is that we provided analysis largest community-based data of older adults in Indonesia. We hope to provide insights and general characteristics of older adults, which represent Indonesian population, not just one region. The limitations of our study were that most of the data were self-reported data, which can create bias in the study and as cross-sectionally collected data, we could not determine the causality of those predictors. This includes assessment of insomnia, which is subjective measurement. The prevalence of insomnia may vary between studies depending on the tools that the researcher used for assessment. Involving older adults' cognitive and social activities, providing social support for lonely individuals, improving their physical function, prompt treatment of arthritis with occupational therapy to overcome limitations and reduction of symptomatic pain may reduce the risk for insomnia.

Early detection and provision of mental health services to depressed older adults may also decrease the risk of insomnia. Our findings regarding age, sex, marital status, residential status, living region, BMI, social capital, tobacco use, physical disability measured by IADL, physical activities, and falls may not show any significant results, but the relationship of insomnia and those variables need to be explored further (future directions).

Availability of Data and Material
Data employed in this study are publicly available by registering request at RAND (https://www.rand.org/well-being/social-and-behavioral-policy/data/FLS/IFLS.html).

Author Contributions
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Conflicts of Interest

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