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Title: Physical Activity to Lower Blood Pressure among Older People with Hypertension in Southeast Asia: A Scoping Review

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ABSTRACT

Background: Hypertension is a serious global health issue among older adults. Physical activity plays a vital role in lowering blood pressure and preventing hypertension-related complications. However, the prevalence of physical inactivity among older adults in Southeast Asia remains high. Although several studies have examined hypertension management and physical activity in general populations, no review has specifically focused on older adults with hypertension in this region. Therefore, this review aims to map the prevalence, types, duration, and frequency of physical activity, as well as the barriers and opportunities for physical activity among older adults with hypertension in Southeast Asian.

Methods: This scoping review followed Arksey and O'Malley's methodological framework and adhered to PRISMA-ScR guidelines. Literature searches were conducted using relevant keywords across ten major databases—PubMed, ScienceDirect, EBSCO, Global Index Medicus, Scopus, Sage, Cochrane Library, Wiley Online Library, ProQuest, and Garuda—as well as Google Scholar. Inclusion criteria comprised articles published in English and Indonesian between 2019 and 2024. Screening was performed using Rayyan software. Data from 26 eligible studies were mapped, categorized, and thematically synthesized using an exploratory descriptive approach.

Results: The findings reveal that the most common activities include walking, regular exercise, and cycling, typically performed for 150 minutes per week at moderate to high intensity. Reported barriers included lack of motivation, limited facility access, and declining physical condition, while opportunities involved social support and the availability of appropriate facilities.

Conclusion: Low adherence to physical activity among older adults with hypertension in Southeast Asia, underscores the need for culturally sensitive and context-specific health programs. Considering the predominance of observational and qualitative studies, future research should explore enablers of effective and acceptable physical activity and systematically examine the role of social support in sustaining physical activity habits among hypertensive older adults in Southeast Asian.

Keywords: Physical activity, blood pressure, hypertension, Aged, quality of life.

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Highlights

- Hypertension is a serious global health problem, and physical activity plays a crucial role in lowering blood pressure among older adults.
- The prevalence of physical activity among older adults with hypertension in Southeast Asia tends to be low, ranging from 14.1% to 66.7%.
- The most commonly performed forms of physical activity include walking and light exercise.
- The major barriers to physical activity comprise physical limitations, lack of energy, insufficient social support, and limited knowledge regarding appropriate exercise practices.
- Opportunities to enhance physical activity involve culturally tailored programs, the utilization of digital technologies, and the promotion of group-based activities.

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Plain language summary

Hypertension is a serious health concern among older adults worldwide. Although physical activity plays a crucial role in lowering blood pressure, the level of physical inactivity among older adults with hypertension in Southeast Asia remains high. This review maps the levels of participation, types, duration, and barriers to physical activity within this population. The findings indicate a generally low level of participation, with walking identified as the most common form of activity. The main barriers include physical limitations, lack of motivation, and insufficient knowledge, while social support and age-friendly facilities represent key opportunities for improvement. These findings underscore the need for context-specific, culturally sensitive, and community-based health programs to promote greater physical activity among older adult

Introduction

Hypertension is a serious global health issue defined as a systolic blood pressure ≥140 mmHg and diastolic blood pressure ≥90 mmHg after two consecutive measurements (World Health Organization, 2021). The prevalence of hypertension has significantly increased from 650 million to 1.3 billion between 1990 and 2019. In Southeast Asia, the incidence rate is also high, affecting more than 294 million people (World Health Organization, 2023). Only 21% of individuals with hypertension have successfully controlled their blood pressure (Zhou et al., 2021). Uncontrolled hypertension poses a risk of severe complications, including cardiovascular disease, stroke, and death (Kim et al., 2018), and decreases the quality of life among the older people while increasing healthcare costs.

Hypertension management emphasizes lifestyle modifications, including physical activity as an integral part of blood pressure management. According to the Joint National Committee (JNC VIII), physical activity, along with a healthy diet, weight management, and good lifestyle

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habits, is recommended to help control hypertension (Muhadi, 2016). Studies show that a lack of physical activity increases the risk of hypertension, particularly affecting the older people population in Southeast Asia (Wheeler et al., 2019). Insufficient physical activity leads to changes in vascular structure and endothelial function and increases the risk of atherosclerosis (Daniele et al., 2022). Therefore, promoting physical activity among the older people is a crucial step in preventing and controlling hypertension.

The World Health Organization (WHO) projects that continued physical inactivity could lead to 240 million preventable new cases of hypertension globally between 2020 and 2030 (World Health Organization, 2023). The prevalence of physical inactivity in Southeast Asia is significant, with 55% of women and 34% of men aged 70 and older not engaging in adequate physical activity (World Health Organization, 2022). Studies indicate that older people who engage in regular physical activity can lower their systolic and diastolic blood pressure, improve cardiovascular function, reduce the risk of complications, and enhance their quality of life (Paluch et al., 2024). Additionally, routine physical activity can reduce vascular resistance, increase vascular flexibility, and help control body weight, cholesterol, and blood sugar levels (Wu et al., 2019). However, studies on physical activity among older people with hypertension remain limited, particularly those focused on the Southeast Asian population. Previous studies, such as (Xia et al., 2022), have generally discussed hypertension management across all age groups, while studies by (Dixon et al., 2021) explored the relationship between the environment, physical activity, and obesity on a global scale. (Irwan et al., 2022) discussed self-care management for hypertensive patients in Southeast Asia, whereas (Y. S. Lee et al., 2021) evaluated methodologies for measuring physical activity in ASEAN countries. The review by (Kazeminia et al. (2020) highlighted the impact of exercise in reducing hypertension but did not specifically focus on the older people in Southeast Asia. Therefore, this review aims to map the prevalence, types, duration, frequency, as well as opportunities and barriers to physical

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activity among older people with hypertension in Southeast Asia. The expected outcome of this review is a better understanding of the state of physical activity among the older people with hypertension and the development of appropriate interventions to increase their participation in physical activity.

Materials and Methods

This scoping review was designed to summarize information from previous studies to explore the prevalence, types, duration, and frequency of physical activity, as well as opportunities and barriers to implementing physical activity among older people with hypertension. The reporting process adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) to ensure comprehensive and transparent documentation as well as to enhance methodological rigor (Tricco et al., 2018). The study protocol has been registered with the Open Science Framework (https://osf.io/6qmuh). This review was conducted in accordance with the scoping review framework proposed by Arksey & O'Malley, (2005), which encompasses five systematic stages of the scoping review :

Stage 1: Research Question

The research question posed in this scoping review is: What types of physical activities have been conducted to lower blood pressure among older people with hypertension in Southeast Asia? The countries in Southeast Asia include Brunei, Malaysia, Indonesia, Thailand, Singapore, the Philippines, Vietnam, Laos, Cambodia, Myanmar, and East Timor.

Stage 2: Relevant Studies and Search Terms

The aim of this review is to provide a comprehensive overview of the types, frequency, and duration of physical activity used to lower blood pressure among older people with hypertension in Southeast Asia. Additionally, the review maps the prevalence, barriers, and opportunities in the implementation of physical activity among older people. Relevant

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documents were searched in various databases, including PubMed, ScienceDirect, EBSCO, Global Index Medicus, Scopus, Sage, Cochrane, Wiley, ProQuest, and Garuda, as well as through the Google Scholar academic search engine. Complete search strategies for all databases are shown in Table 1.

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Table 1. Keywords for Databases

No	Database	Keywords	Article	Date Accessed
1	PubMed	((((((((((((((((((((((((Older Adults[MeSH Terms]) OR (Elderly[MeSH Terms])) OR (Older People[MeSH Terms])) OR (Older Person[MeSH Terms])) OR (Older Patients[MeSH Terms])) OR (Elderly Population[MeSH Terms]))) OR (Adults[MeSH Terms])) AND (Hypertension[MeSH Terms])) OR (Blood pressure[MeSH Terms])) OR (high blood pressure[MeSH Terms])) AND (physical activity[MeSH Terms])) OR (physical exercise[MeSH Terms])) OR (exercise[MeSH Terms])) AND (Southeast Asia[MeSH Terms])) OR (Brunei[MeSH Terms])) OR (malaysia[MeSH Terms])) OR (indonesia[MeSH Terms])) OR (thailand[MeSH Terms])) OR (Thai[MeSH Terms])) OR (singapore[MeSH Terms])) OR (philippines[MeSH Terms])) OR (vietnam[MeSH Terms])) OR (laos[MeSH Terms])) OR (cambodia[MeSH Terms])) OR (myanmar[MeSH Terms])) OR (east timor[MeSH Terms]) AND (y_5[Filter]) AND (y_5[Filter]) AND (y_5[Filter]) AND (y_5[Filter])	252	July 2, 2024
2	Science Direct	physical activity AND elderly OR older person OR older people AND hypertension OR high blood pressure AND southeast Asia OR ASEAN OR Brunei, Malaysia, Indonesia, Thailand, Thai, Singapore, Philippines, Vietnam, Laos, Cambodia, Myanmar, East Timor	659	July 2, 2024
3	Ebsco	MH “Hypertension” OR “high blood pressure” OR “hypertensive” AND "old people" OR "older adults" OR "elderly" AND "Physical activity" OR "physical exercise" OR "exercise" AND "Southeast Asia" OR indonesia	361	July 4, 2024
4	Global Index Medicus	(Hypertension” OR “high blood pressure” OR “hypertensive” AND "old people" OR "older adults" OR "elderly" AND "Physical activity" OR	18	July 4, 2024

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		"physical exercise" OR "exercise" AND "southeast asia" OR Indonesia)		
5	Scopus	(TITLE-ABS-KEY (elderly) OR TITLE-ABS-KEY (("older adults")) AND TITLE-ABS-KEY (hypertension) OR TITLE-ABS-KEY (("high blood pressure")) OR TITLE-ABS-KEY (hypertensive) AND TITLE-ABS-KEY (("Physical activity")) OR TITLE-ABS-KEY (("physical exercise")) OR TITLE-ABS-KEY (exercise) AND TITLE-ABS-KEY (("southeast asia")) OR TITLE-ABS-KEY (indonesia)) AND PUBYEAR > 2018 AND PUBYEAR < 2025	18	July 4, 2024
6	Sage	(((Older Adults(MeSH Terms)) OR (Elderly(MeSH Terms))) AND ((((((((((physical activity(MeSH Terms)) OR (Tai Chi(MeSH Terms))) OR (Aerobic Exercises(MeSH Terms))) OR (walking(MeSH Terms))) OR (swimming(MeSH Terms))) OR (cycling(MeSH Terms))) OR (Strength Training(MeSH Terms))) OR (yoga(MeSH Terms))) OR (resistance training(MeSH Terms))) OR (isometric resistance training(MeSH Terms))) OR (dynamic resistance training(MeSH Terms))) OR (brisk walk(MeSH Terms)))) AND ((((((((((Brunei(MeSH Terms)) OR (Malaysia(MeSH Terms))) OR (Indonesia(MeSH Terms))) OR (Thailand(MeSH Terms))) OR (Thai(MeSH Terms))) OR (Singapore(MeSH Terms))) OR (Philippines(MeSH Terms))) OR (Vietnam(MeSH Terms))) OR (Laos(MeSH Terms))) OR (Cambodia(MeSH Terms))) OR (Myanmar(MeSH Terms))) OR (East Timor(MeSH Terms)))	169	July 2, 2024
7	Cochrane	physical activity OR Tai Chi OR walking OR swimming OR cycling OR Strength Training OR yoga for hypertension elderly in indonesia OR Brunei OR Malaysia OR Thailand OR Thai OR Singapore OR Philippines OR Vietnam OR Laos OR Cambodia OR Myanmar OR East Timor	358	July 2, 2024

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8	Wiley	(((Older Adults(MeSH Terms)) OR (Elderly(MeSH Terms))) AND ((((((((((physical activity(MeSH Terms)) OR (Tai Chi(MeSH Terms))) OR (Aerobic Exercises(MeSH Terms))) OR (walking(MeSH Terms))) OR (swimming(MeSH Terms))) OR (cycling(MeSH Terms))) OR (Strength Training(MeSH Terms))) OR (yoga(MeSH Terms))) OR (resistance training(MeSH Terms))) OR (isometric resistance training(MeSH Terms))) OR (dynamic resistance training(MeSH Terms))) OR (brisk walk(MeSH Terms)))) AND ((((((((((Brunei(MeSH Terms)) OR (Malaysia(MeSH Terms))) OR (Indonesia(MeSH Terms))) OR (Thailand(MeSH Terms))) OR (Thai(MeSH Terms))) OR (Singapore(MeSH Terms))) OR (Philippines(MeSH Terms))) OR (Vietnam(MeSH Terms))) OR (Laos(MeSH Terms))) OR (Cambodia(MeSH Terms))) OR (Myanmar(MeSH Terms))) OR (East Timor(MeSH Terms)))	398	July 2, 2024
9	ProQuest	subject(Elderly) OR subject(older adult) AND subject(hypertension) OR subject(hypertensive) OR subject(High Blood Pressure) AND subject(Physical activity) OR subject(physical exercise) OR subject(southeast asia) AND subject(indonesia)	284	July 8, 2024
10	Garuda	Aktivitas fisik AND lansia hipertensi	38	July 2 2024
11	Google Schoolar	Exploration of perceptions and experiences of physical activity in elderly hypertensive patients in Southeast Asia	40	July 25, 2024

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In addition to searches within the main database, supplementary references were sought through Google Scholar to ensure the completeness of the review. The initial search involved analyzing titles, abstracts, and content to identify relevant keywords and terms, including contextual and cultural variations. Study selection followed the Population, Concept, and Context (PCC) framework, with methodological and temporal criteria summarized in Table 2.

Eligible studies included older adults (≥60 years or the nationally defined threshold) diagnosed with hypertension (systolic ≥140 mmHg and/or diastolic ≥90 mmHg, or according to local diagnostic standards). The Concept focused on physical activity interventions or measurements such as walking, cycling, yoga, tai chi, or similar exercises related to hypertension management among older adults. The Context was limited to studies conducted in Southeast Asia. Only primary, peer-reviewed articles using quantitative, qualitative, or mixed-method designs, published in English or Indonesian between January 1, 2019, and December 31, 2024, and available in full text were included. Exclusion criteria comprised secondary research (e.g., reviews, meta-analyses), conference abstracts, study protocols, studies on non-elderly or general populations, those not addressing physical activity as a key variable, and research conducted outside Southeast Asia.

Table 2. Article Eligibility Criteria

Criteria	
Population	It focused on older people diagnosed with hypertension according to the age limits specified in the country where the research was conducted.
Concept	Physical activity is any bodily movement produced by skeletal muscles that requires energy expenditure, such as walking, cycling, swimming, jogging, tai chi, yoga, older people exercise, gardening, and high-intensity exercise.
Context	Studies were conducted in Southeast Asian countries, including Indonesia, Malaysia, the Philippines, Singapore, Thailand, Brunei, Vietnam, Laos, Cambodia, Myanmar, and East Timor.

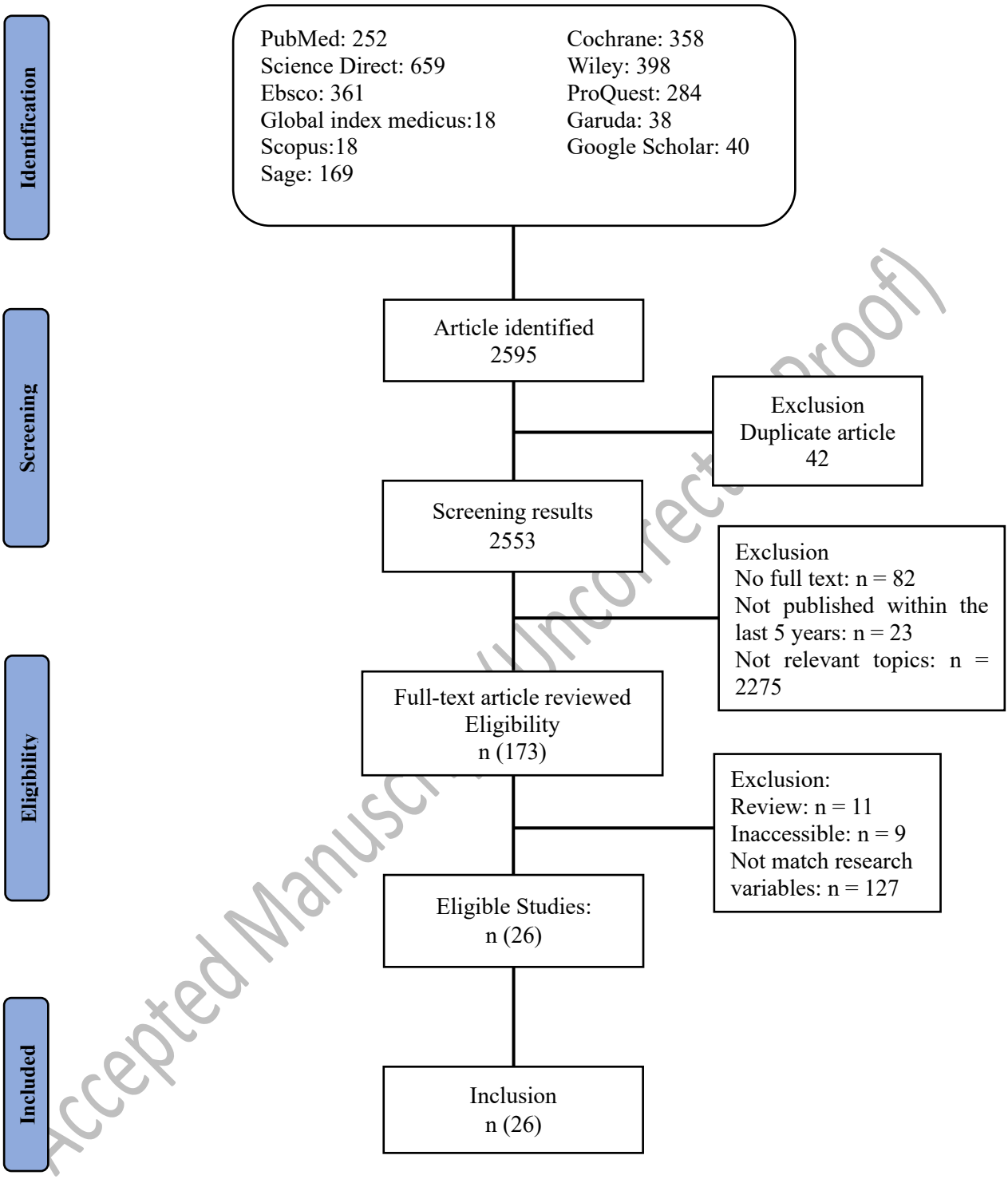
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Stage 3: Study Selection

Figure 1 illustrates the process, screening outcomes, and manuscript extraction criteria following the initial search based on the inclusion and exclusion criteria. The initial selection was conducted by screening titles relevant to the research question, resulting in 2,595 articles for further abstract screening. After duplicates were removed, 2,553 articles remained. The next

step involved re-screening titles for relevance, yielding 173 articles for full-text reading and abstraction review. To enhance the efficiency and accuracy of the screening process, the Qatar Computing Research Institute (Rayyan QCRI) software was utilized (Ouzzani et al., 2016). In the third stage, additional screening was performed by reviewing the reference lists of selected articles, resulting in 146 additional articles, which were subsequently excluded due to irrelevance to physical activity, non-older adult hypertensive populations, non–Southeast Asian contexts, or being literature reviews. This selection process resulted in 26 primary research studies included in the final analysis.

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Figure 1. PRISMA-ScR Flow Diagram (Tricco et al., 2018)

Reliability of Study Extraction

The article selection process was conducted systematically to ensure objectivity and minimize potential bias, following the JBI Scoping Review guidelines (Peters MDJ et al., 2020). The screening procedure was facilitated using Rayyan software (Ouzzani et al., 2016), which supported transparent and efficient management of inclusion and exclusion criteria. The selection process was conducted through sequential screening stages, beginning with the examination of titles and abstracts, followed by a comprehensive full-text review, and concluding with the inclusion of studies that met all eligibility requirements. Two reviewers (DLS and AMI) were involved in the study selection process. Each reviewer carried out the review of the titles, abstracts, and full texts of the retrieved studies, guided by the methodological framework of the Joanna Briggs Institute (JBI) Manual for Evidence Synthesis.

Stage 4: Data Extraction

The extracted data included critical information such as the year of the study, the country where the study was conducted, the research objectives, the population, types of physical activities, the frequency, and duration of physical activities, as listed in Tables 3 and 4.

Stage 5: Thematic Summary and Key Findings

An inductive thematic analysis, guided by the approach of Braun & Clarke (2012), was employed to identify and synthesize emerging key themes across the included studies. The process involved familiarization with the research findings, generation of initial codes, and refinement of these codes through iterative review to establish the final themes reported in the present review.

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Study Characteristics

Out of the 26 studies included, the articles originated from five Southeast Asian countries: Malaysia with two studies (Chan et al., 2020), (Hashidi et al., 2021), Thailand with three studies (Markmee et al., 2021), (Chantakeeree et al., 2022b), (Jayasvasti et al., 2021), Vietnam with two studies (Nguyen Trong et al., 2024), (Nguyen Trong et al., 2024) and eighteen studies from Indonesia (Krismaryani et al., 2022), (Sutriyawan et al., 2022), (Jasmin et al., 2023), (Hasanah et al., 2023), (Roslaini et al., 2022), (Kemila et al., 2020), (Gati et al., 2023), (Afriza et al., 2020), (Mertianda et al., 2022), (Lestari et al., 2019), (Nurlatifa et al., 2023), (Prajayanti et al., 2023), (Amalia et al., 2023), (Seta, 2022), (Aungsuroch et al., 2021), (Suratini, 2023), (Bulu et al., 2021), (Khatimah, 2022) and one study conducted in Singapore (Tan et al., 2019). No relevant articles were found from the Philippines, Laos, Brunei, Cambodia, Myanmar, or East Timor. Table 3 presents quantitative studies on physical activity among older people, while Table 4 presents qualitative studies. The study with the largest sample size was in Malaysia, totalling 5,636 samples (Chan et al., 2020). Meanwhile, other studies had sample sizes ranging from 2 to 615, with participant ages ranging from 60 to 90 years.

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Table 3. Physical Activity among Hypertensive Older People (Quantitative Studies)

Author, year	Objective	Age Range of Sample	Findings	Prevalence	Type of Activity	Duration/Frequency)
(Chan et al., 2020) Malaysia	To investigate the prevalence and factors associated with physical inactivity among older people with hypertension in Malaysia.	N = 5636 Age : 60 years and older	Most older adults in Malaysia are physically inactive.	34.1% of older people with hypertension were reported as physically inactive, while 25.3% of older people without hypertension were reported as physically inactive.	- Household chores - Walking and cycling	- 30 minutes of moderate-intensity activity or walking per day, at least five days a week. - 20 minutes of vigorous-intensity activity per day, at least three days a week. - A combination of activities totaling at least 600 Metabolic Equivalent of Task (MET) minutes per week
(Markmee et al., 2021) Thailand	Investigate the prevalence and factors associated with a 10-year cardiovascular risk level in older people with hypertension.	N = 615 sample Age : 60 - 79 years	The prevalence of 10-year cardiovascular risk among older people with hypertension is at a high-risk level of approximately 30.90%.	65.30% always or occasionally engage in physical activity, while 34.70% rarely or never do so.	Not mentioned	Not mentioned
(Nguyen Trong et al.,	To determine factors including biochemical	N= 272 hypertension patients	Half of the participants have uncontrolled hypertension (60.0%), and there is a high prevalence of	Of the participants, 95.4% from the controlled	According to WHO guidelines, physical activity includes	Physical activity: at least 150 minutes per week for moderate

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2024) Vietnam	markers, dietary habits, and social anthropometric factors associated with uncontrolled hypertension among older people with hypertension in rural areas of Vietnam	Age : 60 years and older	cardiovascular risk factors such as dyslipidemia, obesity, and hyperglycemia.	hypertension group and 90.8% from the uncontrolled hypertension group reported engaging in physical activity.	moderate-intensity activity for at least 150 minutes per week or high-intensity activity for at least 75 minutes per week.	intensity or 75 minutes per week for high intensity.
(Krismaryani et al., 2022) Indonesia	Describe the physical activity of older people with hypertension at Puskesmas Purwokerto Utara II.	N = 56 individuals Age : 60-79 years	- Older people with light physical activity: 11 people (19.6%). - Older people with moderate physical activity: 35 people (62.5%). - Older people with heavy physical activity: 10 people (17.9%)	- Older people with moderate physical activity: 62.5% prevalence. - Older people with light physical activity: 19.6% are considered less or physically inactive	- Structured exercises such as aerobics and group workouts. - Daily activities such as gardening, cycling, jogging, and walking.	Most older people engage in activities such as walking for at least 10 minutes each day.
(Hoai Thuong et al., 2022) Vietnam	To determine the level of medication adherence among patients aged ≥60 years with hypertension and the associated factors in District 10, Ho Chi Minh City, Vietnam	N = 537 individuals Age : ≥ 60 years	64.3% engage in moderate to high levels of physical activity.	64.3% of patients adhere to moderate to high levels of physical activity.	According to the Ministry of Health guidelines, moderate to vigorous physical activity is measured using the International Physical Activity Questionnaire (IPAQ).	Measured using the IPAQ-SF, physical activity is assessed in terms of Metabolic Equivalent of Task (MET) minutes per week, covering physical activity over the past seven days.
(Sutriyawan et al., 2022) Indonesia	To investigate modifiable and non-modifiable risk factors and the most common risk factors	N = 245 respondents Age : 60 years and older	- Hypertension is more commonly found in the age group 60-74 years (79.6%) compared to 75 years and older (47.7%).	65.3% of respondents have lower levels of physical activity, which is associated	Physical activity is categorized as light and moderate.	Physical activity is classified as light if respondents engage in light physical activity for less than 30

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	associated with hypertension in older people .		- The prevalence of hypertension among respondents is 62.4%.	with a higher prevalence of hypertension.		minutes per day, three days per week
(Hashidi et al., 2021) Malaysia	To determine the prevalence of hypertension and factors associated with blood pressure among older people receiving care in a hospital	N = 124 Age : 60 years and older	- The prevalence of hypertension among older people receiving hospital care is 72.6%. - 62.1% of patients engage in physical activity.	62.1% of respondents engage in physical activity.	Specific types of physical activity are not detailed.	The average duration of physical activity is 185.9 minutes per week.
(Jasmin et al., 2023) Indonesia	To investigate the relationship between physical activity and the level of hypertension among older people at Puskesmas Pancasan in 2021.	N = 95 individuals Age : 60 - 78 years	73.4% of older people with low physical activity experience hypertension, compared to 29% of those with good physical activity.	32.6% of older people engage in good physical activity, while 67.4% engage in low physical activity.	Healthy exercise	Once a week
(Hasanah et al., 2023) Indonesia	To describe the physical activity of older people with hypertension at Puskesmas Simpang Tiga	N = 68 individuals Age: 60 - 90 years	45.6% of respondents engage in light physical activity, 38.2% engage in moderate physical activity, and 16.2% engage in heavy physical activity.	- 45.6% of respondents engage in light physical activity. - 38.2% of respondents engage in moderate physical activity. - 16.2% of respondents engage in heavy physical activity.	Walking, brisk walking, swimming, and cycling.	The article does not provide specific details regarding the precise duration and frequency of physical activity.
(Roslaini et al., 2022) Indonesia	To analyze the determinants of physical activity	N = 221 respondents Age : 60	- The majority of respondents engage in high physical activity (54.3%), 16.3% of respondents	- 4.3% of respondents have	Physical activity from low to high intensity	The article does not provide detailed information on the

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	among older people with hypertension in North Aceh	years and older	have low physical activity, and 29.4% have moderate physical activity.	high physical activity. - 29.4% of respondents have moderate physical activity. - 16.3% of respondents have low physical activity.		specific duration and frequency of physical activity performed by the respondents.
(Kemila et al., 2020) Indonesia	To examine the relationship between physical activity habits and the incidence of hypertension among older people in the Kerto Village community	N = 75 older people Age: 60 – 74 years	50.7% of respondents have moderate physical activity, 37.3% have light physical activity, and 9% have heavy physical activity.	- 50.7% have moderate activity. - 37.3% have light activity. - 9% engage in heavy activity.	Leisure cycling, walking or jogging, stretching, and light aerobics	Regular exercise for 30-60 minutes per day, at least 3 times a week
(Gati et al., 2023) Indonesia	To describe the physical activity of older people with hypertension at the Posyandu Lansia Jalakan Hargosari	N = 49 older people Age : 60 years and older	49.0% of respondents have a good level of physical activity, while 51.0% have a low level of physical activity.	- 49.0% of respondents engage in good physical activity. - 51.0% of respondents engage in low physical activity.	Daily general activities, assessed using the Physical Activity Scale for the Elderly (PASE)	The respondents' duration and frequency of physical activity are not provided in the article.
(Afriza et al., 2020) Indonesia	To determine the relationship between physical activity and blood pressure in older people with hypertension	N = 84 respondents Age : 60 years and older	This study found a significant relationship between physical activity and blood pressure in older people with hypertension. Specifically, the more frequently older people engage in physical activity, the greater the reduction in hypertension.	- Light physical activity: 34.5% - Moderate physical activity: 39.3% - Heavy physical activity: 26.2%	Leisure walking, gardening, and cycling	- Light physical activity: 3-4 times per week for 15 minutes per session - Moderate physical activity: 2-3 times per week for 20

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						minutes per session
(Mertianda et al., 2022) Indonesia	To investigate the relationship between exercise activity in older people and hypertension, as well as the level of hypertension	N = 73 respondents Age : 60-69 years	- Optimal exercise activity is performed by 58.9% of older people. - Suboptimal exercise activity is performed by 41.1% of older people.	58.9% of older people studied engage in optimal exercise activity.	Healthy exercise	- Warm-up: 10-15 minutes - Core exercises: 20-60 minutes - Cool-down: 5-10 minutes - Frequency: 3-5 times per week
(Lestari et al., 2019) Indonesia	To determine the relationship between medication adherence and hypertension status among hypertensive patients at the health center	N = 55 respondents Age : 62,9 years	The level of participation in regular exercise or physical activity is relatively low. Only 21.8% of respondents reported engaging in regular exercise.	Only 21.8% of subjects report regular exercise habits.	Walking, jogging, cycling, and swimming	Three times a week for 30 minutes or more
(Nurlatifa et al., 2023) Indonesia	To examine the relationship between physical activity and quality of life in older people with hypertension	N = 50 respondents Age : 60-89 years	The level of physical activity among older people in the morning is still low, with only three older people going for a morning walk and one gardening.	- High physical activity: 18 respondents (36%) - Moderate physical activity: 17 respondents (34%) - Low physical activity: 15 respondents (30%)	- Light physical activity: Morning walks, sweeping, cooking, driving. - Moderate physical activity: Gardening, lifting light weights. - Heavy physical activity: Lifting heavy weights >20 kg.	Does not provide detailed data on duration and frequency
(Prajayanti et al., 2023) Indonesia	To understand the profile of physical activity among older people with hypertension at the	N= 49 Age : Not mentioned	Physical Activity Levels: - Moderate activity: 39 respondents (79.6%) - Heavy activity: 8 respondents (16.3%)	- Moderate activity: 79.6%. - Heavy activity: 16.3%	Gardening, walking, older people exercise	- Walking for at least 15 minutes - Moderate-intensity aerobic physical activity

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	Posyandu Lansia in Tremas Village, Pacitan		- Low activity: 2 respondents (4.1%)	- Low activity: 4.1%		for at least 30 minutes three or more times per week
(Amalia et al., 2023) Indonesia	To identify the type, duration, and frequency of physical activity among older people with hypertension	N=20 Age : 60 - 90 years	Most older people with hypertension engage in physical activities (exercise, cycling, walking). Most perform physical activity for more than 30 minutes, and half engage in physical activity less than three times per week.	- 60% of participants are involved in a combination of activities - 20% walk - 15% engage in exercise - 5% cycling	Exercise, cycling, walking	- Most engage in activities for more than 30 minutes, a small portion for less than 15 minutes, and 15-30 minutes. - Frequency: Less than 3 times per week, 3-5 times per week, more than five times per week.
(Khatimah, 2022) Indonesia	To investigate the relationship between physical activity and hypertension in older people	N = 20 older people	10% of older people are inactive in physical activity	- Inactive: 0% - Somewhat active: 10% - Moderately active: 15% - Active: 75%	Older people exercise	Once a week

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Table 4. Physical Activity among Older People with Hypertension (Qualitative Studies)

Author,year	Objective	Age Range of Sample	Findings	Type of Activity	Duration/Frequency)
(Seta, 2022) Indonesia	To understand and gain in-depth insights into the meaning and significance of living with hypertension according to the experiences of the older people	N = 2 individuals Age : ≥ 60 years	- Respondents indicated that dietary habits, physical activity patterns, lifestyle factors, and low medication adherence were contributing causes of hypertension . - Respondents say that patients usually experience bothersome signs and symptoms when symptoms recur - Hipertensive patients are expected to maintain a healthy lifestyle. - Respondents still engage in traditional medicine practices.	Walking, exercise (aerobics), yoga	Not mentioned
(Aungsuroch et al., 2021) Indonesia	To explore the barriers and challenges in managing hypertension among patients participating in the PROLANIS program	N = 20 individuals Age : ≥ 60 years	- Difficult access to community health centres - Exercise programs that are not suitable for older people - Low participant motivation	PROLANIS exercise	Not mentioned
(Suratini, 2023) Indonesia	To understand the experiences of older people with hypertension who receive family care	N = 8 individuals Age : ≥ 60 years	There are six themes of family care for hypertension as perceived by older people: - Problems experienced when suffering from hypertension - Causes of increased blood pressure in older people - Actions taken - Sources of support for hypertension treatment - Views on hypertension treatment	Older people exercise, walking	20 minutes

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			- Programs needed for hypertension management in older people by healthcare professionals		
(Chantakeeree et al., 2022a) Thailand	To explore health behaviours that promote well-being among older adults in Thailand	N = 40 individuals Age : 63-89 years	There are five main themes related to health behaviours that promote well-being: - Taking responsibility for controlling their blood pressure - Striving to achieve a healthier lifestyle - Experiencing spiritual growth - Having social relationships - Environmental factors that support healthy behaviour	Walking, cycling, dancing	Dancing for 30 minutes
(Jayasvasti et al., 2021) Thailand	To understand the views of older people with prehypertension living near temples regarding long-term self-management properly.	N = 62 individuals Age : ≥ 65 years	Participants have limited knowledge about hypertension and food.	Cycling, push-ups, swinging arms, jogging, dancing, playing with a hula hoop.	Not mentioned
(Tan et al., 2019) Singapura	To explore the social and physical environment perceived by older people with hypertension and the various social factors influencing hypertension management and their healthcare experiences.	N = 20 individuals Age : ≥ 60 years	The findings of this study encompass four interrelated levels: individual, community and institutional, socioeconomic status, and systems and policies. At the personal level, the main findings include the physical and mental well-being perceived by the participants, as well as aspects related to managing their medical conditions..	Walking	Not mentioned

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(Bulu et al., 2021) Indonesia	To understand the behaviour of older people in managing hypertension in the working area of Puskesmas Pertiwi Makassar City	N = 9 individuals Age : 60-70 years	The informants' knowledge about hypertension includes its impacts, which can lead to mental health issues and heart disease. To minimize the effects of hypertension, the informants consume vegetables, reduce fatty foods, and exercise regularly. The informants' beliefs in managing hypertension involve consuming chlorophyll, soursop, cucumber, and vitamins.	Walking	Not mentioned

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RESULTS

Prevalence of Physical Activity among Older People with Hypertension

In the studies conducted, 11 studies have reported that the prevalence of physical activity among older adults with hypertension is greater than 50%. Research by (Krismaryani et al., 2022) reported that older people engaging in moderate physical activity had a prevalence of 62.5%, while those with light physical activity (19.6%) were considered insufficiently or inactive physically. The study by (Markmee et al., 2021) reported that 65.3% of older people with hypertension frequently or occasionally engaged in physical activity, while 34.7% rarely or never participated in physical activity. Furthermore, the research by (Nguyen Trong et al., 2024) stated that 95.4% of the controlled hypertension group and 90.8% of the uncontrolled hypertension group reported engaging in physical activity. Additionally, (Hoai Thuong et al. (2022) demonstrated that 64.3% of hypertensive patients adhered to moderate and high levels of physical activity. Conversely, (Roslaini et al. (2022) found that 54.3% of respondents had high levels of physical activity, 29.4% moderate, and 16.3% low. Kemila et al. (2020) reported that 50.7% of respondents had moderate activity, 37.3% light, and 9% heavy. Moreover, Afriza et al. (2020) found that 34.5% of older people engaged in light physical activity, 39.3% moderate, and 26.2% vigorous . Further, Mertianda et al. (2022) identified that 58.9% of older people participated in optimal sports activities. Nurlatifa et al. (2023) indicated that 30% of the older adults with hypertension had low physical activity, 34.7% moderate, and 36% high. Prajayanti et al. (2023) found that 79.6% of older people had moderate physical activity, 16.3% vigorous, and 4.1% low. Amalia et al. (2023) reported that 60% of participants engaged in a combination of activities, 20% walking, 15% doing gymnastics, and 5% cycling. Lastly, Khatimah (2022) mentioned that 75% of older people were physically active. Conversely, the study by (Chan et al. (2020) found that the prevalence of physical activity among older people with hypertension was below 50%, with 34.1% being

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physically inactive, while 25.3% of older people without hypertension were also inactive. Sutriyawan et al. (2022) reported that 65.3% of older people had reduced levels of physical activity, which was associated with a higher prevalence of hypertension. Hashidi et al. (2021) identified that 62.1% of older people have engaged in physical activity. Jasmin et al. (2023) found that 73.4% of older people with low physical activity experienced hypertension compared to 29% of older people with good physical activity levels. Hasanah et al. (2023) reported that 45.6% of older people engaged in light physical activity, 38.2% in moderate physical activity, and 16.2% in heavy physical activity. Gati et al. (2023) indicated that 49% of respondents had good physical activity levels while 51% had low physical activity levels. Lestari et al. (2019) reported that only 21.8% of respondents had a regular exercise program.

Types of Physical Activity among Older People with Hypertension

In the above studies, various types of physical activities were undertaken by older people with hypertension in Southeast Asia to manage their blood pressure. Quantitative studies (Chan et al., 2020), (Krismaryani et al., 2022), (Hasanah et al., 2023), (Kemila et al., 2020), (Afriza et al., 2020), (Lestari et al., 2019), (Nurlatifa et al., 2023), (Amalia et al., 2023) and qualitative studies (Seta, 2022), (Suratini, 2023), (Chantakeeree et al., 2022b), (Tan et al., 2019), (Bulu et al., 2021) indicated that walking was the primary physical activity performed by older people with hypertension. Other types of physical activities included cycling (Chan et al., 2020), (Krismaryani et al., 2022), (Hasanah et al., 2023), (Kemila et al., 2020), (Afriza et al., 2020), (Lestari et al., 2019), (Amalia et al., 2023), (Chantakeeree et al., 2022b), (Jayasvasti et al., 2021), gymnastics for older people (Krismaryani et al., 2022), (Prajayanti et al., 2023), (Amalia et al., 2023), (Seta, 2022), (Suratini, 2023), (Khatimah, 2022), jogging (Krismaryani et al., 2022), (Kemila et al., 2020), (Lestari et al., 2019), (Jayasvasti et al., 2021), gardening (Krismaryani et al., 2022), (Afriza et al., 2020), (Prajayanti et al., 2023), swimming (Hasanah

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et al., 2023), (Lestari et al., 2019), dancing (Chantakeeree et al., 2022b), (Jayasvasti et al., 2021), household activities (Chan et al., 2020), moderate activities (Nguyen Trong et al., 2024), (Hoai Thuong et al., 2022), (Sutriyawan et al., 2022), (Jasmin et al., 2023), (Roslaini et al., 2022), (Gati et al., 2023), high-intensity activities (Nguyen Trong et al., 2024), (Hoai Thuong et al., 2022), (Roslaini et al., 2022), and push-ups (Jayasvasti et al., 2021).

The quantitative studies indicate that walking is the most frequently undertaken activity by older people with hypertension in Southeast Asia.

Qualitative studies reveal the opportunities and barriers respondents face in engaging in physical activities, which will be further explained in the next section.

Duration and Frequency of Physical Activity

In the analyzed studies, there were various variations in the frequency and duration of physical activities performed by older people with hypertension in Southeast Asia. Some quantitative studies indicate that the types of physical activities undertaken by older people with hypertension vary in terms of duration and frequency to optimize health benefits.

Chan et al. (2020) recommend engaging in moderate-intensity physical activity for 30 minutes per day, at least 5 days a week, or high-intensity activities for 20 minutes per day, a minimum of 3 days a week. Nguyen Trong et al. (2024) recommend 150 minutes of moderate-intensity activity or 75 minutes of high-intensity activity per week. Krismaryani et al. (2022) noted walking activities lasting 10 minutes each day. To measure physical activity intensity, the Metabolic Equivalent (MET) unit was used, defined as the amount of oxygen consumed while sitting at rest, equivalent to 3.5 ml O2 per kilogram of body weight per minute. Similarly Hoai Thuong et al. (2022) measured activity in Metabolic Equivalent-minutes/week. Sutriyawan et al. (2022) classified light physical activity as less than 30 minutes per day for three days a week. Hashidi et al. (2021) reported an average duration of physical activity of 185.9 minutes per week, while Jasmin et al. (2023) noted that physical activity frequency occurred once a

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week. Kemila et al. (2020) recommend regular exercise lasting 30-60 minutes per day, at least 3 times a week. Lestari et al. (2019) also suggest exercising three times a week for 30 minutes or more. Mertianda et al. (2022) recorded healthy exercise durations with a warm-up of 10-15 minutes, a main session of 20-60 minutes, and a cool down of 5-10 minutes, with a frequency of 3-5 times a week. Prajayanti et al. (2023) recommend walking for a minimum of 15 minutes or engaging in moderate-intensity aerobic activity for 30 minutes, three times or more per week. Amalia et al. (2023) reported that most older people engaged in physical activities for more than 30 minutes with a frequency of less than 3 times, 3-5 times, or more than 5 times per week. Khatimah (2022) stated that older people gymnastics is performed once a week. Other studies such as those by Markmee et al. (2021), Hasanah et al. (2023), Roslaini et al. (2022), Gati et al. (2023), and Nurlatifa et al. (2023) did not provide specific details regarding duration and frequency.

In qualitative studies, two investigations mentioned the frequency and duration of physical activities undertaken by older people. Chantakeeree et al. (2022b) reported dancing for 30 minutes, while Suratini (2023) recorded walking for 20 minutes.

The research conducted by Seta (2022), Aungsuroch et al. (2021), Jayasvasti et al. (2021), Tan et al. (2019), and Bulu et al. (2021) revealed that the physical activities performed did not provide specific details regarding duration and frequency.

Opportunities and Barriers to Physical Activity

In the studies presented, we analyzed various factors that can serve as opportunities or barriers to the implementation of physical activities for older people with hypertension in Southeast Asia. We categorized these factors into individual, social, and infrastructural factors. These factors are detailed in the article text, and we draw conclusions based on statements collected from participants in our studies, which are subsequently presented in Table 5. Some statements discussed in the article include "the awareness of older people to engage in physical

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activities" and "the exercise habits of older people," which are considered opportunities stemming from the individuals themselves. Meanwhile, "misconceptions among older people", "lack of motivation among participants to exercise", "participants' busy schedules", and "the declining physical condition of older people" are seen as barriers to physical activity. Social factors that present opportunities include "support from healthcare professionals", "a supportive environment", "support from family members", and "peer motivation". Infrastructural opportunities involve "the availability of sports facilities" whereas barriers consist of "difficult access", "an environment that is not older people -friendly", and "the absence of exercise equipment". Barriers from a social perspective include "lack of social support" and "health professionals not understanding participants' conditions". The synthesized framework illustrating these opportunities and barriers is presented in Figure 2

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Table 5. Opportunities and Barriers to Physical Activity among Older People with Hypertension

Theme	Factors	Finding	Source	Citation
opportunity	Individual	The awareness of older people about engaging in physical activity.	(Seta, 2022), (Suratini, 2023), (Tan et al., 2019)	"...because I already have a history of hypertension, I changed to a healthy lifestyle; when I wake up, I start going for a morning walk..." (Seta, 2022) p. 54 "...light leg exercises for 20 minutes make me feel refreshed..." (Suratini, 2023) p. 237 "...if you do not protect yourself, who will protect you?" (Tan et al., 2019) p. 6
		The exercise habits of older people.	(Chantakeeree et al., 2022a), (Bulu et al., 2021)	"…My need to exercise every day feels like an addiction to exercise. If I can't do it, I feel frustrated…" (Chantakeeree et al., 2022a) p. 6 "…If I don't participate in the dance group, I usually go for a walk or do housework…" (Chantakeeree et al., 2022a) p. 6 "…I often exercise, but it's just walking…" (Bulu et al., 2021) p. 43
	Social	Support from healthcare professionals	(Aungsuroch et al., 2022)	"…the nurse always calls me to exercise…" (Aungsuroch et al., 2022) p. 310
		Supportive environment	(Suratini, 2023)	"…now I participate in the elderly exercise training routine in my community…" (Suratini, 2023) p. 239
		Support from family members	(Jayasvasti et al., 2021)	"…family members support the change, especially children and grandchildren…" (Jayasvasti et al., 2021) p. 9
		Presence of peer motivation	(Jayasvasti et al., 2021), (Tan et al., 2019)	"…they need friends to join them in exercise activities…" (Jayasvasti et al., 2021) p. 11

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				"…yes…many people exercise here…" (Tan et al., 2019) p. 8
	Infrastructure	Availability of sports facilities	(Chantakeeree et al., 2022a), (Tan et al., 2019)	"…I enjoy exercising at the health center…" (Chantakeeree et al., 2022a) p. 7 "…yes, there are swings (exercise equipment) and everything else. It's on the lower floor, across…" (Tan et al., 2019) p. 8
Barriers	Individual	Older people 's misconceptions	(Aungsuroch et al., 2022)	"…I am too old to exercise…" (Aungsuroch et al., 2022) p. 310
		Lack of participant motivation to exercise	(Aungsuroch et al., 2022)	"…I am a bit lazy and bored with exercising…" (Aungsuroch et al., 2022) p. 310
		Participants' busyness	(Jayasvasti et al., 2021), (Tan et al., 2019)	"…lately, I have not attended exercise classes because I have to feed the patients…" (Jayasvasti et al., 2021), p. not available in Tan et al.) "…yes, before my grandchildren were born, I practiced yoga and swimming, but after they were born, I stopped exercising to take care of them…" (Tan et al., 2019)
		Weakened physical condition of older people	(Tan et al., 2019)	"…what affects me is my weakened legs and abdomen, which I cannot control…" (Tan et al., 2019) p. 5 "…because I can't climb, I am afraid of my heart, oh, I can't run…" (Tan et al., 2019, p. 6)
	Social	Lack of social support	(Jayasvasti et al., 2021)	"…I feel too tired to exercise. I don't think the program staff came to follow up; I just think they left us, so I stopped practicing…" (Jayasvasti et al., 2021) p. 10

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		Healthcare professionals lack understanding of participants' conditions	(Tan et al., 2019)	"…but if I am asked to walk and exercise alone, I use a cane. What if I fall? How? He doesn't understand…" (Tan et al., 2019) p. 9
	Infrastructure	Difficulty accessing	(Aungsuroch et al., 2022)	"…I want to go exercise, but I don't have a motorbike…" (Aungsuroch et al., 2022) p. 310
		Older people -unfriendly environment	(Chantakeeree et al., 2022a)	"…inside the house, there are several different levels that often cause people to slip and fall…" (Chantakeeree et al., 2022a) p. 7
		Absence of exercise equipment	(Jayasvasti et al., 2021)	"…they (the Subdistrict Administration Organization) do not have a budget, so they cancelled the exercise equipment and exercise classes, so I stopped exercising…" (Jayasvasti et al., 2021) p. 10

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DISCUSSION

This review aims to explore the prevalence of physical activity among older people with hypertension, the types of physical activities undertaken, their duration and frequency, as well as the opportunities and barriers encountered in their implementation. Findings from various studies indicate a range of prevalence rates for physical activity, with some studies reporting relatively low figures, specifically below 50%. This aligns with previous research indicating that regions such as Oceania, East Asia, and Southeast Asia tend to exhibit low levels of physical activity among older people, including those with chronic health conditions like hypertension (Guthold et al., 2018). Sedentary lifestyles are a significant risk factor contributing to the global increase in hypertension prevalence (Mills et al., 2020). A lack of physical activity can exacerbate hypertensive conditions and increase the risk of other health complications. Therefore, lifestyle management strategies for older people with hypertension, particularly aimed at enhancing participation in physical activity, should be a primary focus of health interventions. The implementation of programs supporting active lifestyles can improve the quality of life for older people with hypertension in Southeast Asia.

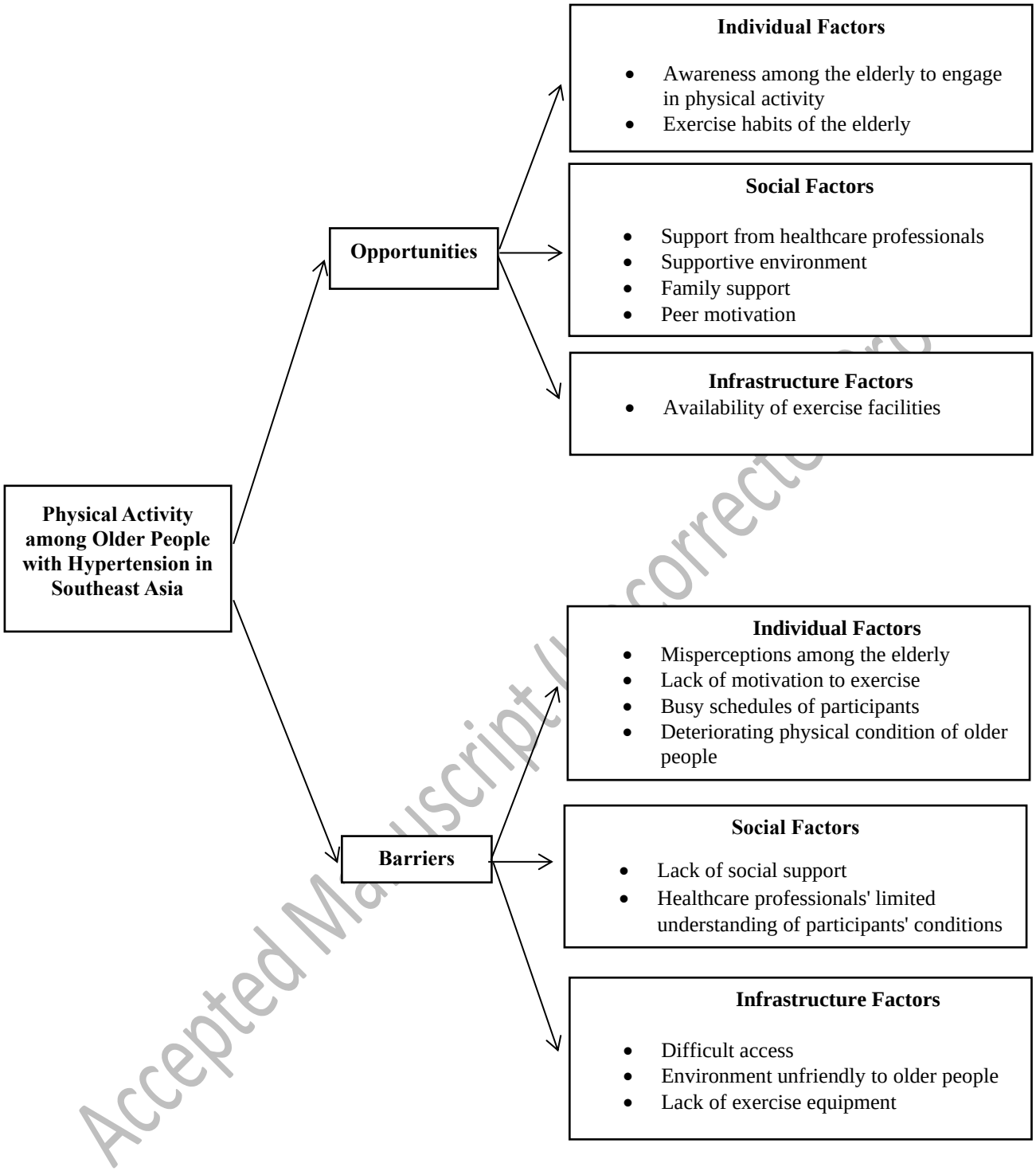
Other findings suggest that the most frequently performed physical activity among older people with hypertension is walking. Walking is chosen due to its ease of execution, lack of requirement for specialized equipment, and adaptability to individual fitness levels (Patel et al., 2018). Additional research by L.-L. Lee et al. (2021) found that regular walking can lower systolic blood pressure by up to 4.11 mmHg. In addition to walking, other popular activities include cycling, older people gymnastics, jogging, gardening, swimming, dancing, and household chores. These findings are encouraging as walking offers numerous health benefits; however, appropriate duration and intensity must be considered to optimize health benefits while minimizing injury risks. Other physical activities should also be promoted as alternatives or complements. Hence, there is a need to design physical activity programs that encourage

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walking and other easily accessible activities, supported by safe facilities, parks with walking paths, and community programs. Education regarding the duration and intensity of walking is also necessary to ensure maximum health benefits without excessive risks, ultimately improving the quality of life for older people with hypertension and reducing the risk of hypertension-related complications.

Additionally, other reviews have identified various factors influencing participation in physical activities among older people with hypertension in Southeast Asia, specifically individual, social, and infrastructural factors.

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Figure 2. Framework of Opportunities and Barriers to Physical Activity Among Older People with Hypertension in Southeast Asia

One opportunity stemming from individual factors is the awareness of older people to engage in physical activities and their exercise habits. Support from healthcare professionals,

a supportive environment, family support, and peer motivation also represent significant opportunities from social factors (Widianti et al., 2021). The availability of adequate sports facilities serves as a supportive factor from the infrastructural perspective. However, several barriers must be addressed. From the individual perspective, misconceptions, lack of motivation, busy schedules, and declining physical conditions pose significant challenges. Misconceptions and a lack of understanding regarding the importance of physical activity can diminish older people' motivation to participate in exercise programs. This is consistent with research by G.-Y. Lee et al. (2022), which indicates that a lack of motivation is a significant barrier to physical activity. From a social standpoint, insufficient social support and healthcare professionals' inadequate understanding of participants' conditions also represent significant barriers (Morrison et al., 2023). Meanwhile, from an infrastructural perspective, difficult access to sports facilities, an environment that is not older people -friendly, and the absence of exercise equipment hinder older people' participation in physical activities (Johnson et al., 2020). To address these barriers, a comprehensive and innovative approach is required. Medical personnel and fitness experts need to be trained to provide appropriate recommendations and ensure that older people with hypertension can participate in physical activities safely and effectively. Furthermore, educational campaigns aimed at raising awareness about the benefits of physical activity for managing hypertension are crucial. Governments and healthcare providers must actively participate in providing older people-friendly sports facilities and creating supportive environments. Additionally, further research is necessary to understand the specific barriers faced by older people with hypertension and to evaluate the effectiveness of various interventions. By addressing these disparities, it is hoped that the risks of health complications associated with hypertension can be reduced, thus improving the overall quality of life for older people. The implications of these findings highlight the importance of

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collaboration among various stakeholders to create sustainable and effective solutions for older people with hypertension in Southeast Asia.

The limitation of this review is that only materials in English and Indonesian were included in the analysis.

CONCLUSION

This review represents the first study investigating physical activity among older people with hypertension in Southeast Asia in a natural setting without intervention. Several analyzed articles indicate that the prevalence of physical activity among older people with hypertension in this region remains below 50%. There are opportunities and barriers regarding physical activity for older people with hypertension. Given the low participation rates, it is necessary to design physical activity programs that can encourage and motivate older people to be more active, supported by safe facilities, parks with walking paths, and community programs facilitating walking and other easily accessible activities. Education on the appropriate benefits of physical activity is also required to enhance older people knowledge.

Ethical Considerations

Compliance with ethical guidelines

This study was exempt from Institutional Review Board for Human Subjects (IRB) evaluation requirements as the analyzed articles only disclosed anonymized information or did not include personal data traceable to specific individuals.

Authors' contributions: Demitrius Liklao Sikone contributed to the conceptualization, study design, database searching, study selection, data extraction, and drafting of the manuscript. **Andi Masyitha Irwan** contributed to methodological supervision, participated in the study selection including resolving discrepancies with the primary author, supervised data analysis and interpretation, and critically revised the manuscript for important intellectual content. All authors approved the final version of the manuscript.

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