

SYSTEMATIC REVIEW

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Physical activity experience of patients with hypertension: a systematic review and synthesis of qualitative literature

Qun Li^{1,2†}, Jieqiong Jiang^{1,3†}, Anyan Duan¹, Jiao Hu³, Ling Li³ and Wei Chen^{1*}

Abstract

Background Hypertension continues to increase in prevalence, and it has become a major cause of increased mortality globally. Physical activity (PA) has been shown to be a first-line treatment for controlling blood pressure. However, participation rates in PA are still poor. Therefore, it's imperative to explore the factors that affect patient PA adherence.

Methods A synthesis of qualitative research of the PA experience of patients with hypertension was conducted. We systematically searched for qualitative studies published in English from inception to May 2023 in the databases of PubMed, Embase, Web of Science, CINAHL, PsycINFO, and Cochrane Library. The Joanna Briggs Institute tool was used to extract data, and the Capability, Opportunity, Motivation-Behaviour model was used to synthesize data.

Results This qualitative research included 17 studies, identified 85 findings, summarized 9 categories, and finally meta-aggregated 3 synthesized findings, including *capabilities of patients with hypertension, PA opportunities and PA motivators*. The capabilities included age, other health problems, and PA knowledge and skills. Opportunities included time constraints, environmental factors, physical activity resources, and social support. Motivators included self-efficacy, pursuing physical health, and experience from PA.

Conclusion The available evidence contributes to a comprehensive understanding of the barriers and facilitators of PA in patients with hypertension. Most of these barriers can be addressed and improved. When designing and implementing physical activity programs for patients with hypertension, an individualized PA program should first be designed, tailored to the patient's capacity. Secondly, patients should be provided with additional PA resources and enhanced social support. Lastly, patients' motivation can be increased by enhancing their PA experience.

Keywords Hypertension, Physical activity, Qualitative meta-synthesis, Systematic review

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Background

In recent years, the increasing prevalence of hypertension has led to a growing global disease burden. The relevant research found that increased blood pressure has become the leading cause of increased global mortality, based on data from 204 countries and regions between 1990 and 2019 [1]. Hence, it's essential to help patients effectively control their blood pressure. The first-line treatment for high blood pressure is lifestyle changes, including physical activity (PA) [2]. According to the European Society of Cardiology guidelines, hypertension patients should participate in moderate-intensity aerobic PA (such as walking, jogging, cycling, or swimming) for at least 30 min per day, 5 to 7 days per week, to help prevent and treat hypertension and reduce the risk of cardiovascular disease and mortality [3]. However, insufficient PA globally contributes to an increase the risk of chronic diseases [4]. Moreover, enhancing PA among patients with hypertension is essential, as it significantly influences blood pressure control [5]. Hence, it's imperative to explore the factors that affect patient PA adherence.

Studies have shown that physical inactivity is mainly related to feeling tired, lack of time, poor physical condition, socio-economic factors, and environmental factors [6, 7]. Nevertheless, most studies were cross-sectional surveys and only discussed several existing factors. There still needs to be a more in-depth understanding of the PA experience of patients with hypertension. Qualitative research could help us deeply understand the phenomenon and its essence, which is vital in understanding behavior of patients with hypertension [8, 9]. Synthesis of these qualitative studies in a related area could bring integrated evidence to describe and explain the topic of interest [10]. To facilitate PA in patients with hypertension, there is a strong need for a synthesis of studies to guide practice.

The Capability, Opportunity, and Motivation-Behaviour model (COM-B model) assumes that behavior would change when the individual has the capability(including physical and psychological abilities), opportunity(including physical and social environments), and motivation (including reflexive and spontaneous motivation) [11]. The COM-B model, in which capability, opportunity, motivation and behavior are components of the model, interact and counteract each other. It is practical for PA management in musculoskeletal conditions, pregnancy, and multiple sclerosis patients [12–14]. Hence, the COM-B model will provide the theoretical framework for this synthesis to explain the facilitators and barriers of PA in patients with hypertension. The synthesized findings could benefit the design and implementation of PA programs for patients with hypertension.

Methods

Research design

This review followed Joanna Briggs Institute (JBI) meta-synthesis approach to summarize high-quality evidence for practice [15]. Moreover, we used the Enhancing Transparency in Reporting the Synthesis of Qualitative Research (ENTREQ) Statement to guide the findings and ensure the regularity of this review [16]. The systematic review was registered on PROSPERO (CRD42022322119).

Eligibility criteria

We focused on the facilitators and barriers influencing PA in patients with hypertension. According to the PICoS (participants, phenomenon of interest, context, and study design) statement, studies were included if they met the following criteria: (1) Participants: the population focuses on patients with a definite diagnosis of essential hypertension; (2) Phenomenon of interest: PA experience, facilitators or barriers of patients with hypertension; (3) Context: we did not restrict background conditions for this review; (4) Study design: the design is qualitative methodology, and mixed methods were included if they offered clear qualitative analysis and the primary data could be extracted. The exclusion criteria included: (1) those based on recordings or researcher observations of consultation or no direct quotes; (2) reviews, protocol, conference abstracts, commentaries, and editorials; (3) the duplicated data; (4) the study with poor quality assessment; (5) study was not published as full text in English.

Search strategy

This review used a three-stage search strategy [17] to comprehensively search the databases of PubMed, Embase, Web of Science, CINAHL, PsycINFO, and Cochrane Library. We performed a preliminary search in PubMed by analyzing the text words in the title and abstract, as well as the index terms describing the article. Then, we searched the identified keywords and index terms extensively among the remaining databases. Finally, we manually searched the included studies of reference lists to reduce article omissions. Key terms included: hypertension, high blood pressure*, exercise, physical activit*, physical exercise*, aerobic exercise*, exercise training*, experience, qualitative research, and semi-structured interview. The retrieval time starts from database inception to May 2023. Appendix A presents detailed search strategies. A total of 5136 publications were identified through the database search, 1 article from manually searching other sources. They were imported into EndNote X9; two authors screened the literature independently and asked a third author to resolve any disagreements. Finally, this research included 17

articles. The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) diagram presented detailed results that met the inclusion criteria, which could ensure transparency and rigor in our research (Fig. 1).

Quality appraisal

This review used the JBI Critical Appraisal Checklist for Qualitative Research to critically appraise the methodological quality of the included studies [18]. The checklist consisted of 10 items; each item could be answered by “yes”, “no”, “unclear” and “not applicable”. If the answer is “yes”, then scored 1. Those total scores of 5 or lower were rated as low quality and would be excluded finally [19]. Two reviewers (QL and AD) independently assessed the included articles, and disputes could be resolved through

discussion with the third reviewer (WC). Table 1 provides the quality assessment results.

Data extraction

Two reviewers (QL and JJ) read the 17 articles carefully, independently extracted data, and consulted the third author (WC) to solve any disagreements. The extraction process used the extraction tool of JBI-QAR to obtain the descriptive characteristics, including the authors(year) of publication, country, methodology, data collection, participants, phenomena of interest, data analysis, and findings.

Data synthesis

Firstly, two reviewers (QL and AD) independently read, extracted, and appraised the findings from the included

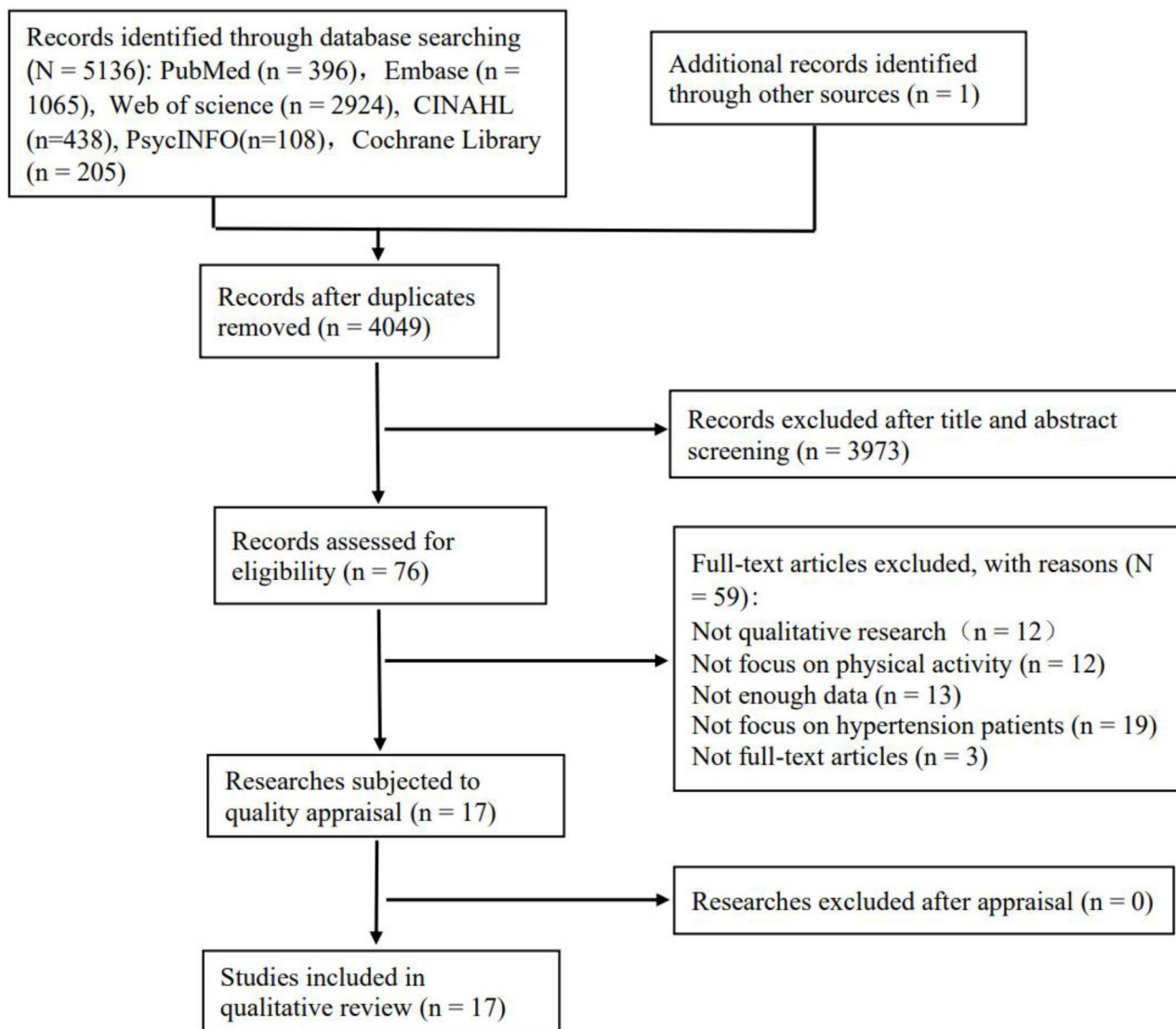


Fig. 1 PRISMA flow chart of the search process

Table 1 Quality assessment of the studies

Study	Is there congruity between the stated philosophical perspective and the research methodology?	Is there congruity between the research methodology and the research question or objectives?	Is there congruity between the research methodology and the methods used to collect data?	Is there congruity between the research methodology and the interpretation of results?	Is there a statement locating the researcher culturally or theoretically?	Is the influence of the researcher on the research, and vice-versa, addressed?	Are participants, and their voices, adequately represented?	Is the research ethical and approved by an appropriate body?	Do the conclusions drawn in the research report flow from the analysis, or are they over-assertive, or based on the evidence of the data?	Score
Ling-Ling Lee et al. (2007)[21]	U	Y	Y	Y	N	N	Y	U	Y	6
Arlene A. Schmid et al. (2009)[22]	U	Y	Y	Y	N	N	Y	Y	Y	7
Beune, E.J.A.J. et al. (2010)[23]	U	Y	Y	Y	N	N	Y	Y	Y	8
Sara E. Kolb et al. (2011)[24]	Y	Y	Y	Y	N	N	Y	Y	Y	8
Barbara G. Bokhour. et al. (2012) [25]	Y	Y	Y	Y	N	N	Y	Y	Y	8
Razatul Shima et al.(2014)[26]	Y	Y	Y	Y	N	N	Y	Y	Y	8
Helena Legido-Quigley et al. (2015)[27]	U	Y	Y	Y	N	N	Y	Y	Y	7
Marylen Rimanudo (2015)[28]	Y	Y	Y	Y	N	N	Y	U	Y	7

Table 1 (continued)

Study	Is there congruity between the stated philosophical perspective and the research methodology?	Is there congruity between the research methodology and the research question or objectives?	Is there congruity between the research methodology and the methods used to collect data?	Is there congruity between the research methodology and the interpretation of results?	Is there a statement locating the researcher culturally or theoretically?	Is the influence of the researcher on the research, and vice-versa, addressed?	Are participants, their voices, adequately represented?	Is the research ethical according to the standards of the research community?	Do the conclusions drawn in the report flow from the analysis, interpretation, evidence of ethical approval by an appropriate body?	Score
Mayumi Mizutani, RN et al. (2016)[29]	Y	Y	Y	Y	N	N	Y	Y	Y	8
Merhawi Teklezgi Gebrezgi et al. (2017)[30]	Y	Y	Y	Y	N	N	Y	Y	Y	7
Nomasonto B.D. Magobe et al. (2017)[31]	Y	Y	Y	Y	N	Y	Y	Y	Y	9
Shrestha et al. (2018)[32]	Y	Y	Y	Y	N	N	Y	Y	Y	7
Saurav Basu. et al.(2020)[33]	Y	Y	Y	Y	N	N	Y	Y	Y	8
Katia Gallegos-Carrillo et al. (2021)[34]	Y	Y	Y	Y	N	N	Y	Y	Y	7
Lemna N. Bulto et al. (2021)[35]	Y	Y	Y	Y	N	Y	Y	Y	Y	8

Table 1 (continued)

Study	Is there congruity between the stated philosophical perspective and the research methodology?	Is there congruity between the research methodology and the research question or objectives?	Is there congruity between the research methodology and the methods used to collect data?	Is there congruity between the research methodology and the interpretation of results?	Is there a statement locating the researcher culturally or theoretically?	Is the influence of the researcher on the research, and vice-versa, addressed?	Are participants, their voices, adequately represented?	Is the research ethical according to current research report criteria or, for recent studies, international, and is there evidence of ethical approval by an appropriate body?	Do the conclusions drawn in the research report flow from the analysis, interpretation, of the data?	Score
Yupin Aung-suroch et al. (2021)[36]	Y	Y	Y	Y	N	U	Y	Y	8	
Gun-Young Lee et al. (2022)[37]	U	Y	Y	Y	N	Y	U	Y	7	

Note Y-Yes, N-No, U-Unclear

articles. Then, the COM-B model was used to guide the data synthesis. After extracting similar results and integrating them inductively to obtain new categories, reviewers finally generalized to form the integration results. The group members will discuss and determine the final result of any disagreement. To establish confidence in the evidence produced in this meta-aggregative review and serve as a practical tool to assist in decision making, we also used the ConQual approach, which is a rating of dependability and credibility of each synthesized finding by giving score of High, Moderate, Low or Very Low [20]. The dependability is assessed by answering the 5 critical appraisal questions for qualitative research methods, and the credibility is based on the congruency of the authors interpretation and the supporting data (Supplementary file).

Results

Characteristics of the studies

All studies were published from 2007 to 2022. There were 15 qualitative studies [21,23–33,35–37], and 2 mixed-method studies [22, 34]. Among the 17 included studies, the sample size ranged from 13 to 117. Three studies were conducted in the United States, two in Mexico, and the other in Indonesia, India, Amsterdam, Ethiopia, Eritrea, Korea, China, Colombia, Soweto, Indonesia, Malaysia, and Nepal. Table 2 presents detailed information.

Meta-synthesis of qualitative data

In total, this study extracted 85 findings from the 17 included studies (Appendix B), aggregated nine categories according to similar meanings, and then synthesized these categories into three synthesized conclusions based on the COM-B model, Fig. 2 depicts the final conceptual map. In addition, Table 3 shows the included study from which each theme is derived, and Appendix C presents detailed information.

Synthesized finding 1: capabilities of patients with hypertension

Fourteen papers discussed the *capabilities of patients with hypertension* as a critical factor in influencing PA (Table 3). We identified two categories to support this synthesis: age and other problems, and PA knowledge and skills.

Age and other problem

The age was considered a reason for not engaging in PA regularly. They claimed that the PA was unsuitable for older people.

“I don’t gym at all, ...my age also... I am 52 years old now.” (Participant 3, Female, Patient) [31].

Accompanying other health problems such as arthritis, pain, and being overweight could also limit engagement in PA.

“I can’t do running exercise, because I feel back pain.” (P12) [35].

“Two people, both woman and over 60 years, indicated difficulties with their legs and knees due to arthritis.” [24].

PA knowledge and skills

Many participants showed that the lack of health literacy and knowledge of PA were the barriers to PA implementation. They were prone to distorting the information.

“I have so much work at my home, so there is enough exercise!” (Female, 40) [33].

“One perception held primarily by Ghanaian participants was that people with hypertension can participate in PA only if there are no symptoms.” [23].

Meanwhile, they preferably incorporated the simple and free PA into their daily activities.

“Walking was regarded as a simple, free activity which does not require particular skills.” (28 I, 182 I). [21]

Synthesized finding 2: PA opportunities

Opportunities are significant for facilitating the participation of PA, which was discussed in 13 papers (Table 3). This synthesized finding included four categories: time constraints, environmental factors, PA resources, and social support.

Time constraints

The participants claimed that overloaded schedules often hindered participation in PA due to busy work, family demands, and other social activities.

“One participant who worked from 4 a.m. until 11 p.m. daily found it impossible to do so during weekdays.” [27].

“All groups also mentioned family demands as a factor inhibiting PA (e.g. having to care for children or parents).” [23].

Environmental factors

Seven studies showed that the environment of PA also needs to be considered. Inconvenient transportation and unsafe environment both hindered participation in PA.

Table 2 Characteristics of included studies

Author (year)	Country	Methodology	Data collection	Participants	Phenomena of interest	Data analysis	Findings
Lee et al. (2007)[21]	China	Qualitative	Interviews	Age is over 60 years; 22 participants (13 males and 9 females).	Study the role of self-efficacy within the process of initiating and maintaining regular walking as PA for older people.	Thematic analysis (Nvivo 2.0)	Reasons for initiating regular walking: 1. Facilitators: avoid being a burden; 2. Don't require particular skills; 3. Benefits obtained by other people; 4. Provision of a pedometer. Barriers: Informal caring duties; Reasons for maintaining regular Walking: 1. Interpersonal and environmental interactions; 2. Peers' successful experiences; 3. By their own physiological and psychological responses to a period of regular walking; Did not engage in PA due to unfamiliar or undesirable or because of concerns about possible injury or increased stroke risk.
Schmid et al. (2009)[22]	The United States	Mixed-methods	Focus groups	28 veterans had sustained a stroke or transient ischemic attack.	This exploratory investigation focused on BP self-management practices and preferences among patients who had sustained a stroke or transient ischemic attack.	Thematic content analysis	Perceptions of PA Inhibitors and enablers of PA: 1. Hypertension and other health conditions; 2. Healthcare; 3. Social context; 4. Culture; 5. Financial limitations; 6. Living-environment; 7. Individual constraints. Difficulties: 1. Arthritis; 2. Problem to find the time or make themselves get into a routine; 3. Lack of willpower or laziness; 4. Feel the physical activity is too difficult; 5. Stress. Barriers to PA: 1. Other health conditions, such as arthritis; 2. Unsafe environment.
Beune et al. (2010)[23]	Amsterdam	Qualitative	Semi-structured interviews	Median age of 47 (range from 35–65), 46 participants (20 males and 26 females).	Explore and compare perspectives of Ghanaian, Surinamese and White-Dutch patients with hypertension as regards to PA.	Categorization of findings	
Kolb et al. (2011)[24]	Mexico	Qualitative	Semi-structured interviews	Mean age of 74 years (range from 35 to 86 years); 15 patients (3 males and 12 females).	Obtain perceptions of hypertensive Mexican American adults about their hypertension.	Content analysis	
Bokhour et al. (2012)[25]	The United States	Qualitative	Semi-structured interviews	Average age was 60 (SD = 10.31), 48 patients (44 males and 4 females) The average BP at the clinic visit was 160/93 mmHg.	Explore how patients' "explanatory models" of hypertension and social context relate to their reported daily hypertension self-management behaviors.	Thematic analysis	
Shima et al. (2014)[26]	Malaysia	Qualitative	In-depth interview	Mean age was 49 (SD = 9.3); 25 participants from the major ethnic groups in Malaysia: Malays, Chinese, and Indians (11 males, 14 females).	Explore patients' experiences with their illnesses and the reasons which influenced them in not following hypertensive care recommendations in primary health clinic settings.	Thematic analysis (NVivo 9)	Barriers of hypertensive care nonadherence with PA 1. Were unaware of the importance of PA; 2. Found it difficult to change their lifestyle after being diagnosed; 3. Was unsafe for their PA or to walk outside their houses; 4. Unaware of such activities in their community; 5. Were busy with their work; 6. Neither had time nor self-motivation.

Table 2 (continued)

Author (year)	Country	Methodology	Data collection	Participants	Phenomena of interest	Data analysis	Findings
Legido-Quigley et al. (2015)[27]	Colombia	Qualitative	Semi-structured interviews and focus groups discussions	Average age of participants was 60 years (range 35–82 years) with 12 males and 18 females.	Explore patients' knowledge, attitudes, behaviour and health care seeking experiences in relation to detection, treatment and control of hypertension in Colombia.	Inductive approach and thematic analysis (QSR NVivo 10)	1. The job is busy; 2. The support of spouse.
Rimando (2015)[28]	The United States	Qualitative	Semi-structured interviews	Average age is 62 years (range from 55 to 75); 28 participants (6 males and 22 females).	Understand the perceived barriers to and facilitators of hypertension self-management among underserved African American older adults in a southeastern clinic.	Thematic content analysis	Barriers: 1. Lack of motivation; 2. Fear of injury or pain.
Mizutani et al. (2016)[29]	Indonesia	Qualitative	Semi-structured interviews	Mean age was 51.2 (SD=8.1) Twelve couples (n= 24); Slightly over half (n= 13) of the participants had not completed primary school education.	Explore the perceptions of middle-aged husbands and wives, whose lives were affected directly or indirectly by hypertension, their healthy-lifestyle behaviors, and related reasons for practicing the behaviors.	Categorization of findings	1. They would like to be healthy and to have physical energy for work; 2. They were aware of the necessity of the behaviors; 3. They obtained the information from health professionals, family, and friends; 4. They had a prior experience of having cardiovascular disease followed by improved health status.
Gebrezgi et al. (2017)[30]	Eritrea	Qualitative	Focus group interviews and in-depth interviews	The mean age of the in-depth interview and focus group participants was 61 ± 7 and 53 ± 4 years respectively; 48 patients (26 males and 22 females).	Identified barriers to and facilitators of hypertension management among the hypertensive population.	Thematic analysis	Misconception about PA (difficult to implement, can be harmful to the body)
Magobe et al. (2017)[31]	Soweto	Qualitative	Focus group and individual interviews	Age was above 20 years; 44 patients (13 males and 31 females).	Describe the experiences of patients with hypertension with regard to the facilitation of their own health-promoting lifestyle change measure of regular PA.	Thematization and categorization of findings	1. Experiences of PA; 2. The age;
Shrestha et al. (2018)[32]	Nepal	Qualitative	Focus group discussions	Mean age was 45.9 ± 11.6 years; 35 participants (26 males, 9 females).	Explore barriers and facilitators to treatment among patients with newly diagnosed hypertension aged ≥ 18 years.	Thematic framework analysis (ATLAS. Ti v.7)	Barriers: 1. Laziness and bad weather; 2. A busy schedule and comorbidities such as musculoskeletal pain; 3. Misconceptions of PA.
Basu et al. (2020)[33]	India	Qualitative	Semi-structured interviews	Mean (SD) age of the participants was 53.4 (8.1) years, 30 participants (16 males and 14 females).	Determine perspectives on reasons for non-adherence to antihypertensive therapy and its socioeconomic determinants.	Thematic analysis	Existing practices, barriers, and challenges: 1. Unable to differentiate from ordinary physical activity. 2. Due to joint pains or health disabilities. 3. None of the participants correctly reported the recommended PA requirement in terms of frequency per week and duration per day.

Table 2 (continued)

Author (year)	Country	Methodology	Data collection	Participants	Phenomena of interest	Data analysis	Findings
Gallegos-Carrillo et al. (2021)[34]	Mexico	Mixed-methods	Semi-structured interviews	Aged 35–70 years, 117 participants (low adherence and who did not join the PA program, had an average age of 53.5 years, and 55% were male. The average age among participants in the high-adherence was 57.6 years, and 27.8% were male)	Explore the factors underlying adherence to a specific exercise-referral scheme aimed at increasing PA in patients with hypertension using the health care services of the Social Security System.	Content analysis (Nvivo 7.0)	Main barriers to the practice of PA: 1. Social or Family Support; 2. Self-Efficacy; 3. Time Constraints; 4. Geography; 5. Job. 6. Adherence was associated with participant perceptions of the severity of their disease and their susceptibility to it; 7. Unwillingness to perform PA
Bulto et al. (2021)[35]	Ethiopia	Qualitative	Semi-structured interview	Mean (SD) age of the participants was 55 (8) years (range from 31 to 64 years), 18 patients (11 males and 7 females).	Assess patients' self-perceived heart disease risk and barriers to PA in patients with hypertension.	Thematic analysis (NVivo 12)	Barriers to PA: 1. Physical health problems, such as leg, back and chest pain; 2. Lack of time, being busy with routine activities and having a lot of commitments; 3. Lack of accessible PA facilities.
Aunguroch et al. (2021)[36]	Indonesia	Qualitative	Focus Group Discussions	Average age of 56.6 years 20 hypertension patients (1 male and 19 females).	Explore the barriers and challenges of patients in managing hypertension.	Content analysis	Barriers to PA: 1. Difficult access to the public health center; 2. Unsuitable PA for the elderly; 3. Participants' motivation.
Lee et al. (2022)[37]	Korea	Qualitative	Focus group interviews	Aged 70 to 75 years; 10 patients (3 males and 7 females).	Utilize community participatory research with photovoice to investigate why Korean older adults with hypertension are not likely to participate in PA.	Content analysis	The crucial factors affecting the PA of older adults: 1. Health illiteracy; 2. Distortion of health information; 3. Fear of PA; 4. Rejection of any changes in life.

Notes PA is physical activity, SD is standard deviation

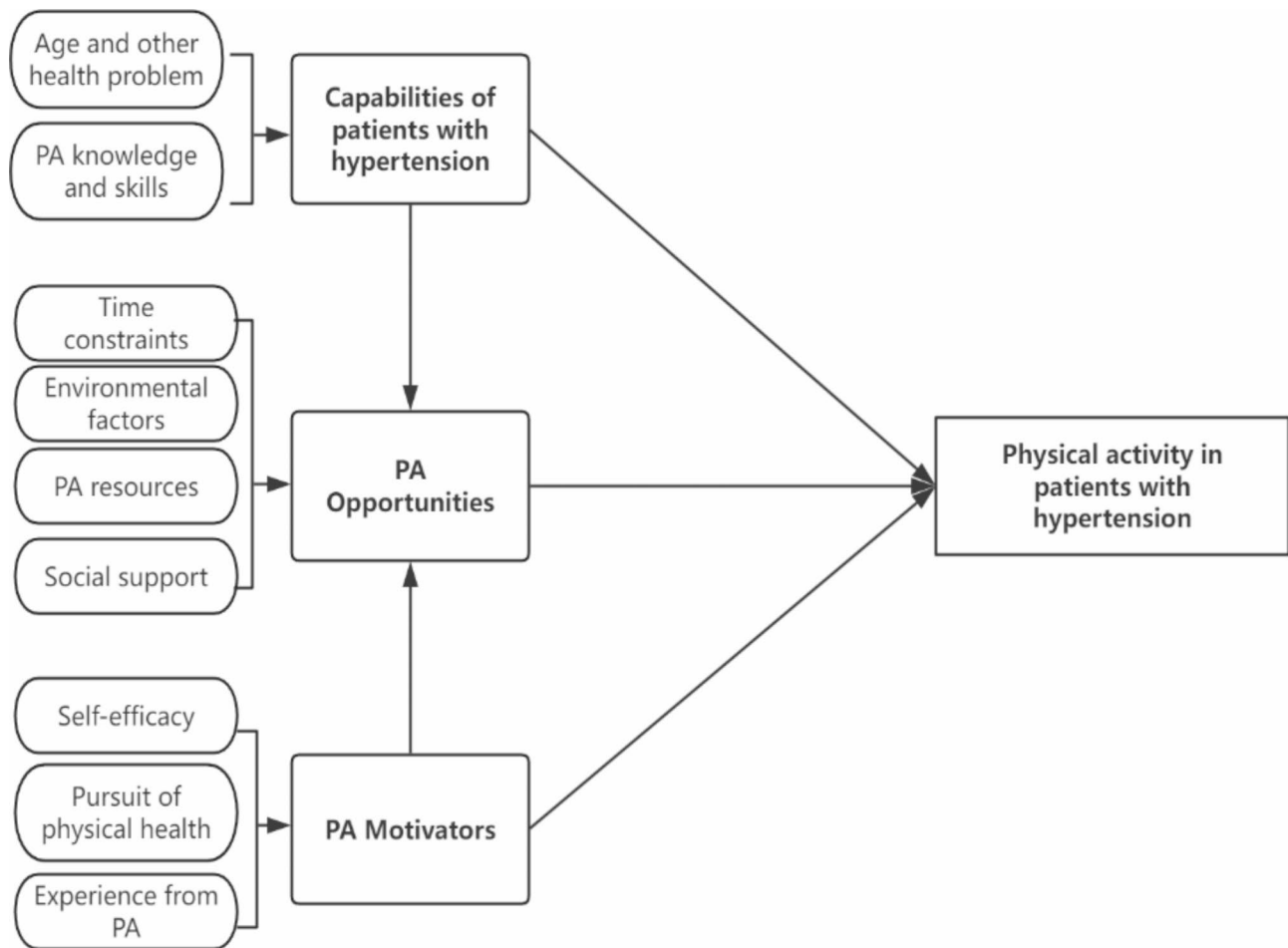


Fig. 2 PA conceptual map for patients with hypertension

Table 3 Results of Meta-synthesis

Synthesized findings	Category	Papers
Capabilities of patients with hypertension	1.Age and other health problem	[24],[25],[28],[31],[32],[33],[35],[36]
	2.PA knowledge and skills	[21],[22],[23],[26],[30],[32],[33],[37]
PA Opportunities	3.Time constraints	[23],[24],[26],[27],[29],[32],[34],[35]
	4.Environmental factors	[23],[25],[26],[29],[32],[34],[36]
	5.PA resources	[21],[23],[29],[35]
	6.Social support	[21],[23],[26],[27],[28],[34],[36],[37]
PA Motivators	7.Self-efficacy	[22],[23],[24],[28],[32],[34],[36],[37]
	8.Pursuit of physical health	[21],[23],[29]
	9.Experience from PA	[21],[23],[25],[31],[37]

Notes The numbers in the third column of the table represent the corresponding references in this paper. PA is physical activity

Additionally, the difference in the cultural climate could affect participation in the PA.

“I want to go to exercise, but I don’t have a motorbike, and no one sent me.” (B2, FGD 3). [36]

“... because in my neighborhood, it is not real safe to be walking around, up and down the street.” (#10–white man, age 64) [25].

“It’s not our habit. You know, we Ghanaians we are... we like fat people. So we don’t do exercise.” (Ghanaian female-ID15) [23].

PA resources

Accessible resources play a crucial role in facilitating participants to PA. Providing free and accessible sports facilities would contribute to promoting PA.

“The patients reported there were either no exercise facilities or, if they existed, they were not adequate or too far away from where they lived.” [35].

The PA location also affected participation, with some participants saying that having sports equipment at home helped them participate in PA, while others said they could do it at work.

“When you are back from work, you feel too lazy and tired to go to the gym. But I have the machine in the house here, ..., I can just go and start here.” (Ghanaian male-ID10) [23].

“Before morning prayers, I go to a farm, plant bananas, and dig for one hour, almost every day, at least four times a week.” (Couple 4, male participant) [29].

Social support

Social support was associated with positive PA participation [38]. This review showed three main aspects that affected social support: (1) the PA guidance from physicians; (2) companionship and support from family members and friends; (3) support from social organizations. The participants claimed that professional advice could facilitate PA.

“But nurses always call me to join the exercise (B1, FGD 3).” [36].

“But who teaches us what to do?. There is an exercise program. But how do I know if it’s right for me or not?” (C) [37].

Companionship was also a significant factor affecting PA:

“I have to do it alone, and I don’t really like that.... it’s nicer if someone would join me.” (Surinamese female-ID18) [23] “It difficult to walk very far, but often the husband or wife motivated each other and they went for a walk together.” [27].

The PA programs by social organizations such as churches also increased participation: *“The church is helping me with my BP, because once a week we go to exercise training.” (Ghanaian female-ID1) [23].*

Synthesized finding 3: PA motivators

Twelve papers described the PA motivators of participants as also very crucial. As one of the determinants of behavior, increasing motivation is central to most health behavior interventions [39]. We found three categories that could explain the motivation for PA participation: self-efficacy, pursuit of physical health, and experience from PA.

Self-efficacy

A previous study has shown that self-efficacy could benefit the PA engagement of hypertension patients [40]. Self-efficacy refers to a person’s ability to perform the necessary actions to produce specific performance achievements. Participants with higher confidence in their ability to carry out PA were likelier to maintain and report a positive effect.

“Yeah, right now, I said, first, I’m going to do my exercises for me, and afterwards I solve the rest.” [34].

Our findings also proved that the need for more self-efficacy made it more challenging to complete the PA programs.

“Two women indicated that it was a lack of will-power or laziness that prevented them from doing exercises.” [24].

Pursuit of physical health

The pursuit of physical health is also a contributing factor to PA. Participants said PA improved their physical health, encouraging them to be active.

“And I swim. But yeah, that has nothing to do with my high BP. In general, it’s just good to exercise at least a half hour every day.” (ID 45) [23].

“After I got a stroke three years ago, I had paralysis, but I tried to walk around a lot and exercise (my) left hand using (a) ball.” (Couple 10, male participant) [29].

Experience from PA

Our findings suggested that participants had both negative and positive experiences during PA. Fear of injury, fatigue and other negative experiences would make patients more reluctant to keep regular PA.

“I went climbing while taking hypertension medication... Suddenly I felt dizzy and my legs were losing strength. It must have been about two years ago. Since then, I haven’t exercised at all.” (E) [37].

“I do try to exercise sometimes, but you know I get tired... and I will do it for a month only, then I just get tired.” (Participant 1, Female, Patient) [31].

However, PA could sometimes bring positive psychological and physiological experiences to participants, which would help them to maintain their PA.

"I live my life just like I used to; sports are a part of who I am." (White-Dutch male-ID37) [23].

"Another man stated that he didn't like taking medication, liked to drink and smoke, and that only exercising would control his hypertension." [25].

Discussion

PA is a first-line treatment for blood pressure control; it is crucial to facilitate its initiation and maintenance in patients [41]. This review summarized the 17 qualitative research studies exploring the PA experiences of patients with hypertension. The findings would be discussed as they relate to the overarching components of the COM-B Model. Our results contribute to a comprehensive understanding of the barriers and facilitators of PA, providing complementary data to quantitative findings.

Capabilities of patients with hypertension

The findings of this review show that age and other health problems will impair the patient's capacity, especially arthritis and pain. It was consistent with the previous literature [42]. Therefore, healthcare professionals should focus on age and physical condition when providing PA advice. Giving different types of PA based on the patient's physical condition helps them to be more active in their PA. As an alternative PA regimen, aquatic motion could not only effectively control blood pressure but also promote PA compliance in older patients [43]. Additionally, some traditional Chinese sports, such as Tai Chi and Ba Duan Jin, have already shown significant effects in regulating blood pressure [44], alleviating pain, and improving physical function [45]. Compared with other moderate and high-intensity PA, traditional Chinese sports might lower the risk of injury for patients with poor physical condition [46]. Meanwhile, the implementation plans for PA programs should be more personalized. Healthcare professionals need to have a deeper understanding of the patient's physical condition and put forward PA recommendations promptly according to the specific conditions of patients.

Another finding suggests that the lack of knowledge and skills could also result in physical inactivity. Patients may not fully understand the importance of PA or can't successfully convert this knowledge into actual behavior change. The result is consistent with the results of Chen et al. [47], where only 3% of Americans understand the correct PA guideline. Therefore, the government or community should emphasize promoting and disseminating of PA knowledge to hypertensive people, especially in low-income and lacking education areas [48]. Furthermore, the previous study proved that developing a practical counseling approach could also help promote PA adherence [49]. Based on the patient's situation,

one-on-one counselling, motivational interviewing and other behavior change techniques should be used [50]. Healthcare professionals should develop the counselling skills and promote communication with patients to provide the proper PA recommendations. Additionally, for those patients who claimed to lack the skills required for PA, the healthcare professionals could suggest simple or non-skilled physical activities for participants. There is also a need to organize relevant training in practical skills using new approaches, such as real-time videoconferencing and virtual reality technology [51, 52].

PA opportunities

The patients with hypertension claimed that time constraints always hindered the PA. They were busy with the workload, family care, and other social activities. It is necessary to consider the flexibility when healthcare professionals deliver PA programs to participants [53]. As PA might not be a priority leisure choice, strategies to reduce barriers to PA need to consider other behaviors that occupy individuals' leisure time. Therefore, it is essential to encourage companies to implement flexible scheduling systems. In the meantime, healthcare professionals could suggest that patients incorporate PA into their daily activities, especially transportation, such as walking or cycling to work instead of driving [54]. Besides, guiding the family members' support for sharing family responsibilities is also beneficial in providing more time for participants' PA engagement.

Environmental factors also affect the adherence to PA. It corresponds with the recent studies that unsafe areas would result in physical inactivity, while the immediate home environment might contribute to positive PA [55, 56]. Therefore, the link between urban planning and the public health sector should be strengthened [57]. It is necessary to establish special sports centers near the community, especially indoor sports facilities, which would reduce geographical limitations and encourage residents to participate actively. Considering the convenience and safety of the footpaths and cycleways is also essential [58]. In addition to the physical environment, intangible cultural elements are indispensable. The previous study has proved that acculturation was positively associated with PA levels [59]. It is necessary to pay attention to the specific cultural needs of ethnic-minority populations and different cultural backgrounds when developing services to promote PA.

Providing accessible and free resources would contribute to PA. As a previous study showed, the cost of equipment on PA would discourage 33.3% of people from physical activity [60]. Therefore, communities, churches, companies and other social organizations should provide more free and accessible sports facilities. Some facilitated tools also could encourage PA by giving feedback,

self-monitoring, setting goals, and recording data. The preliminary studies have shown that telemedicine programs such as pedometers, wearable PA trackers and accelerometers are effective in promoting PA [61–63]. And for patients in low- and middle-income countries, PA can be facilitated through technologies such as mobile phone calls, smartphone app interventions, and short message services [64]. Furthermore, adopting multidisciplinary teamwork, such as physical exercise professionals, alongside the use of telemedicine, could also help to maintain long-term PA [65]. In addition, several participants said they could participate in PA at work. However, the previous study showed that introducing additional leisure time to PA can improve workers' health with a higher level of PA [66]. Hence, advising patients on better balancing work and PA is necessary.

Social support was also an influential factor in PA. It mainly includes three aspects: one is professional advice from healthcare providers. The patients complained that the lack of doctors' guidance would hinder PA, which shows healthcare professionals should provide suggestions timely to address the patient's problems now, social media platforms are a practical approach [67]. The second is the companionship of families and peers. As Huang et al. [68] found that companionship would promote the maintenance of PA. Hence, suggesting the patients' families and friends provide companionship is also a facilitator for PA. The third is the support from the other social communities. A previous study showed that church-based intervention could help to promote PA [69]. Therefore, the policymakers should provide more guidance and support to other institutions of the PA in society.

PA motivators

Our findings indicate that self-efficacy could affect the PA, which is consistent with Chu et al. [70]. As a vital determinant of an individual's active participation in regular PA, self-efficacy should be valued [71]. Thus, it is necessary to help patients keep a positive attitude, such as suggesting patients set simple goals to increase their confidence in PA engagement [72]. The healthcare professionals could deliver an attractive and acceptable plan promoting PA engagement. Moderate incentive approaches (e.g., cash rewards and vouchers) can also stimulate PA [73].

To pursue health, the patients were always willing to participate in PA. Through regular PA, they found that the PA could help control the blood pressure and be healthier. A previous study has reported a similar influence that pursuing health is associated with positive PA [74]. Therefore, healthcare professionals should apply community information columns and health classes to continually reinforce the benefits of PA, such as lowering

blood pressure, improving life and health, and activating the intrinsic motivation of patients with hypertension to perform PA. Additionally, establishing role models has been proven to help motivate patients to PA [75].

Our study shows that positive feelings after PA promote engagement. It is consistent with previous study, which suggested that positive experience plays a prominent role in the motivational phase of PA change [76]. While unpleasant experiences would hinder the PA, such as tiredness, fear of injury, and pain [77]. Dunton et al. [78] also proved that modification of affective responses during PA in real-life situations may be an intervention strategy for PA promotion. Therefore, designing a PA program should fully consider safety and comfort. Additionally, healthcare professionals should guide patients in identifying the discomfort symptoms during PA. In this way, the negative experience of PA is reduced, and the motivation to PA increases.

There are several limitations to this paper. Firstly, we should have searched the grey literature or studies published in other languages, which may ignore some information. Secondly, this review only included the experience of patients with hypertension. Future research should explore the experience of the related members, such as families, close friends, and healthcare providers. It would be helpful to design more comprehensive programs to encourage the patients to participate in PA. Thirdly, the differences among participants, such as age, gender, and cultural context, could affect the accuracy of the result. Hence, future studies could develop more stringent criteria and discuss the PA experience of patients with diverse backgrounds. It will help design more personalized PA programs and promote patients' health. Fourthly, the ConQual score of the synthesized findings was "low" (Appendix D), which may affect the confidence of this review. It indicates that a higher-quality of qualitative study should be designed, specifically referring to the description of the researcher's own situation based on the cultural context and values, as well as the elaboration of the researcher's influence on the study. Finally, although the author has systematically learned the content of qualitative research, author's professional background might still influence the results.

Conclusion

Based on the COM-B theory, this study identified three synthesized findings and nine categories to explain the facilitators and barriers of PA. To more effectively promote PA in patients with hypertension, the following three aspects are the focus: firstly, it is vital to consider the patient's age, physical condition, PA knowledge and skills to enhance their ability to PA; Secondly, increasing patients' opportunities for PA by reducing time and environmental constraints and increasing PA resources

and social support is also necessary; Finally, improving self-efficacy, encouraging health pursuit and enhancing positive experiences are essential to increase patients' motivators. Briefly, this review provides qualitative evidence to design and implement PA programs for patients with hypertension.

Abbreviations

PA	Physical Activity
COM-B model	The Capability, Opportunity, Motivation- Behaviour model
JBI	Joanna Briggs Institute

Supplementary Information

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Supplementary Material 1
Supplementary Material 2
Supplementary Material 3
Supplementary Material 4
Supplementary Material 5

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Author contributions

Qun Li wrote the main manuscript text. Wei Chen provided the guidance for the design and revision for the text. Qun Li, Jieqiong Jiang and Anyan Duan conducted quality appraisal, data extraction, and meta-synthesis. Ling Li and Jiao Hu provided critical comments. All authors read and approved the final manuscript.

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Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethical approval and consent to participate

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Consent for publication

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Competing interests

The authors declare no competing interests.

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References

- Global burden of 87 risk factors in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019[J]. *Lancet*, 2020, 396(10258): 1223–1249.
- Carey RM, Moran AE, Whelton PK. Treatment of hypertension: a Review[J]. *JAMA*. 2022;328(18):1849–61.
- Williams B, Mancia G, Spiering W, et al. 2018 ESC/ESH guidelines for the management of arterial hypertension[J]. *Eur Heart J*. 2018;39(33):3021–104.
- Guthold R, Stevens GA, Riley LM, et al. Worldwide trends in insufficient physical activity from 2001 to 2016: a pooled analysis of 358 population-based surveys with 1.9 million participants[J]. *Lancet Glob Health*. 2018;6(10):e1077–86.
- Abdisa L, Girma S, Lami M, et al. Uncontrolled hypertension and associated factors among adult hypertensive patients on follow-up at public hospitals, Eastern Ethiopia: a multicenter study[J]. *SAGE Open Med*. 2022;10:20503121221104442.
- Souza ALK, Santos LPD, Rech CR, et al. Barriers to physical activity among adults in primary healthcare units in the National Health System: a cross-sectional study in Brazil[J]. *Sao Paulo Med J*. 2022;140(5):658–67.
- Lopes S, Félix G, Mesquita-Bastos J, et al. Determinants of exercise adherence and maintenance among patients with hypertension: a narrative review[J]. *Rev Cardiovasc Med*. 2021;22(4):1271–8.
- Widyakusuma NN, Suryawati S, Wiedyaningsih C, et al. What do seniors believe about Medication Adherence? A qualitative study among seniors with chronic conditions in Yogyakarta, Indonesia[J]. *Patient Prefer Adherence*. 2023;17:1381–92.
- Woods SB, Hiefner AR, Udezi V, et al. They should walk with you: the perspectives of African americans living with hypertension and their family members on disease self-management[J]. *Ethn Health*. 2023;28(3):373–98.
- Walsh D, Downe S. Meta-synthesis method for qualitative research: a literature review[J]. *J Adv Nurs*. 2005;50(2):204–11.
- Michie S, Van Stralen MM, West R. The behaviour change wheel: a new method for characterising and designing behaviour change interventions[J]. *Implement Sci*. 2011;6:42.
- Webb J, Baker A, Palmer T, et al. The barriers and facilitators to physical activity in people with a musculoskeletal condition: a rapid review of reviews using the COM-B model to support intervention development[J]. *Public Health Pract (Oxf)*. 2022;3:100250.
- Rockliffe L, Peters S, Heazell AEP, et al. Understanding pregnancy as a teachable moment for behaviour change: a comparison of the COM-B and teachable moments models[J]. *Health Psychol Behav Med*. 2022;10(1):41–59.
- Silveira SL, Riemann-Lorenz K, Heesen C, et al. Current and long-term physical activity among adults with multiple sclerosis in the United States: COM-B variables as explanatory Factors[J]. *Int J Behav Med*. 2021;28(5):561–74.
- Lockwood C, Munn Z, Porritt K. Qualitative research synthesis: methodological guidance for systematic reviewers utilizing meta-aggregation[J]. *Int J Evid Based Healthc*. 2015;13(3):179–87.
- Tong A, Flemming K, McInnes E, et al. Enhancing transparency in reporting the synthesis of qualitative research: ENTREQ[J]. *BMC Med Res Methodol*. 2012;12:181.
- Ning H, Jiang D, Du Y et al. Older adults' experiences of implementing exergaming programs: a systematic review and qualitative meta-synthesis[J]. *Age Ageing*, 2022, 51(12).
- Hannes K, Lockwood C, Pearson A. A comparative analysis of three online appraisal instruments' ability to assess validity in qualitative research[J]. *Qual Health Res*. 2010;20(12):1736–43.
- Tacconelli E. Systematic reviews: CRD's guidance for undertaking reviews in health care[J]. *Lancet Infect Dis*. 2010;10(4):226.
- Munn Z, Porritt K, Lockwood C, et al. Establishing confidence in the output of qualitative research synthesis: the ConQual approach[J]. *BMC Med Res Methodol*. 2014;14:108.
- Lee LL, Avis M, Arthur A. The role of self-efficacy in older people's decisions to initiate and maintain regular walking as exercise – findings from a qualitative study[J]. *Prev Med*. 2007;45(1):62–5.
- Schmid AA, Damush TM, Plue L, et al. Current blood pressure self-management: a qualitative study[J]. *Rehabil Nurs*. 2009;34(6):223–9.
- Beune EJ, Haafkens JA, Agyemang C, et al. Inhibitors and enablers of physical activity in multiethnic hypertensive patients: qualitative study[J]. *J Hum Hypertens*. 2010;24(4):280–90.
- Kolb SE, Zarate-Abbott PR, Gillespie M, et al. Perceptions about high blood pressure among Mexican American adults diagnosed with hypertension[J]. *Fam Community Health*. 2011;34(1):17–27.
- Bokhour BG, Cohn ES, Cortés DE, et al. The role of patients' explanatory models and daily-lived experience in hypertension self-management[J]. *J Gen Intern Med*. 2012;27(12):1626–34.
- Shima R, Farizah MH, Majid HA. A qualitative study on hypertensive care behavior in primary health care settings in Malaysia[J]. *Patient Prefer Adherence*. 2014;8:1597–609.

27. Legido-Quigley H, Camacho Lopez PA, Balabanova D, et al. Patients' knowledge, attitudes, behaviour and health care experiences on the prevention, detection, management and control of hypertension in Colombia: a qualitative study[J]. *PLoS ONE*. 2015;10(4):e0122112.
28. Rimando M. Perceived barriers to and facilitators of Hypertension Management among Underserved African American older Adults[J]. *Ethn Dis*. 2015;25(3):329–36.
29. Mizutani M, Tashiro J, Maftuhah, et al. Model development of healthy-lifestyle behaviors for rural muslim indonesians with hypertension: a qualitative study[J]. *Nurs Health Sci*. 2016;18(1):15–22.
30. Gebrezgi MT, Trepka MJ, Kidane EA. Barriers to and facilitators of hypertension management in Asmara, Eritrea: patients' perspectives[J]. *J Health Popul Nutr*. 2017;36(1):11.
31. Magobe NBD, Poggenpoel M, Myburgh C. Experiences of patients with hypertension at primary health care in facilitating own lifestyle change of regular physical exercise[J]. *Curationis*. 2017;40(1):e1–8.
32. Shrestha S, Shrestha A, Koju RP, et al. Barriers and facilitators to treatment among patients with newly diagnosed hypertension in Nepal[J]. *Heart Asia*. 2018;10(2):e011047.
33. Basu S, Engtipi K, Kumar R. Determinants of adherence to antihypertensive treatment among patients attending a primary care clinic with limited medical armamentarium in Delhi, India: a qualitative study[J]. *Chronic Illn*. 2022;18(2):295–305.
34. Gallegos-Carrillo K, Reyes-Morales H, Pelcastre-Villafuerte B, et al. Understanding adherence of hypertensive patients in Mexico to an exercise-referral scheme for increasing physical activity[J]. *Health Promot Int*. 2021;36(4):952–63.
35. Bulto LN, Magarey J, Rasmussen P, et al. Awareness of heart disease and associated health behaviours in a developing country: a qualitative study[J]. *Nurs Open*. 2022;9(6):2627–36.
36. Aunguroch Y, Gunawan J, Polsook R, et al. Barriers and challenges in managing hypertension in Belitung, Indonesia: a qualitative Study[J]. *Nurse Media J Nurs*. 2021;11(3):305–17.
37. Lee GY, Kim KO, Ryu JH et al. Exploring perceived barriers to physical activity in Korean older patients with hypertension: Photovoice Inquiry[J]. *Int J Environ Res Public Health*, 2022, 19(21).
38. Scarapicchia TMF, Amireault S, Faulkner G, et al. Social support and physical activity participation among healthy adults: a systematic review of prospective studies[J]. *Int Rev Sport Exerc Psychol*. 2017;10(1):50–83.
39. Knittle K, Nurmi J, Crutzen R, et al. How can interventions increase motivation for physical activity? A systematic review and meta-analysis[J]. *Health Psychol Rev*. 2018;12(3):211–30.
40. Tan F, Oka P, Dambha-Miller H, et al. The association between self-efficacy and self-care in essential hypertension: a systematic review[J]. *BMC Fam Pract*. 2021;22(1):44.
41. Alpsoy Ş. Exercise and Hypertension[J]. *Adv Exp Med Biol*. 2020;1228:153–67.
42. Forechi L, Mill JG, Griep RH, et al. Adherence to physical activity in adults with chronic diseases: ELSA-Brasil[J]. *Rev Saude Publica*. 2018;52:31.
43. Dunlap E, Alhalimi T, McLaurin N et al. Hypotensive effects of aquatic Exercise training in older Adults[J]. *Am J Hypertens*, 2023.
44. Ma J, Ma L, Lu S et al. The Effect of Traditional Chinese Exercises on Blood Pressure in Patients with Hypertension: A Systematic Review and Meta-Analysis[J]. *Evid Based Complement Alternat Med*, 2023, 2023: 2897664.
45. Li R, Chen H, Feng J et al. Effectiveness of Traditional Chinese Exercise for symptoms of knee osteoarthritis: a systematic review and Meta-analysis of Randomized Controlled Trials[J]. *Int J Environ Res Public Health*, 2020, 17(21).
46. Cui Hua LJF, Bin Y, Jun LY, Han LC. Liu Ning Ning. Safety of Tai Chi: Meta-analysis[J]. *J Beijing Sport Univ*, 2018(06): 117–24.
47. Chen TJ, Whitfield GP, Watson KB, et al. Awareness and knowledge of the physical activity guidelines for americans, 2nd Edition[J]. *J Phys Act Health*. 2023;20(8):742–51.
48. Piercy KL, Bevington F, Vaux-Bjerke A, et al. Understanding Contemplators' knowledge and awareness of the physical activity Guidelines[J]. *J Phys Act Health*. 2020;17(4):404–11.
49. Stonerock GL, Blumenthal JA. Role of counseling to promote adherence in healthy Lifestyle Medicine: strategies to improve Exercise Adherence and enhance physical Activity[J]. *Prog Cardiovasc Dis*. 2017;59(5):455–62.
50. Krist AH, Davidson KW, Mangione CM, et al. Behavioral counseling interventions to promote a healthy Diet and Physical Activity for Cardiovascular Disease Prevention in adults with Cardiovascular Risk factors: US Preventive Services Task Force Recommendation Statement[J]. *JAMA*. 2020;324(20):2069–75.
51. Lynch CP, Williams JS, K J R, et al. Tablet-aided Behavioral intervention Effect on self-management skills (TABLETS) for Diabetes[J]. *Trials*. 2016;17:157.
52. Prasertsakul T, Kaimuk P, Chinjenpradit W, et al. The effect of virtual reality-based balance training on motor learning and postural control in healthy adults: a randomized preliminary study[J]. *Biomed Eng Online*. 2018;17(1):124.
53. Wong EY, Lee AH, James AP, et al. Process evaluation of the 'Singapore Physical Activity and Nutrition Study'[J]. *Eval Program Plann*. 2020;83:101847.
54. Bastone AC, Moreira BS, Vasconcelos KSS, et al. Time trends of physical activity for leisure and transportation in the Brazilian adult population: results from Vigitel, 2010–2019[J]. *Cad Saude Publica*. 2022;38(10):e00057222.
55. Quiroz-Mora CA, Serrato-Ramírez DM, Bergonzoli-Peláez G. [Factors associated with adherence to physical activity in patients with chronic non-communicable diseases][J]. *Rev Salud Publica (Bogota)*. 2018;20(4):460–4.
56. Kajosaari A, Laatikainen TE. Adults' leisure-time physical activity and the neighborhood built environment: a contextual perspective[J]. *Int J Health Geogr*. 2020;19(1):35.
57. Zhong J, Liu W, Niu B, et al. Role of built environments on physical activity and Health Promotion: a review and policy Insights[J]. *Front Public Health*. 2022;10:950348.
58. Gribbon C. Physical activity and the environment[J]. *Arch Dis Child Educ Pract Ed*. 2021;106(2):113.
59. Zhu X, Liu J, Sevoyan M, et al. Acculturation and leisure-time physical activity among Asian American adults in the United States[J]. *Ethn Health*. 2022;27(8):1900–14.
60. Ashton LM, Hutchesson MJ, Rollo ME, et al. Motivators and barriers to engaging in healthy eating and physical Activity[J]. *Am J Mens Health*. 2017;11(2):330–43.
61. Omar N, Yeoh BS, Chellappan K, et al. The effects of pedometer-based exercise on central and peripheral vascular functions among young sedentary men with CVD risk factors[J]. *Front Physiol*. 2023;14:1062751.
62. Singh B, Zopf EM, Howden EJ. Effect and feasibility of wearable physical activity trackers and pedometers for increasing physical activity and improving health outcomes in cancer survivors: a systematic review and meta-analysis[J]. *J Sport Health Sci*. 2022;11(2):184–93.
63. Kanai M, Izawa KP, Kobayashi M, et al. Effect of accelerometer-based feedback on physical activity in hospitalized patients with ischemic stroke: a randomized controlled trial[J]. *Clin Rehabil*. 2018;32(8):1047–56.
64. Boima V, Doku A, Agyekum F, et al. Effectiveness of digital health interventions on blood pressure control, lifestyle behaviours and adherence to medication in patients with hypertension in low-income and middle-income countries: a systematic review and meta-analysis of randomised controlled trials[J]. *EClinicalMedicine*. 2024;69:102432.
65. Viana S, Salvador R, Morouço P, et al. The contribution of Exercise in Telemedicine Monitoring in reducing the modifiable factors of Hypertension-A Multidisciplinary Approach[J]. *Eur J Investig Health Psychol Educ*. 2022;12(4):363–86.
66. Park S, Lee JH. Associations of occupational and leisure-time physical activity with self-rated health in Korea[J]. *Prev Med*. 2022;158:107022.
67. Ruiz-Kortés M, Múzquiz-Barberá P, Herrero R et al. How the Presence of a doctor known to patients impacts a web-based intervention to promote physical activity and healthy eating Behaviour in individuals with an Overweight/Obesity-Hypertension phenotype: a Randomised Clinical Trial[J]. *Nutrients*, 2023, 15(7).
68. Huang WY, Huang H, Wu CE. Physical activity and social support to promote a health-promoting lifestyle in older adults: an intervention Study[J]. *Int J Environ Res Public Health*, 2022, 19(21).
69. Whitt-Glover MC, Goldmon MV, Gizlice Z, et al. Learning and developing individual Exercise skills (L.A.D.I.E.S.) for a Better Life: A Church-based physical activity intervention - baseline participant Characteristics[J]. *Ethn Dis*. 2017;27(3):257–64.
70. Chu IH, Chen YL, Wu PT et al. The associations between Self-determined motivation, Multidimensional Self-Efficacy, and device-measured physical Activity[J]. *Int J Environ Res Public Health*, 2021, 18(15).
71. Choi J, Lee M, Lee JK, et al. Correlates associated with participation in physical activity among adults: a systematic review of reviews and update[J]. *BMC Public Health*. 2017;17(1):356.
72. Anderson CL, Feldman DB. Hope and Physical Exercise: the contributions of Hope, Self-Efficacy, and Optimism in Accounting for Variance in Exercise Frequency[J]. *Psychol Rep*. 2020;123(4):1145–59.

73. Miranda JJ, Pesantes MA, Lazo-Porras M, et al. Design of financial incentive interventions to improve lifestyle behaviors and health outcomes: a systematic review[J]. *Wellcome Open Res.* 2021;6:163.
74. Kaewthummanukul T, Brown KC. Determinants of employee participation in physical activity: critical review of the literature[J]. *Aaohn j.* 2006;54(6):249–61.
75. O'donnell N, Jerin SI, Mu D. Using TikTok to Educate, Influence, or Inspire? A content analysis of Health-related EduTok Videos[J]. *J Health Commun.* 2023;28(8):539–51.
76. Parschau L, Fleig L, Warner LM, et al. Positive Exercise Experience facilitates Behavior Change via Self-Efficacy[J]. *Health Educ Behav.* 2014;41(4):414–22.
77. McCormack C, Cullivan S, Kehoe B, et al. It is the fear of exercise that stops me - attitudes and dimensions influencing physical activity in pulmonary hypertension patients[J]. *Pulm Circ.* 2021;11(4):20458940211056509.
78. Dunton GF, Crosley-Lyons R, Rhodes RE. Affective response during real-world physical activity as an intervention Mediator[J]. *Exerc Sport Sci Rev;* 2023.

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