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Person–Environment–Occupation (PEO) Approach to Managing Sleep Disorders in Older Adults with Hypertension

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ABSTRACT

Hypertension and sleep disorders significantly impact older adults' quality of life and daily functioning. Sleep quality is influenced by physical health, environmental, and occupational factors. The Person–Environment–Occupation (PEO) model provides a comprehensive framework for exploring these interactions. This study examined the relationship between blood pressure and sleep quality in older adults and illustrated the application of the PEO approach in managing sleep disturbances among hypertensive elderly individuals. Using a quantitative analytic observational design with cross-sectional methods, research was conducted in Boyolali involving 30 older adults selected through purposive sampling. Data collection included demographic questionnaires, Pittsburgh Sleep Quality Index (PSQI), and blood pressure measurements using OMRON HEM-7121 digital sphygmomanometer. Data analysis utilized Pearson correlation and descriptive statistics guided by the PEO framework. Findings revealed 70% of participants had hypertension, and 63.3% experienced poor sleep quality. Significant positive correlations were observed between systolic blood pressure and PSQI scores (r=0.72; p=0.001) and between diastolic blood pressure and PSQI scores (r=0.65; p=0.002). Participants with hypertension demonstrated poorer sleep quality than those without hypertension. According to the PEO model, sleep disturbances were influenced by person-related factors (hypertension, stress, fatigue), environmental factors (lighting, noise, family support), and occupational factors (daily routines, sleep hygiene, activity balance). In conclusion, significant associations exist between blood pressure and sleep quality in older adults. The PEO approach serves as a holistic occupational therapy framework, enhancing sleep quality and overall well-being through interventions including sleep hygiene education, stress management, environmental adjustments, and activity regulation.

Keywords: Older adults, Hypertension, Sleep quality, Occupational therapy, PEO model

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1. INTRODUCTION

With advancements in healthcare technology, improved access to medical services, and enhanced quality of life, the elderly population worldwide is growing rapidly. The World Health Organization (2023) projects that by 2050, the number of people aged 60 and above will reach 2.1 billion, with most residing in developing countries such as Indonesia. According to the Central Statistics Agency of Indonesia (2023), the elderly population in the country has reached 25.6 million, accounting for approximately 9.6% of the total population. This demographic increase presents various health challenges, particularly due to the rising prevalence of chronic diseases and functional impairments that can impact the quality of life and independence of older adults.

Hypertension is one of the most prevalent health issues among the elderly. The global prevalence of hypertension in this age group is reported to be 62.5% (Global Burden of Disease Study, 2022), making it a significant risk factor for cardiovascular disease, stroke, and kidney failure. In Indonesia, the Primary Health Research (Riskesdas) survey (2022) found that 57.6% of older adults suffer from hypertension, with low rates of effective hypertension management. Factors contributing to this condition include low physical activity, unhealthy dietary habits, stress, and physiological changes related to aging. In addition to hypertension, sleep disorders are prevalent among older adults. Aging brings physiological changes, such as reduced melatonin production, disruptions in circadian rhythms, and diminished deep sleep stages, all of which contribute to insomnia symptoms, including frequent nighttime awakenings and poor sleep quality (Ohayon et al., 2021). Research indicates that about 30–50% of older adults experience sleep disturbances, especially those with chronic illnesses (Morphy et al., 2022). In Indonesia, Prasetyo et al. (2021) reported that 68.3% of older adults in Yogyakarta had poor sleep quality, as measured by the Pittsburgh Sleep Quality Index (PSQI).

There is a bidirectional relationship between hypertension and sleep quality. Older adults with hypertension commonly face nocturia, chronic musculoskeletal pain, anxiety, and sleep apnea, which can disrupt sleep and negatively impact quality of life (Javaheri et al., 2018). Conversely, poor sleep quality may lead to overactivation of the sympathetic nervous system, elevated cortisol levels, and endothelial dysfunction, all of which can increase blood pressure (Liu et al., 2023). Chen et al. (2022) also observed that older adults with higher PSQI scores were at

greater risk for hypertension compared to those with good sleep quality.

This study was carried out in Boyolali, where a majority of older adults experienced both hypertension and sleep disturbances. Approximately 70% of participants were classified as hypertensive, with an average systolic blood pressure of 142.8 mmHg and diastolic blood pressure of 85.1 mmHg. Additionally, 63.3% of respondents reported poor sleep quality, with an average PSQI score of 6.4. Statistical analysis showed a strong and significant positive correlation between systolic blood pressure and sleep quality ($r = 0.72$; $p = 0.001$), as well as between diastolic blood pressure and sleep quality ($r = 0.65$; $p = 0.002$). Participants with hypertension also had significantly higher PSQI scores than those without hypertension. Sleep disturbances in older adults are affected not only by physical health conditions but also by environmental factors and daily activity patterns. Consequently, occupational therapy approaches play a crucial role in helping older adults improve their sleep quality. One relevant framework is the Person–Environment–Occupation (PEO) model, which explains that occupational performance is shaped by the dynamic interaction between the person, environment, and occupation across an individual's lifespan (Christiansen & Baum, 2023). In relation to sleep disturbances, person factors include physical health, hypertension, stress, and pain; environmental factors involve lighting, noise, bed comfort, and family support; while occupation factors encompass sleep routines, bedtime activities, and management of daily activities.

Using the PEO model, occupational therapy can deliver holistic and client-centered interventions. Strategies such as sleep hygiene education, stress management, environmental modifications, daily activity planning, and the development of healthy sleep routines may enhance sleep quality among older adults. The community-based occupational therapy interventions effectively improve both sleep quality and quality of life in this population (Ho & Siu, 2018; Santos et al., 2021). Therefore, this study aims to describe the Person–Environment–Occupation (PEO) approach among older adults with hypertension and sleep disturbances to support the development of more comprehensive and holistic occupational therapy interventions for community-dwelling older adults.

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2. METHODS

This study utilized a quantitative analytic observational design with a cross-sectional approach. A cross-sectional design was chosen to examine the relationships among blood pressure, sleep quality, and Person–Environment–Occupation (PEO) factors related to hypertension in older adults at a single point in time. The research was carried out in Boyolali, Central Java, from August to September 2025. The study population included older adults aged 60 years and above residing in Sindon Village, Boyolali. Purposive sampling was used based on predefined inclusion and exclusion criteria, yielding a sample of 30 participants. Inclusion criteria comprised individuals aged 60 years or older, capable of effective communication, and willing to provide informed consent. Exclusion criteria involved participants with severe communication impairments or acute medical conditions. The sample size was determined according to the minimum standard required for correlation analysis to explore relationships between variables.

The independent variables were systolic and diastolic blood pressure, while the dependent variable was sleep quality among the older adult participants. The occupational therapy framework employed the Person–Environment–Occupation (PEO) model, which considered person factors (physical condition, hypertension, stress, and pain), environmental factors (sleep environment, lighting, noise, and family support), and occupation factors (sleep routines, daily activities, and sleep hygiene). Data collection included a sociodemographic questionnaire, the Pittsburgh Sleep Quality Index (PSQI), and blood pressure measurements taken using an OMRON HEM-7121 digital sphygmomanometer. Sleep quality was assessed using the PSQI, with scores of 5 or lower indicating good sleep quality and scores above 5 indicating poor sleep quality. The PSQI demonstrated acceptable reliability with a Cronbach's alpha of 0.83. Blood pressure was measured twice after participants rested for at least five minutes, and the average of these readings was used for analysis. Data analysis involved both univariate and bivariate methods. Univariate analysis described respondent characteristics, blood pressure, and sleep quality through frequency distributions, percentages, means, and standard deviations. Bivariate analysis utilized Pearson correlation with a significance threshold of $p < 0.05$ to examine the relationship between blood pressure and sleep quality.

Additionally, descriptive analyses of Person, Environment, and Occupation

factors were conducted to aid occupational therapy in interpreting sleep disturbances among older adults. Ethical standards upheld in this study included informed consent, confidentiality, beneficence, and non-maleficence. All participants were informed about the study's objectives and provided signed consent before data collection. Participant identities were kept anonymous throughout the research.

3. RESULTS

Table 1. Demographic and Baseline Characteristics of Participants (n = 30)

Characteristics	n	%
Age (years)	Mean (min-max) 67.2 (54–88)	
Age group		
60–69 years (young-old)	13	43.3
≥70 years (old-old)	17	56.7
Gender		
Female	17	56.7
Male	13	43.3
Education level		
Elementary school	12	40.0
Other/Not specified	18	60.0
Occupation		
Farmer/Laborer	11	36.7
Housewife	10	33.3
Other/Not specified	9	30.0
Marital status		
Married	22	73.3
Other (widowed/single)	8	26.7
Living arrangement		
With spouse and children	17	56.7
Other	13	43.3
Medical history		
Hypertension	15	50.0
Stroke/Diabetes/Heart disease/None	15	50.0

This quantitative cross-sectional study was conducted from August to September 2025 in Boyolali and involved 30 older adults. Table 1 shows that the average age of respondents was 67.2 years, with ages ranging from 54 to 88 years. The majority (43.3%) were classified as young-old adults aged 60–69 years. Females comprised 56.7% of the sample. Most participants had completed elementary school education (40%) and were employed as farmers/laborers (36.7%) or housewives (33.3%). A large proportion were married (73.3%) and lived with their spouses and children (56.7%). Regarding medical history, half of the respondents reported hypertension, while others had histories of stroke, diabetes mellitus, heart disease, or no chronic illness.

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Table 2. Blood Pressure Measurements (n=30)

Category	Criteria	Frequency (n)	Percentage (%)
Normal	Systolic <120 mmHg and Diastolic <80 mmHg	3	10.0
Elevated (Prehypertension)	Systolic 120–129 mmHg and Diastolic <80 mmHg	1	3.3
Stage 1 Hypertension	Systolic 130–139 mmHg or Diastolic 80–89 mmHg	3	10.0
Stage 2 Hypertension	Systolic ≥140 mmHg or Diastolic ≥90 mmHg	18	60.0
Hypotension	Systolic <90 mmHg or Diastolic <60 mmHg	5	16.7

Table 2 shows that most participants had hypertension. The majority were classified with stage 2 hypertension, 10% had stage 1 hypertension, and 10% were within normal blood pressure ranges. Additionally, 16.7% of respondents exhibited hypotension. The mean systolic blood pressure was 142.8 mmHg (range 78–204 mmHg), and the mean diastolic blood pressure was 85.1 mmHg (range 48–105 mmHg).

Table 3. Distribution of Pittsburgh Sleep Quality Index (PSQI) Scores (n = 30)

PSQI Category	Score Range	Frequency (n)	Percentage (%)
Good Sleep Quality	≤ 5	11	36.7
Poor Sleep Quality	> 5	19	63.3

Mean PSQI Score: 6.4 ± (SD); Mean PSQI Score: 6.4 ± 2.4; Minimum Score: 2; Maximum Score: 11

Table 3 shows that most older adults reported poor sleep quality as measured by the Pittsburgh Sleep Quality Index (PSQI). Specifically, 63.3% of participants had PSQI scores of 5 or higher, indicating poor sleep quality, while 36.7% had scores of 5 or lower, indicating good sleep quality. The average PSQI score was 6.4, with a maximum of 11, indicating severe sleep disturbances in some individuals.

Table 4. Analysis of the Relationship between Blood Pressure and Sleep Quality

Variable	Correlation Coefficient (r)	ρ-Value
Systolic vs PSQI	0.72	0.001
Diastolic vs PSQI	0.65	0.002

Pearson correlation analysis revealed a strong and statistically significant positive relationship between blood pressure and sleep quality. Systolic blood pressure was positively correlated with PSQI scores ($r = 0.72$; $p = 0.001$), and diastolic blood pressure also demonstrated a significant positive correlation with PSQI scores ($r = 0.65$; $p = 0.002$). These results suggest that higher blood pressure in older adults is associated with poorer sleep quality. Additionally, comparative analysis

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showed that older adults with hypertension had a higher mean PSQI score (7.1) compared to those without hypertension (4.3; p = 0.003), indicating that hypertension is a significant risk factor for sleep disturbances in this population.

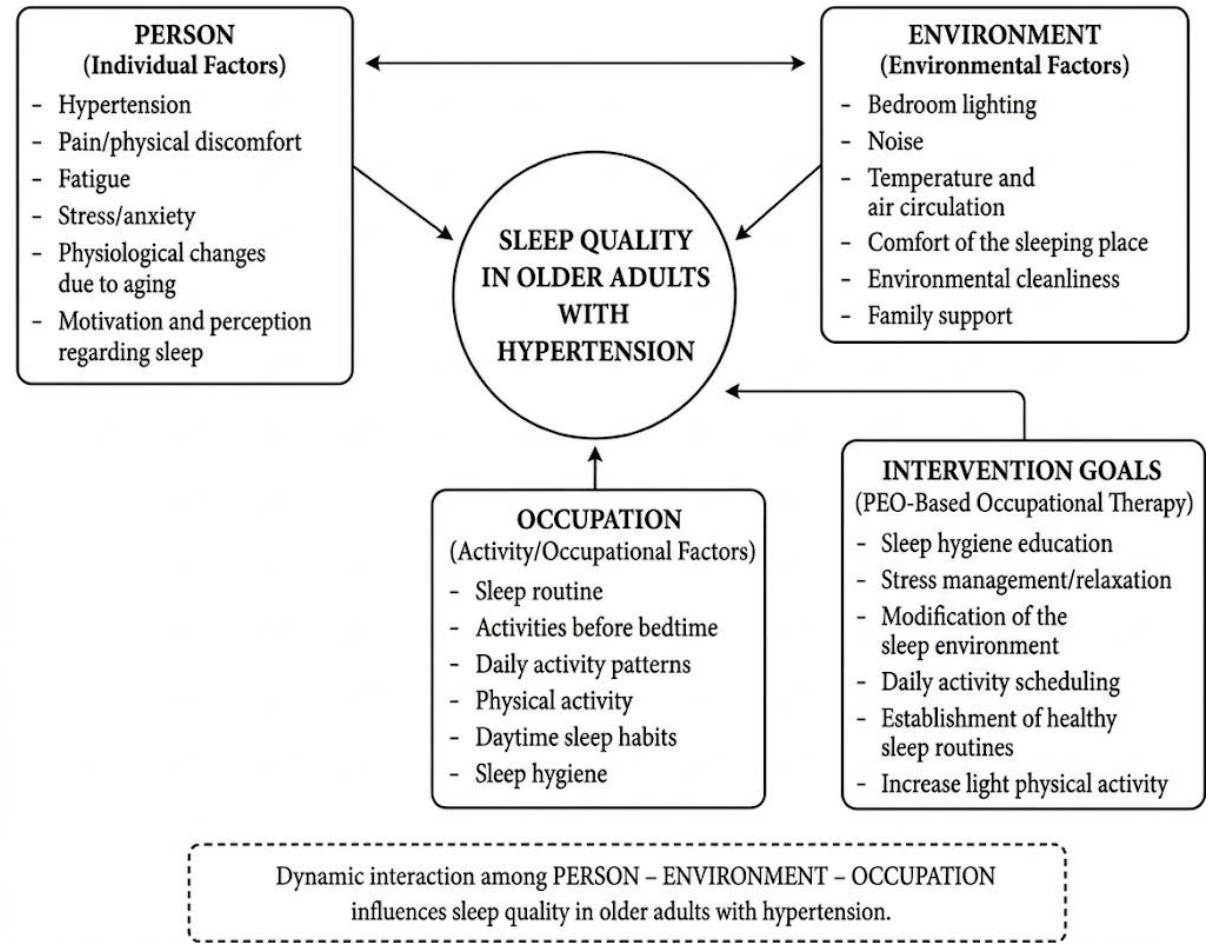

Figure 1. Person–Environment–Occupation (PEO) Framework for Sleep Quality Management in Older Adults with Hypertension

Using the Person–Environment–Occupation (PEO) model, several factors contributing to poor sleep quality among older adults were identified. Person-related factors included hypertension, pain, fatigue, stress, and physiological changes due to aging. Environmental factors encompassed uncomfortable sleep settings, lighting, noise, room temperature, bed comfort, and family support. Occupational factors involved daily activity patterns, bedtime routines, daytime napping habits, and inadequate sleep hygiene practices. The interplay of these three domains contributed to sleep disturbances among hypertensive older adults. The PEO model suggests that sleep quality in older adults is shaped by the interaction among individual

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characteristics (person), environmental factors (environment), and daily activities (occupation). This study found that poor sleep quality was affected not only by physical health but also by environmental conditions and activity patterns. Consequently, occupational therapy interventions grounded in the PEO framework can offer comprehensive management through sleep hygiene education, stress reduction, environmental adjustments, and balanced activity scheduling. Such interventions may improve sleep quality, sustain independence, and enhance quality of life for older adults with hypertension.

4. DISCUSSION

The results of this study revealed that the majority of older adults in Sindon Village, Boyolali, experienced hypertension and poor sleep quality. The high rate of hypertension observed highlights that it continues to be a significant health concern among the elderly. Age-related physiological changes, such as reduced vascular elasticity, metabolic alterations, and increased cardiovascular strain, contribute to elevated blood pressure in this population. Additionally, factors like unhealthy lifestyle habits, low physical activity, stress, and chronic illnesses may further increase the risk of hypertension in older adults. These findings align with the Riskesdas (2022) report, which identified hypertension as one of the most common chronic conditions among the elderly.

Furthermore, this study found that most participants reported poor sleep quality, as measured by the Pittsburgh Sleep Quality Index (PSQI). Age-associated physiological changes, including decreased melatonin production, circadian rhythm disturbances, and diminished deep sleep stages, increase the risk of insomnia and frequent nighttime awakenings in older adults. These results are consistent with previous research by Ohayon et al. (2021) and Prasetyo et al. (2021), which documented a high prevalence of sleep disturbances among older individuals, especially those with chronic health issues. Poor sleep quality may adversely impact physical recovery, cognitive performance, emotional well-being, and overall quality of life in this population. Statistical analysis revealed a significant positive correlation between blood pressure and sleep quality. Elevated systolic and diastolic blood pressure levels were linked to higher PSQI scores, indicating poorer sleep quality in older adults. These results align with previous research demonstrating a bidirectional relationship between hypertension and sleep disturbances. Hypertension can

disrupt sleep continuity due to factors such as nocturia, physical discomfort, anxiety, and sleep apnea. Conversely, sleep deprivation may contribute to elevated blood pressure by activating the sympathetic nervous system and elevating cortisol levels. Consequently, hypertension and sleep disturbances may form a cyclical pattern that progressively deteriorates the health of older adults.

From an occupational therapy perspective, sleep is regarded as a vital occupation that supports health, energy restoration, and engagement in daily activities. The Person–Environment–Occupation (PEO) model is useful for understanding sleep disturbances in older adults with hypertension, as the dynamic interactions among personal, environmental, and occupational factors influence sleep quality.

The person component encompasses physical and psychological conditions such as hypertension, pain, fatigue, stress, anxiety, and age-related physiological changes. In this study, hypertension and physical discomfort were identified as key factors impacting sleep quality in older adults. Additionally, stress and anxiety related to health conditions may interfere with relaxation and reduce sleep efficiency.

The environment component includes physical and social environmental aspects such as lighting, noise, room temperature, bed comfort, and family support. An uncomfortable sleep environment can lead to increased nighttime awakenings and poorer sleep quality among older adults. Family support also plays a crucial role in helping older adults establish healthy sleep routines and maintain emotional well-being. The occupation component involves daily activity patterns, activity balance, sleep routines, and sleep hygiene practices. Irregular schedules, excessive daytime napping, low physical activity, and poor bedtime habits can contribute to diminished sleep quality in older adults. An imbalance in occupation may lead to increased fatigue and impair the body's ability to achieve restorative sleep.

Using the PEO approach, occupational therapy interventions should be applied holistically by simultaneously addressing the person, environment, and occupation. Strategies such as sleep hygiene education, stress management, relaxation techniques, environmental modifications, and daily activity scheduling can effectively enhance sleep quality in older adults with hypertension. Community-based occupational therapy programs integrated into elderly healthcare services may support occupational balance,

preserve functional independence, and promote healthy aging in this population.

5. CONCLUSION

A significant relationship was found between blood pressure and sleep quality among older adults in Sindon Village, Boyolali. Older adults with hypertension exhibited poorer sleep quality compared to those without hypertension. Elevated systolic and diastolic blood pressure levels were linked to higher PSQI scores, indicating worse sleep quality.

Sleep disturbances in older adults are influenced not only by physical conditions such as hypertension but also by environmental factors and daily activity patterns. The Person–Environment–Occupation (PEO) model emphasizes that the interaction among personal health, environmental conditions, and occupational activities is crucial in determining sleep quality in this population.

Occupational therapy interventions grounded in the PEO approach, such as sleep hygiene education, stress management, modifications to the sleep environment, and regulation of daily activities, may effectively enhance sleep quality, functional performance, and overall quality of life for older adults with hypertension. Thus, community-based occupational therapy programs should be further developed and integrated into elderly healthcare services to promote healthy aging.

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AUTHOR CONTRIBUTIONS

ESW and UY was responsible for conceptualization, data collection, data analysis, and manuscript preparation. UY and RH supervised the research process, contributed to the methodological design, validated the research instruments, and critically revised the manuscript. ESW, UY and RH contributed to data interpretation and provided critical review and final approval of the manuscript.

CONFLICT OF INTEREST

The authors declared no potential conflicts of interest with respect to the publication of this article.

DATA AVAILABILITY STATEMENT

The data are not publicly available due to privacy or ethical restrictions.

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