Journal of Psychosomatic Research 182 (2024) 111669

Contents lists available at ScienceDirect

Journal of Psychosomatic Research

journal homepage: www.elsevier.com/locate/jpsychores

Association of nightmares with cardio-cerebrovascular disease, hypertension and hyperlipidemia in older adults: A population-based cross-sectional study

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ARTICLE INFO

Keywords:
Nightmares
Nightmare disorder
Cardio-cerebrovascular disease
Hypertension
Hyperlipidemia
Risk factor
KoGES

ABSTRACT

Objective: This cross-sectional study investigated the relationship of nightmares with cardio-cerebrovascular disease (CVD), hypertension and hyperlipidemia which are major preceding diseases of CVD in older adults.
Methods: Participants (n = 2824; mean age 63.6 ± 6.6 years, females 49.3%) completed the Disturbing Dream and Nightmare Severity Index (DDNSI), which was used to divide the sample into either the Nightmare or Non-Nightmare group (cut-off score ≥ 10). Demographic information, history of CVD (cerebrovascular disease, myocardial infarction, congestive heart failure, coronary artery disease, and arrhythmia), hypertension, hyperlipidemia, and self-report questionnaires about stress (Perceived Stress Scale), depression (Beck Depression Inventory), sleep quality (Pittsburgh Sleep Quality Index), and insomnia symptoms were also collected.
Results: Among the sample, 379 participants (13.4%) reported experiencing nightmares more than once a year, and 73 participants (2.6%) were classified as having nightmare disorder based on DDNSI scores (≥10). 11.3% of participants (n = 319) reported having more than one CVD. Approximately half of the participants reported a history of hypertension (52.1%, n = 1471) and hyperlipidemia (47.7%, n = 1346). Logistic regression analysis indicated the Nightmare group was 2.04 times at higher risk for hyperlipidemia (OR = 2.04, 95% CI 1.22–3.40, p = .006) after controlling for covariates compared to the Non-Nightmare group. Although non-significant, there was a trend toward a higher risk of hypertension in the Nightmare group (OR = 1.67, 95% CI 0.99–2.84, p = .056).
Conclusions: Results of this study indicate frequent nightmares in older adults may be associated with hyperlipidemia, which are risk factors for CVD. Further studies are needed to explore nightmares' directionality and health consequences in an aging population.

1. Introduction

Nightmares are extremely vivid and unpleasant repeated dreams that accompany arousal during sleep [1]. The prevalence of experiencing nightmares once a week is 2–6% in the general population [2–6]. Nightmares are generally experienced more frequently in childhood [7], with frequency decreasing as individuals age [8–12]. Hence, there have been few studies of nightmares that have been conducted in older samples, and little is known about the prevalence or health consequences of nightmares in this population. Nightmares are accompanied by autonomic arousal responses such as sweating, heart palpitations, and tachypnea. Although the physiological mechanisms of nightmare development are not clearly known, some studies have suggested that nightmares are associated with autonomic dysregulation in rapid eye movement (REM) sleep based on polysomnography (PSG) [13–16]. So far, studies investigating the effects of nightmare distress in old age have focused primarily on its effect on sleep or mental health, such as insomnia and suicide [17–21].

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https://doi.org/10.1016/j.jpsychores.2024.111669
Received 8 December 2023; Received in revised form 4 April 2024; Accepted 13 April 2024
Available online 21 April 2024

Cardio-cerebrovascular disease (CVD) refers to diseases of the blood vessels and heart. A few studies have tried to find out the relationship between nightmares and CVD. A large cohort study by Sandman and colleagues reported that nightmares were associated with frequent headaches, hypertension, arthritis, and other physical symptoms, but the effect size was statistically small [22]. A more recent study by Campbell and colleagues (2023) reported frequent and/or severe nightmares were significantly associated with hypertension and heart problems after adjusting for PTSD diagnoses and other covariates in veterans [23].

While there haven't been direct reports of the association between nightmares and CVD, there is some evidence that sleep disturbance is associated with CVD in old adults. Sleep structure changes with aging, which leads to decrease in total sleep time. Sleep deprivation accompanying aging results in decreased slow-wave sleep, sleep quality and sleep efficiency [24,25]. Previous studies have suggested that sleep deprivation and decreased slow-wave sleep in old age increase blood pressure and the risk of hypertension [26]. Additionally, low sleep quality resulting from sleep deprivation is associated with higher risk of hypertension, heart disease, and coronary arterial heart disease [27–29]. For example, insomnia symptoms have also been found to be a risk factor for hypertension [30].

Nightmares can also cause sleep disturbance. Previous studies have demonstrated that questionnaire-based nightmares are associated with sleep disturbance, including insomnia symptoms (initiating sleep, maintaining sleep and early awakenings), daytime sleepiness, impaired sleep quality and decreased total sleep time [3,31–33]. While not conducted in a sample consisting of older adults, a previous study by Li and colleagues (2010) found that insomnia symptoms, sleep-disordered breathing symptoms, and sleep-related daytime consequences were significantly associated with nightmare frequency. Specifically, based on nightmare frequency (1–2 times per month, 1–2 times per week, and >3 times per week), there was increasing likelihood of insomnia (odds ratio 1.21, 1.31, 1.38, respectively). Also, a study by Simor and colleagues (2012) indicated increased wakefulness, nocturnal awakenings and reduced sleep efficiency in participants reporting nightmares at least once per week based on polysomnography [15]. While the association between nightmares and sleep disturbance is complex, frequent nightmares may cause nocturnal awakenings that eventually, over time, are conditioned with the bed and can develop into insomnia. Additionally, individuals with nightmares may be reluctant to sleep to avoid nightmares. Additionally, insomnia and nightmares may share a common component of hyperarousal that may increase vulnerability to both conditions and increase likelihood of sleep disturbance [3,15,32,34].

Considering the relationship between autonomic arousal, sleep, and nightmares, there may be an association between frequent nightmares and CVD in older adults. According to previous studies, the prevalence of non-communicable diseases like heart disease, cerebrovascular disease or diabetes increases after 55 years of age [35]. We thus set the age cutoff at 55, following previous studies that have categorized 55-year-olds as young- old [36,37]. Therefore, this study aimed to explore the relationship between nightmares and CVD in an older population aged 55 and over, recruited from a large-scale population-based cohort study. The narrow definition that refers to ischemic heart disease (myocardial infarction, angina pectoris) and cerebrovascular disease (stroke) were used, but pre-conditions like hypertension, hyperlipidemia, and atherosclerosis using the broad definition were also included [38].

2. Method

2.1. Participants

Data for this study were collected from the Korean Genome and Epidemiology Study (KoGES), an ongoing community-based cohort study in Korea conducted biennially from 2001. As the cohort study focused on longitudinal effects of aging, data of aged 55 or under was not collected. The current study used data from 2017 to 2018, the 8th follow-up survey (Exam 9) of nightmares was first collected. Among 2951 people recruited for the original cohort, this study was conducted on 2824 people aged between 55 and 85, excluding those who did not respond to the nightmare questions and those under the age of 55 (Appendix A Supplementary data).

Before participation in the cohort study, participants signed an informed consent form to participate in the study approved by an institutional review board of Korea University Ansan Hospital. This study was additionally approved by an institutional review board of Sungshin Women's University.

2.2. Sociodemographic factors

Participants completed five questions about gender, age, employment status, monthly household income and marital status, and lifestyle habits including alcohol consumption, smoking status, and exercise. Participants were asked about their current employment status (“employed” or “unemployed”). Monthly family income was recorded in 500,000 KRW (approximately 380 USD) increments for each tier. Marital status was divided into 2 categories, married or unmarried (single, divorced, separated, bereaved, cohabitating, and others).

For lifestyle habits, all participants were asked to answer whether they have ever consumed alcohol in the past, responding “yes” or “no”. Participants who answered yes to this question were further queried about how long they have been consuming alcohol (duration), the type of alcohol consumed in the past year, the average number of times consumed, and the amount of alcohol consumed in one setting. Total alcohol consumption was calculated as grams per day by calculating alcohol concentration and amount of consumption of each type of drink. Participants with 15 g or more alcohol consumption were defined as the ‘heavy drinking group’ [39,40], and those whose alcohol consumption is <15 g were categorized as the ‘normal group’. Smoking status was divided into three groups: never smoker, past smoker, and current smoker. For exercise, exercise was operationally defined as ‘regular exercise resulting in body sweat’; the exercise variable was dichotomized based on whether they exercised regularly or led a sedentary lifestyle.

2.3. Nightmares

The Disturbing Dream and Nightmare Severity Index (DDNSI) was developed to evaluate sleep problems and nightmare experiences of trauma survivors by Krakow and colleagues [41], and validated in Korean by Lee and colleagues [42]. Among the 5 items of DDNSI, two questions measure the frequency of nightmares which are nights of nightmares per week and the number of nightmares per week. An additional three questions address awakenings due to nightmares, and the severity and intensity of nightmare problems. The total score ranges from 0 to 37, and scores ≥10 correspond to clinical levels of nightmares, or nightmare disorder [43]. Internal consistency (Cronbach's α) of the DDNSI in this study was 0.909.

2.4. Sleep quality

The Pittsburgh Sleep Quality Index (PSQI) developed by Buysse [44], and validated in Korean by Sohn, Kim, Lee, & Cho was used in this study [45]. This scale consists of seven subscales: subjective sleep quality, sleep onset latency, sleep duration, sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. Consisting of 18 questions, with a total score of 0 to 21, a higher score reflects lower sleep quality [44]. In this study, the internal consistency (Cronbach's α) was 0.699.

2.5. Insomnia symptoms

Three items asking about "difficulty in sleep onset", "difficulty in maintaining sleep", and "early awakening," were used to measure insomnia symptoms [1]. If participants answered that they were experiencing these symptoms, frequency per week was also measured. Participants who responded to experiencing one or more of the three symptoms of insomnia at least three times a week were classified as being in the insomnia group.

2.6. Cardio-cerebrovascular disease (CVD)

Participants were asked questions about treatment or diagnosis history to determine the type of 5 diseases of CVD which were myocardial infarction, congestive heart failure, coronary artery disease, arrhythmia, and cerebrovascular disease (stroke). In addition to the above conditions, hypertension and hyperlipidemia was also answered. Two questions were used to determine presence of disease: "Have you been diagnosed with an illness?" and "Have you received treatment for an illness?" Participants responded with "yes or no," and if they answered "yes", they were also asked about the corresponding disease in which they either received diagnosis and/or treatment. In this study, CVD and risk factors were classified into CVD, hypertension, and hyperlipidemia.

2.7. Depression

The Korean version of the Beck Depression Inventory was used to measure depressive symptoms [46]. This scale consists of 21 questions for evaluating depression and behavior over the past two weeks, with a total score of 0 to 63. Higher scores reflect higher levels of depression [47]. The internal consistency coefficient (Cronbach's α) in this study was 0.874.

2.8. Stress

The Perceived Stress Scale (PSS) developed by Cohen et al. (1983) was used to measure perceived level of stress [48]. This scale consists of 10 questions for evaluating the level of perceptive stress experienced in daily life over the past month with a total score of 0 to 40, indicating that the higher the score, the higher the level of perceived stress. Internal consistency (Cronbach's α) in this study was 0.741.

2.9. Data analysis

Statistical analysis in this study was performed using SPSS 23.0 version (IBM Corp., Armonk, NY, USA). Descriptive analyses were presented in frequencies and percentages for the categorical variables including demographic characteristics and prevalence of nightmares, and the mean and standard deviation (SD) for continuous variables.

Binomial logistic regression was used to determine the effects of nightmare disorder on CVD and risk factors. Participants were divided into two groups, the Nightmare group and Non-Nightmare group, based on the DDNSI cut-off point (≥10). Nightmare group (Nightmare group/Non-Nightmare group) was entered as an independent variable and the presence/absence of each disease (CVD, hypertension and hyperlipidemia) as a dependent variable.

Multiple logistic regression was conducted with three models as some of the covariates in the fully adjusted model could be mechanisms rather than cofounders. The first model was presented as a crude model without covariates. In the second model, sociodemographic characteristics (age, gender) were entered as covariates. In the third model, a fully adjusted model was presented with lifestyle habits (smoking, exercise, alcohol consumption), psychological variables (depression, and stress), and insomnia added as additional covariates. An adjusted odds ratio with 95% CI was presented.

3. Results

3.1. Basic characteristics of study participants

A total of 2824 individuals' (females 48.9%) mean age was 63.6 years (SD = 6.6, age range 55–85). 11.3% of participants ($n = 393$) reported having more than one CVD. Participants who reported one or more of the three symptoms of insomnia at least three times a week accounted for 17.1% ($n = 483$). Among the participants, 13.4% ($n = 379$) reported experiencing nightmares more than once a year. Additionally, 73 participants (2.6%) were categorized into the Nightmare group based on their DDNSI score (≥10). This information is presented in Table 1.

3.2. The relationship between the nightmares and CVD and risk factors in older adults

Results from logistic regression analysis indicated the Nightmare group was 1.9 times (OR = 1.91, 95% CI 1.16–3.13, $p = .010$) at higher risk for hypertension in a univariate model. After controlling for covariates, there was a higher risk for hypertension after controlling for sociodemographic factors in model 2, and a significant trend in model 3 after additionally controlling for lifestyle habits and psychological variables.

The Nightmare group was at 2.04 times (OR = 2.04, 95% CI 1.22–3.04, $p = .006$) higher risk for hyperlipidemia compared to the Non-Nightmare group in the fully adjusted model. A significant relationship between nightmares and CVD was not found (Table 2).

4. Discussion

This study investigated the association of nightmares with CVD and its preceding disease (hypertension and hyperlipidemia) in the older population in a population-based cohort study. Few studies have investigated health consequences of nightmares, especially in older adults. Results indicated that individuals with clinical levels of nightmares were at elevated risk for hyperlipidemia after controlling for covariates.

4.1. Prevalence of nightmares and CVD

There was a 2.6% prevalence in our sample for individuals who met criteria for nightmare disorder based on a standardized questionnaire (DDNSI). This is comparable to previous studies that have reported prevalence of nightmares in the general adult population to be 2.4–5.1% [3,5,49,50], indicating nightmare prevalence of older adults is not lower (or higher) than the general population. One of the main strengths of our study was the inclusion of a standardized questionnaire to measure nightmares. The criteria for defining and diagnosing nightmares vary from study to study [17], and most large population-based studies limited the measurement of nightmares through a single question measuring nightmare frequency [3,5,6]. In this respect, this study utilized the DDNSI, a standardized questionnaire reflecting nightmare frequency and severity, resulting awakenings, and intensity of nightmares.

4.2. Relationship between nightmares and CVD in older adults

In our study, the Nightmare group was 1.67 times more likely to have hypertension and 2.04 times more likely to have hyperlipidemia compared to the Non-Nightmare group after adjusting for covariates. This is similar to results found in a study of Campbell and colleagues (2023) that investigated the association in veterans. In this study, having frequent, severe, or frequent and severe nightmares were associated with elevated risk for hypertension (OR 1.42, OR 1.56, and OR 1.47, respectively), and heart problems (OR 1.43, OR 1.48 and OR 1.59, respectively). Considering that hypertension and hyperlipidemia is a

Table 1
Characteristics of participants ($N = 2824$).

Classification			n (%) or M (±SD)
	Total		2824
Demographic information	Gender	Male	1442 (51.1)
		Female	1382 (48.9)
	Age*		63.6 (±6.6)
	Marriage**	Not married	367 (13.0)
		Married	2457 (87.0)
	Occupation	Employed	1612 (57.1)
		Unemployed	1212 (42.9)
	Monthly family income***	< 500	146 (5.2)
		500 to 1000	179 (6.3)
		1000 to 1500	170 (6.0)
		1500 to 2000	227 (8.0)
		2000 to 3000	490 (17.4)
		3000 to 4000	499 (17.7)
		4000 to 6000	592 (21.0)
		≥ 6000	521 (18.4)
Lifestyle habit	Regular exercise	Irregular	1232 (43.6)
		Regular	1592 (56.4)
	Smoking	Non-smoker	1721 (60.9)
		Past- smoker	821 (29.1)
		Smoker	282 (10.0)
	Alcohol	Normal	2327 (82.4)
		Heavy drinker	487 (17.6)
Sleep factors	Insomnia symptoms	No	2341 (82.9)
		yes	483 (17.1)
	Sleep quality (PSQI)		4.0 (±3.1)
Psychological factors	Depression (BDI)		6.2 (±6.2)
	Stress (PSS)		15.0 (±4.3)
Nightmares	Nightmare frequency	Weekly	70 (2.5)
		Monthly	71 (2.5)
		Annually	238 (8.4)
		None	2445 (86.5)
	DDNSI	Overall	0.6 (± 3.0)
		Nightmare group	73 (2.6)
		Non-nightmare group	2751 (97.4)
Cardio-cerebrovascular disease (CVD)	Hypertension	Hypertensive group	1471 (52.1)
		Healthy group	1353 (47.9)
	Hyperlipidemia	Hyperlipidemia group	1346 (47.7)
		Healthy group	1478 (52.3)
	Cardio-cerebrovascular disease	Heart disease: Myocardial infarction	187 (6.6)
		Heart disease: Congestive heart failure	54 (1.9)
		Heart disease: Coronary heart disease	3 (0.1)
		Heart disease: Arrhythmia	96 (2.0)
		Myocardial infarction	55 (1.9)
		Cerebrovascular disease	147 (5.2)
		Healthy group	2505 (88.7)

Abbreviation: PSS = Perceived Stress Scale; BDI = Beck Depression Inventory; PSQI = Pittsburgh Sleep Quality Index; DDDNSI = the Disturbing Dream and Nightmare Severity Index.

* Age range was 55–85 years.

** Marriage was determined by having a current spouse.

*** Income was measured in 1000 Korean Won.

major risk factor of CVD and also part of the broader concept of CVD, our results expand the association between nightmares and cardio-cerebrovascular disease to older adults in the general population.

While there have been few studies investigating the relationship between nightmares and CVD, there are a few possible mechanisms that may explain this association. First, changes in the autonomic nervous system caused by nightmares may directly cause CVD. Autonomic imbalance, characterized by excessive arousal of sympathetic neural activities and decreased parasympathetic neural activities [51], are generally measured by indicators such as resting heart rate (RHR), heart rate variability (HRV), and heart rate recovery (HRR) [52]. A study examining the difference of changes in autonomic nerve using PSG brainwaves during non-REM and REM sleep between Nightmare and Non-Nightmare groups found that the Nightmare group showed overall decreased HRV levels, reflecting decreased parasympathetic tone [53], increased alpha-wave and excessive arousal of sympathetic neural responses using EEG [14]. In particular, previous study has shown that an increase in sympathetic nerve activity leads to an increase in catecholamine concentration in the blood. And via compensatory mechanisms, the continuous increase in catecholamine concentration could lead a decrease in beta-adrenergic receptor responsiveness, and which is associated with CVD such as heart failure [54]. This indicates that frequent awakenings during sleep due to frequent and chronic nightmares may cause continuous autonomic imbalance, which is risk factor of CVD.

Second, changes in sleep due to nightmares may indirectly increase risk of CVD. In particular, repeated nightmares are reported to be related to various sleep problems such as frequent awakening during sleep [31,55,56], insomnia with difficulty initiating sleep and difficulty returning to sleep after awakening [18,20,55] which is also related to short sleep time and low sleep quality [3,15,18,57]. Although there have been few studies investigating the relationship between nightmares and CVD, studies have continued to identify the relationship between sleep problems and CVD. According to previous studies, short sleep duration is associated with C-reactive protein, which is known as an inflammatory marker for CVD [58]. Previous studies also have noted the relationship between short sleep duration and other CVD, such as hypertension, coronary heart disease [28,59–62]. Considering research, the possibility of an indirect pathway that sleeping quality, quantity, and traits of sleep structure due to nightmares attributed to CVD could be regarded.

The third possibility is that medications such as antihypertensives may have influenced nightmare symptoms. A previous study that reported a relationship between nightmares and cardio-cerebrovascular

Table 2
Logistic analysis of nightmare and cardiovascular diseases ($N = 2824$).

	Nightmare disorder group					
	Model[b] 1 (OR 95% CI)	p[a]	Model 2 (OR 95% CI)	p[a]	Model 3 (OR 95% CI)	p[a]
Hypertension	1.91 (1.16–3.13)	0.010*	1.70 (1.02–2.85)	0.043*	1.67 (0.99–2.84)	0.056
Hyperlipidemia	2.29 (1.40–3.75)	0.001**	2.09 (1.27–3.43)	0.004**	2.04 (1.22–3.40)	0.006**
Cardio-cerebrovascular disease (CVD)	1.25 (0.64–2.47)	0.512	1.00 (0.50–2.02)	0.994	0.88 (0.43–1.83)	0.738

*$p < .05$.
**$p < .01$.
***$p < .001$.
[a] P-value by logistic regression b.
[b] Model 1: crude; Model 2: adjusted for sociodemographic factors (gender, age); Model 3: adjusted for sociodemographic factors, lifestyle habits (smoking, regular exercise, alcohol consumption), insomnia symptoms, depression (BDI), and stress (PSS).

symptoms such as irregular heartbeats, spasmodic chest pain found that taking medication for cardio-cerebrovascular problems was not attributable to the occurrence of nightmares [63]. However, medication including β-blockers, antihypertensives, and anti-depressants have been reported nightmares as a potential side effect [64–66]. Thus, future studies should thoroughly examine the type and usage of medications, and directionality of medication use and nightmares.

Finally, other sleep disorders such as obstructive sleep apnea (OSA) may explain the association between nightmares and CVD. According to a previous study, patients with OSA have repeated respiratory events during REM sleep, which may increase vulnerability to nightmares [67]. It has been suggested that patients who experience frequent nocturnal awakenings due to recurrent apneas during REM sleep recall more nightmares [68]. Additionally, OSA is a risk factor of CVD, with a meta-analysis reporting 1.7 times increased likelihood of CVD in OSA patients [69]. The literature has also indicated an increasing risk of OSA prevalence with age [70,71], especially a sharp increase in women with the onset of menopause [72,73]. Thus, the possibility that other sleep disorders may have indirectly contributed to the association between nightmares and CVD should also be considered.

In this study, nightmares were significantly associated with hyperlipidemia after controlling for all covariates, but not hypertension or CVD. While not examined closely in this study, we speculate that the activation of the sympathetic nervous system, which leads to increased secretion of catecholamines, and subsequently upregulates lipoprotein lipase production and ultimately increases the concentration of cholesterol and triglyceride may explain the association between nightmares and hyperlipidemia [74]. However, it is unclear why nightmares were associated with hyperlipidemia specifically, and not hypertension or CVD. This could partially be explained by the small sample size of the disease (319 out of 2824, 11.3%) which could not sufficiently represent prevalence of the disease. Also, considering the nature of the cohort study, there is a possibility that a bias existed with follow-up data, with drop-out rates of participants with heart disease being higher compared to participants with hypertension or hyperlipidemia. This is a possibility since the prevalence of all-cause heart disease included this study (myocardial infarction, congestive heart failure, coronary artery disease, and arrhythmia, stroke) had lower prevalence rates compared to the general old population. Thus, efforts to reveal mechanisms related to each CVD and nightmare are needed in further studies.

4.3. Limitations

The limitations and suggestions for future studies of this study are as follows. First, this study was conducted to investigate the association between nightmares and CVD, and since the data in this study was not tracked longitudinally, there are limitations to ascertaining causal relationship between the variables. In addition, although this study verified the relationship between nightmares and CVD, the direction between nightmares and CVD has not been proven yet. Considering the possibility of interaction between sleep and CVD [75], future replication studies are needed.

Second, we included cardio-cerebrovascular diseases and risk factors which was defined by a history of being diagnosed by a doctor or currently being treated. The reported prevalence of hypertension is 54.2 for the aged 60s, and of dyslipidemia is reported to be 30%–60% for general population, which are similar with prevalence of this study (52.1%, 47.7%). However, reported heart disease and cerebrovascular disease was 13.8%, 10.2% respectively, which are much higher than our results (6.6%, 5.2%). Since the operational definition of disease used in our study were assessed with self-report questionnaires, underdiagnosis and underreporting of CVD could have occurred. Considering our prevalence of disease might be underestimated that having limitations of generalized, future studies using medical examinations to determine diagnoses will be needed.

Third, medication such as antihypertensives that participants with CVD take may have affected nightmares but was not collected and considered in our study. In addition, insomnia symptoms were controlled as a covariate in this study, but other sleep disorders were not considered. As covered in the discussion, since sleep disorders which have not been measured in this study but could affect the relationship between nightmares and CVD, objective diagnostic assessment such as PSG will be needed.

5. Conclusion

Despite the limitations, this study has expanded the previous literature by investigating the relationship between nightmares and hypertension and hyperlipidemia which are primary preceding diseases of cardio-cerebrovascular disease in older adults based on a large-scale population cohort study. While the directionality of the relationship between the two relationships has yet to be determined, this study is a first step in examining correlates of nightmares beyond mental health into the physical health domain. Hypertension and hyperlipidemia are chronic metabolic diseases, and identifying risk factors for nightmares may be important to explore in older adults.

CRediT authorship contribution statement

Youjin Lee: Writing – original draft, Formal analysis. **Dasom Park:** Formal analysis, Conceptualization. **Soriul Kim:** Writing – review & editing, Investigation. **Chol Shin:** Supervision. **Sooyeon Suh:** Writing – review & editing, Supervision, Project administration.

Declaration of competing interest

None.

Acknowledgment

This study was supported by the Korea Centers for Disease Control and Prevention grant, Republic of Korea (2017-E71001-00, 2018-E7101-00).

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jpsychores.2024.111669.

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