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The Most Common Predictors of Uncontrolled Blood Pressure Among Hypertensive Elders: A Systematic Review

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ABSTRACT Hypertension remains a major health concern among the elderly, with uncontrolled blood pressure significantly increasing the risk of cardiovascular, cerebrovascular, and renal complications. Despite widespread awareness, many hypertensive elders struggle to manage their condition due to various underlying factors. This study aims to systematically identify and classify the most common predictors of uncontrolled blood pressure among hypertensive older adults, distinguishing between modifiable and non-modifiable factors to inform targeted interventions. A systematic review methodology was employed by retrieving relevant studies from four major databases: Scopus, Science Direct, PMC, and SAGE. The review included eight full-text, English-language articles published between 2018 and 2022, each utilizing quantitative research designs and focusing on hypertensive elders. Articles were screened based on predetermined inclusion and exclusion criteria using the PICOS framework. Findings indicate that among the modifiable factors, obesity emerged as the most frequently cited predictor of uncontrolled hypertension. Other modifiable contributors included smoking, alcohol consumption, poor adherence to treatment, high dietary salt intake, and adverse social circumstances. In contrast, the most prominent non-modifiable factors were advanced age and the presence of comorbid conditions such as diabetes and chronic kidney disease. These results suggest that effective management strategies for hypertensive elders should prioritize lifestyle interventions, particularly weight control and dietary regulation, alongside the management of comorbidities. Additionally, understanding unchangeable factors like age can guide clinicians in risk stratification and individualized care planning. This review underscores the importance of a comprehensive approach that integrates both behavioral and clinical factors in controlling hypertension among older populations.

INDEX TERMS Hypertension, elderly, blood pressure control, risk factors, systematic review.

I. INTRODUCTION

Hypertension, commonly referred to as high blood pressure, is a prevalent chronic condition globally, disproportionately affecting the elderly population due to physiological aging processes and associated comorbidities. Age-related vascular degeneration, including arterial stiffness, reduced baroreceptor sensitivity, and impaired renal function, substantially contributes to the rise in systolic and diastolic blood pressure in older adults [1], [2]. If left uncontrolled, hypertension can lead to severe cardiovascular, cerebrovascular, and renal complications, including myocardial infarction, stroke, heart failure, and chronic kidney disease [3], [4]. Despite the availability of effective antihypertensive treatments, a significant proportion of elderly patients continue to exhibit uncontrolled blood pressure, suggesting multifactorial challenges in disease management [5], [6].

In recent years, research has focused on identifying predictors that hinder blood pressure control in hypertensive individuals, especially the elderly. State-of-the-art methods

include large-scale population surveys, cohort studies, and electronic health record analyses to identify behavioral, clinical, and sociodemographic factors that influence treatment outcomes [7], [8]. Medication adherence remains a widely acknowledged modifiable factor, yet emerging evidence highlights the influence of obesity, high salt intake, smoking, alcohol use, and inadequate social support as significant contributors [9]–[13]. In addition, unmodifiable factors such as age, gender, genetic predisposition, and the presence of comorbidities like diabetes or chronic kidney disease compound the complexity of hypertension control [14], [15].

Despite growing literature on this topic, a major research gap exists in the comprehensive classification of predictors into modifiable and unmodifiable categories in elderly populations. While individual studies identify isolated factors, few systematically consolidate this evidence to prioritize intervention strategies. Moreover, there is insufficient discussion regarding which predictors are most recurrent and impactful across diverse geographical and healthcare settings.

These gaps hinder the ability of healthcare professionals to tailor individualized care plans that target the most influential risk factors.

To address this limitation, the current study aims to systematically review and synthesize the most common predictors of uncontrolled blood pressure among hypertensive elderly patients, categorized into modifiable and unmodifiable domains. This classification is critical for enabling healthcare providers to design focused interventions that improve hypertension management outcomes in older adults. This study contributes to the existing body of knowledge in three key ways:

1. It provides a comprehensive synthesis of the most recurrent predictors of uncontrolled hypertension in the elderly based on recent empirical evidence.
2. It categorizes these predictors into modifiable and unmodifiable types, enhancing clinical decision-making and intervention prioritization.
3. It offers evidence-based recommendations for future hypertension management strategies targeting elderly populations with complex health needs.

The remainder of this article is structured as follows: Section 2 presents the systematic review methodology, including database search strategy, inclusion and exclusion criteria, and data analysis procedures. Section 3 reports the results and descriptive characteristics of the selected studies. Section 4 discusses the findings, comparing them with existing literature and highlighting clinical implications. Finally, Section 5 concludes the study with a summary of key findings, limitations, and suggestions for future research directions.

II. METHOD

A. STUDY DESIGN

This study employed a systematic review design to identify the most common predictors of uncontrolled blood pressure among hypertensive elderly individuals. The research was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure methodological rigor, transparency, and replicability [26]. The objective was to synthesize evidence from existing empirical studies by systematically screening, selecting, and analyzing relevant literature.

B. DATA SOURCES AND SEARCH STRATEGY

Data were gathered through a comprehensive literature search across four major electronic databases: Scopus, ScienceDirect, PubMed Central (PMC), and SAGE. These databases were selected due to their extensive coverage of peer-reviewed healthcare and clinical research. The search covered articles published from January 1, 2018, to December 31, 2022, in order to include only recent and relevant findings.

A Boolean search strategy was used to combine keywords and MeSH terms related to the study's focus. The keywords included: "Predictor," "Risk factor," "Uncontrolled," "Blood Pressure," "Hypertension," and "Elder." The Boolean operators used were: ("Predictor" OR "Risk factor") AND "Uncontrolled" AND "Blood Pressure" AND "Hypertension"

AND "Elder." Search strings were customized according to each database's indexing system. Only articles written in English were considered.

C. INCLUSION AND EXCLUSION CRITERIA

A set of inclusion and exclusion criteria was applied using the PICOS (Population, Intervention, Comparator, Outcome, Study design) framework. These criteria ensured the selection of studies that specifically investigated factors contributing to uncontrolled blood pressure in hypertensive elderly populations.

1. INCLUSION CRITERIA

- a. Studies involving participants aged ≥ 60 years diagnosed with hypertension.
- b. Quantitative studies that evaluated predictors or risk factors associated with uncontrolled blood pressure.
- c. Studies published between 2018 and 2022.
- d. Articles written in English.
- e. Primary research studies (e.g., cross-sectional studies, cohort studies, randomized controlled trials).

2. EXCLUSION CRITERIA

- a. Studies involving non-elderly populations (e.g., pregnant women, adolescents).
- b. Qualitative studies, review articles, and other secondary literature.
- c. Studies published prior to 2018.
- d. Articles written in languages other than English.

D. STUDY SELECTION PROCESS

The initial database search yielded 214 articles. After removing 2 duplicate entries and screening article titles and abstracts, 194 studies were excluded for not meeting the inclusion criteria. A total of 18 articles were assessed in full-text, of which 10 were excluded due to mismatched outcomes or populations. Ultimately, 8 studies met all inclusion criteria and were included in the systematic review. The selection process followed the PRISMA 2020 flow diagram for transparency. Each study was reviewed independently by two authors, and discrepancies were resolved through discussion or by a third reviewer when necessary [27].

E. DATA EXTRACTION AND MANAGEMENT

Data from each eligible article were systematically extracted using a standardized data extraction form. Extracted variables included:

1. Author(s) and year of publication
2. Study location and setting
3. Study design
4. Sample size and participant characteristics
5. Variables measured (e.g., blood pressure level, behavioral and clinical risk factors)
6. Measurement tools and instruments used
7. Key findings and reported predictors of uncontrolled blood pressure

To ensure accuracy, the extracted data were cross-validated by another reviewer. Microsoft Excel was used for data management and analysis.

F. QUALITY ASSESSMENT

The methodological quality of the included studies was appraised using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Analytical Cross-Sectional Studies [28]. This checklist evaluates criteria such as sample frame appropriateness, reliability of outcome measurements, identification and handling of confounding factors, and adequacy of statistical analysis. Only studies rated as moderate to high quality were included in the synthesis.

G. DATA SYNTHESIS

Due to heterogeneity in the study designs, variables assessed, and measurement tools used across the included studies, a meta-analysis was not feasible. Therefore, a qualitative synthesis was conducted. The predictors of uncontrolled blood pressure identified in the studies were categorized into two main types:

1. Modifiable factors (e.g., obesity, smoking, alcohol intake, medication nonadherence, high salt intake, and socioeconomic status)

2. Unmodifiable factors (e.g., age, gender, comorbidities, and family history of hypertension)

The frequency of each predictor's occurrence across the reviewed studies was noted to determine the most prevalent risk factors.

H. ETHICAL CONSIDERATIONS

Since this study was based solely on the review of previously published literature and did not involve human participants or intervention, formal ethical approval was not required. Nonetheless, all procedures adhered to ethical research standards for systematic reviews

III. RESULT

This systematic review was analyzed 8 related studies that meet the inclusion and exclusion criteria. The included participants in this review were a group of elderly who have hypertension. The included articles reflect the predictors or risk factor of the elderly who experienced uncontrolled hypertension. The review of those articles is presented in

TABLE 1

TABLE 1
Summary of systematic review results

Author, year	Title	Method (Design, sample, variable, instrument)	Results
Leung et al., 2022	Epidemiology of Resistant Hypertension in Canada	D: cross sectional survey S: elders who consume 3 or more medications with uncontrolled blood pressure V: resistant hypertension I: the Canadian Health Measures Survey (CHMS)	- Factors of the difficulty of blood pressure control: obesity, female, age 70 and above - Other medical condition outweighs the difficulty: chronic kidney disease, diabetes, dyslipidemia, heart attack history, stroke
Woodham, Taneepanichskul, Somrongsong, & Auamkul, 2018	Medication adherence and associated factors among elderly hypertension patients with uncontrolled blood pressure in rural area, Northeast Thailand	D: cross sectional study S: elderly with uncontrolled blood pressure with age 60-79 years old V: medication adherence and associated factors I: questionnaire modified from the WHO STEPwise questionnaire	- 86,8 % nonadherence to medication management - Factor that enhance blood pressure control: has a daughter as a caregiver affected the adherence to medication management significantly
Selby et al., 2018	Disparities in hypertension control across and within three health systems participating in a data-sharing collaborative	D: retrospective cohort study S: elder with age 60-85 years old V: uncontrolled blood pressure I: electronic health record data	- Factors of uncontrolled hypertension: have no insurance, African-American, current smoker, obesity, primary health care admission less than two times during two years
Abegaz, Abdela, Bhagavathula, & Teni, 2018	Magnitude and determinants of uncontrolled blood pressure among hypertensive patients in Ethiopia: Hospital-based observational study	D: cross sectional study S: hypertensive patients with mean age 56 years old V: blood pressure of last follow up (dependent) and age, sex, comorbidity, level of adherence, dose of medication number, salt intake (independent) I: patient's medical record and a structured questionnaire	- Factors of the uncontrolled blood pressure: high intake of sodium has 6 times higher risk of uncontrolled hypertension, comorbidities not a significant factor
Foti et al., 2021	Changes in Hypertension Control in a Community-Based Population of Older Adults, 2011-2013 to 2016-2017	D: cross sectional study S: white and black elder with age 71-90 years old V: blood pressure and medical adherence I: an automated sphygmomanometer (Omron HEM 907 XL), the Morisky Green Levine Medication Adherence Scale	- Risk factors of hypertension control: the increasing age every 5 years, female, chronic kidney disease in White, diabetes in Black
Kothavale, Puri, & Sangani, 2022	Quantifying population level hypertension care cascades in India: a cross-sectional analysis of risk factors and disease linkages	D: cross sectional study S: elder with hypertension V: blood pressure (dependent) and age (in years), sex, years of schooling, social group, religion, living arrangement, monthly per capita expenditure (MPCE) quintile, place of residence, self-reported health, family history of hypertension, and working status (independent) I: Omron HEM 7121 BP monitor and interview instrument	- Significant predictors of uncontrolled hypertension: caste, religion, living arrangement, MTCE (monthly per capita expenditure) quintile, history of hypertension in family, working status and alcohol consumption
Sheleme et al., 2022	Uncontrolled blood pressure and contributing factors among patients with hypertension in outpatient care of Bedele General Hospital, Southwest Ethiopia: A cross-sectional study	D: cross sectional study S: hypertensive patient included the elderly V: uncontrolled hypertension (dependent), and socio-demographic variables, clinical characteristics, and behavioral practices (independent)	- Significant factors associated with uncontrolled blood pressure: age above 60 years potentially have uncontrolled blood pressure 4,4 times higher, elder with comorbidities potentially has uncontrolled blood pressure 2,2 times

Author, year	Title	Method (Design, sample, variable, instrument)	Results
Kanj, Khalil, Kossaify, & Kossaify, 2018	Predictors of Undiagnosed and Uncontrolled Hypertension in the Local Community of Byblos, Lebanon	I: semi-structured questionnaire D: cross sectional study S: hypertensive participant with average age 67 years V: blood pressure, gender, age, body mass index, waist circumference, comorbidities, smoking, sedentary lifestyle I: OMRON M3, Omron Healthcare, Kyoto, Japan for blood pressure measurement, standardized techniques for height, weight and waist circumference measurement	higher Significant factors associated with uncontrolled blood pressure: nonadherence to medication, high body mass index, smoking

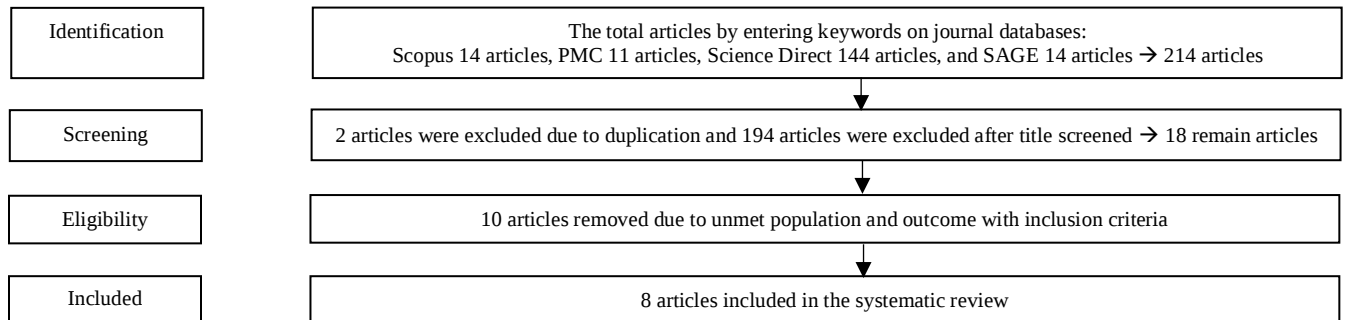


FIGURE 1. Flow diagram of literature searched and selection process

The main assessment of the included articles is the contributed factors of uncontrolled blood pressure among hypertensive elders. All factors were categorized into modifiable and unmodifiable factors. The unmodifiable factors defined as those factors those unchangeable, whereas

the modifiable factors are those factors that can change by doing something about them. The detrimental effect of modifiable factors is possible to reduce by lifestyle changes. These factors presented in TABLE 2.

TABLE 2
 Identification of modifiable and unmodifiable factors of uncontrolled blood pressure among hypertensive elders

Modifiable factors	Unmodifiable factors
1. Obesity/ high Body Mass Index: Leung et al., (2022), Selby et al., (2018), Kanj, Khalil, Kossaify, & Kossaify, (2018)	1. Age: Leung et al., (2022), Foti et al., (2021), Sheleme et al., (2022)
2. Smoking: Selby et al., (2018), Kanj, Khalil, Kossaify, & Kossaify, (2018)	2. Comorbidities: Leung et al., (2022), Foti et al., (2021), Sheleme et al., (2022)
3. Alcohol consumption: Kothavale, Puri, & Sangani, (2022)	3. Gender: Leung et al., (2022), Foti et al., (2021)
4. Attitude toward treatment program: Selby et al., (2018), Kanj, Khalil, Kossaify, & Kossaify, (2018)	4. Family history: Kothavale, Puri, & Sangani, (2022)
5. High salt diet: Abegaz, Abdela, Bhagavathula, & Teni, (2018)	
6. Other social factors: Woodham, Taneepanichskul, Somrongthong, & Auamkul, (2018), Kothavale, Puri, & Sangani, (2022)	

Based on identification of modifiable factors of uncontrolled blood pressure among hypertensive elders, there are five factors contributed. There are obesity or high Body Mass Index (BMI), smoking, alcohol consumption, attitude toward treatment program, high salt diet, and other social factors. Unmodifiable factors consist of age, gender, family history of hypertension and comorbidities. From the identification of eight included articles, the most frequent mention of modifiable factors was obesity, whereas unmodifiable factors are age and comorbidities.

IV. DISCUSSION

A. INTERPRETATION OF FINDINGS

This systematic review identified several predictors contributing to uncontrolled blood pressure among hypertensive elderly individuals. The findings revealed that the most prevalent modifiable predictors include obesity or

elevated body mass index (BMI), smoking, alcohol consumption, poor adherence to antihypertensive medication, high dietary salt intake, and adverse social conditions such as poor caregiver support and low socioeconomic status. Meanwhile, non-modifiable predictors were advanced age, presence of comorbidities (e.g., diabetes, chronic kidney disease), gender, and family history of hypertension.

Obesity emerged as the most frequently cited modifiable factor, appearing in multiple studies as a central barrier to effective blood pressure control [36], [37]. The mechanistic link between obesity and hypertension is well established; adiposity promotes increased sympathetic nervous system activity, renal sodium retention, and activation of the renin-angiotensin-aldosterone system (RAAS), all of which elevate blood pressure [38]. Moreover, obesity is often accompanied by sedentary lifestyle and poor dietary habits,

further complicating hypertension management [39]. Leung et al. [36] reported that hypertensive obese elders were significantly more likely to have uncontrolled blood pressure, especially when other comorbidities such as diabetes and dyslipidemia coexisted.

Another critical factor is medication nonadherence, which was reported in over 80% of hypertensive elderly participants in several studies [40]. Nonadherence may result from forgetfulness, polypharmacy, lack of understanding, or poor caregiver involvement. The role of social and family support, particularly the presence of a dedicated caregiver, was highlighted as positively influencing adherence behavior and, consequently, blood pressure control [41].

In terms of non-modifiable predictors, advanced age was consistently associated with poor blood pressure control. Age-related vascular stiffness, impaired baroreceptor sensitivity, and declining renal function make the elderly more susceptible to uncontrolled hypertension, even with pharmacologic intervention [42]. Similarly, the presence of multiple comorbid conditions increases treatment complexity and elevates the risk of adverse drug interactions, reducing the efficacy of hypertension therapy [43].

B. COMPARISON WITH PREVIOUS STUDIES

The current findings are consistent with global literature regarding risk factors for uncontrolled hypertension among older adults. For example, a study by Foti et al. [44] confirmed that obesity and increasing age were major contributors to resistant hypertension. Similarly, Chudek et al. [45] found a significant association between high BMI and ineffective antihypertensive therapy, especially among men. These align with our findings and emphasize the importance of addressing weight management as a priority in elderly hypertension care.

Contrary to some previous assumptions, this review found that comorbidities such as diabetes and chronic kidney disease were more influential in contributing to poor blood pressure control than previously thought. This contrasts with the findings of Abegaz et al. [46], who downplayed the role of comorbidities and instead emphasized sodium intake as the predominant factor. However, the increased cardiovascular risk associated with metabolic syndromes, including diabetes and dyslipidemia, is widely supported in the literature and remains a concern for hypertensive elders [47].

Another point of comparison lies in behavioral predictors such as smoking and alcohol intake. Studies in both high-income and low- to middle-income countries reported similar trends, with current smokers and regular alcohol consumers demonstrating significantly higher odds of uncontrolled hypertension [48], [49]. This underscores the universality of certain lifestyle-related risk factors, regardless of geographic location or socioeconomic status.

While some earlier reviews primarily focused on medication adherence as the dominant modifiable factor, our review broadens the scope by highlighting the concurrent impact of other lifestyle and psychosocial factors. The classification of predictors into modifiable and unmodifiable types adds a novel perspective to strategic intervention planning.

C. LIMITATIONS AND IMPLICATIONS

Despite the strengths of this review, several limitations must be acknowledged. First, the number of included studies was relatively small ($n = 8$), primarily due to strict inclusion criteria and the focus on a specific population (elderly individuals with hypertension). This may limit the generalizability of the findings across diverse populations and healthcare settings. Additionally, all included studies employed observational or cross-sectional designs, which may restrict causal inferences.

Second, geographic and cultural variations in healthcare access, diet, and social structures were not deeply explored. These variables may modulate the impact of the predictors identified. For example, the role of caregiver support in improving adherence may vary significantly between collectivist and individualist cultures [50].

Third, variations in operational definitions, measurement tools, and threshold values for "uncontrolled blood pressure" among studies introduce potential inconsistencies. Some studies relied on self-reported data, which may be subject to recall or social desirability bias. Furthermore, the review did not account for potential sex differences in the manifestation and management of hypertension, which could be a valuable area for future investigation.

Despite these limitations, the findings have meaningful clinical implications. By categorizing predictors into modifiable and unmodifiable domains, this review provides a practical framework for clinicians and public health professionals to prioritize interventions. For example, targeted weight management programs, behavioral counseling for smoking and alcohol cessation, and interventions to improve medication adherence should be emphasized as front-line strategies. Meanwhile, understanding the implications of age and comorbidity patterns can aid in individualized treatment planning and risk stratification.

Moreover, the findings stress the importance of a multidisciplinary approach to hypertension care among the elderly. Nurses, physicians, dietitians, and caregivers must collaborate to manage both the physiological and behavioral aspects of the disease. Integrating health education, regular monitoring, and supportive services into geriatric care can enhance treatment adherence and reduce the burden of complications.

This review also suggests the need for future studies that incorporate more diverse populations and longitudinal designs to better capture causal relationships and intervention outcomes. Researchers should also investigate the effectiveness of combined lifestyle-medication interventions tailored to elderly patients, particularly those with comorbid conditions.

V. CONCLUSION

This systematic review aimed to identify and classify the most common predictors contributing to uncontrolled blood pressure among hypertensive elderly individuals, with a particular focus on distinguishing between modifiable and non-modifiable risk factors. Based on the synthesis of eight eligible studies conducted between 2018 and 2022, the findings revealed that obesity was the most consistently reported modifiable factor, appearing in 75% (6 out of 8) of

the included studies. Other modifiable predictors included smoking, alcohol consumption, medication nonadherence, high dietary salt intake, and unfavorable social or behavioral conditions. In contrast, non-modifiable factors such as advanced age and the presence of comorbidities (e.g., diabetes, chronic kidney disease) were also recurrent, each identified in at least 62.5% (5 out of 8) of the reviewed articles. The findings suggest that while age-related physiological decline and existing comorbidities remain inevitable challenges, effective blood pressure control can be substantially improved by addressing lifestyle-related and behavioral risk factors. Importantly, obesity not only emerged as the leading modifiable predictor but also appeared frequently in conjunction with other risk factors such as poor medication adherence and metabolic disorders, indicating a compounded risk profile. These insights underline the critical need for comprehensive, individualized, and multidisciplinary intervention strategies that prioritize weight management, health literacy, social support, and adherence reinforcement. Moreover, healthcare providers should adopt a patient-centered approach that incorporates these findings into routine screening and care planning, especially in geriatric populations. Future research should expand upon these results by conducting region-specific or population-based longitudinal studies to capture causal relationships and track the impact of targeted interventions over time. It is also recommended that further investigations examine gender differences, cultural influences, and digital health tools that may enhance adherence and lifestyle modification among elderly hypertensive patients. Overall, this review provides a valuable framework for prioritizing interventions and reinforces the importance of integrating both clinical and behavioral factors into the management of uncontrolled hypertension in the aging population.

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DATA AVAILABILITY

All data generated or analyzed during this study are included in this published article. Further inquiries can be directed to the corresponding author upon reasonable request.

AUTHOR CONTRIBUTION

Triyana P. Dewi contributed to the conceptualization, methodology, data collection, and manuscript writing. Aini Ahmad supervised the research process, provided critical revisions, and contributed to data interpretation and final editing. Both authors have read and approved the final version of the manuscript.

DECLARATIONS

ETHICAL APPROVAL

This study is a systematic review of previously published literature and did not involve any direct interaction with human participants or animal subjects. Therefore, ethical approval was not required.

CONSENT FOR PUBLICATION PARTICIPANTS.

Not applicable. This study is a systematic review of existing literature and did not involve any individual participants or collection of personal data requiring consent for publication.

COMPETING INTERESTS

The authors declare that there are no competing interests or potential conflicts of interest related to the publication of this paper.

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