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

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ABSTRACT Aging process implies challenges for the elderly, specifically related to degeneration in the vascular system. The uncontrolled blood pressure has detrimental effects on brain, heart and kidney that cause organ failure. Hypertension is getting harder to control if the patients unaware with the factors that outweigh blood pressure control. Medication nonadherence and unhealthy behavior are known as the essential factors related to uncontrolled blood pressure. The study aims to assess the most common predictors of uncontrolled blood pressure, which involved elders with hypertension. The method used is a systematic review obtained from databases of Scopus, Science Direct, PMC, and SAGE. The total of eight full text articles in English language and randomized controlled trial design determined from 2018 to 2022 included in the assessed articles. The result did not reveal medication adherence as the most common factor, but obesity as modifiable predictor is obesity, whereas unmodifiable are age and comorbid. It is indicated that the require intervention for hypertensive elder is focused on body weight and comorbid management. The implication of this systematic review is beneficial for the elderly to achieve blood pressure control by enhancing the awareness of changeable factors and adopt a healthy lifestyle. Furthermore, the nurse also easier to determine the appropriate intervention for elders.

INDEX TERMS Blood pressure, Elder, Hypertension, Predictor, Uncontrolled.

I. INTRODUCTION

Hypertension in the elderly has a characteristic of vascular degeneration, which characterized by arterial stiffness due to advanced age [1]. Undisciplined hypertension management is potential to be a health problems precipitate of heart, brain and kidney [2]. Heart failure due to hypertension is easier to attack the elders compared to younger adults, it can reach even five times at the age of more than 80 and mostly caused death [3]. High blood pressure is known as a preventable cause of many diseases related vascular if the survivor aware of the hypertension risk factor [4].

WHO declared about 520 million hypertension survivor unaware of the health problem and 720 million did not receive proper treatment with the highest prevalence in Africa region [5]. The global report of average blood pressure documented that systolic and diastolic blood pressure was higher in South Asia, Sub-Saharan Africa, Middle and East Europe. The tendency of lower blood pressure found in high-income country [6].

Multiethnic study that involved Malay, Chinese and Indian found older age, Malay ethnicity, being male, low educational level and unemployed were significant factors of hypertension. Older age was identified as a consistent factor related uncontrolled hypertension [7]. Study about hypertension in the elderly was conducted by Muli et al. (2020) found that the elders also had stroke, myocardial infarction, heart failure, chronic kidney disease and retinopathy. Identification of uncontrolled blood pressure risk factor in hypertension said were monotherapy and diabetes [8]. The similar research performed by Mitra & Wulandari (2019) in Indonesia discovered that current smoking habit, irregular medication, and sodium consumption as the variables which caused of uncontrolled blood pressure. The smoking as a main focus that perceived needs education and health counseling to stop smoking [9]. The research in China identified that the worker elders, uninsured, unmarried and social-behavior aspects as the independent predictors of uncontrolled blood pressure among hypertensive elders [10].

The poorly controlled blood pressure in elderly has an important contributing factor is medication adherence. That is undeniable that uncontrolled blood pressure among elder has a detrimental effect on the quality of life [11]. The most frequent complication that mentioned were stroke, myocardial infarction and heart failure. The vascular disease such as peripheral vascular disease and aneurysm also need an attention [12]. The prevention of vascular disease focuses on intervention to lower blood pressure under 140/90 mmHg based on American Heart Association and American Stroke Association [13]. American Heart Association identified that many factors that contributed to the gap between the goal and the currently observed levels of blood pressure target, but are focused on knowledge of antihypertensive medication adherence [14]

According to the previous study related elder hypertension indicated that the predictors of uncontrolled hypertension might divide into factors that possibly change and unchanged. Commonly said in the researches that uncontrolled blood pressure mostly caused by irregular medication. The most common strategy as a focus intervention in blood pressure control is to enhance medication adherence, but often ignore the other key factors. There was no article which grouped the predictor into modifiable and unmodifiable factors. The review of these factors has to discover to achieve high quality nursing care in elderly by knowing which factors are priorities.

The aim of this systematic review is expected to deliver information about the most common predictor of uncontrolled blood pressure among hypertensive elders which divided into modifiable and unmodifiable factors that contribute to enhance the focus strategy to achieve the hypertensive

treatment goals. All included resources in this systematic review determined from 2018 to 2022 which discover the updated predictor of uncontrolled blood pressure in elderly.

II. METHODOLOGI

This study is a systematic review which arranged from journal database identification included Scopus, Science Direct, PMC, and SAGE. The articles were conducted from 2018 or later with the focus is the risk factors or predictors of uncontrolled blood pressure among hypertensive elders. English research studies about blood pressure control which involved hypertensive elder are included, whereas the literature review and systematic review are excluded.

There were 214 articles from the beginning, then remain 11 articles after analyzing by inclusion and exclusion criteria, checked for duplication, title and the content. The process of articles identification was started by entering keywords of “predictor”, “uncontrolled”, “blood pressure”, “hypertension” and “elder”. Boolean searching method was used to look for the keywords of “Predictor” OR “Risk factor” AND “Uncontrolled” AND “Blood pressure” AND “Hypertension” AND “Elder”. According to PICOS screening process, the inclusion and exclusion criteria are set as follows: based on academic databases such as Scopus, PMC, Science Direct and SAGE.

Search literature process related handling predictors of uncontrolled blood pressure among elders begins by searching the articles through the database determined from 2018 until 2022. The entering keywords related to predictors of uncontrolled blood pressure among elders resulted in the total of 214 articles.

TABLE 1
Inclusion and exclusion criteria

Criteria	Inclusion	Exclusion
Population	Older adults or elders with hypertension	Adolescent or pregnant woman
Intervention	None	None
Comparator	None	None
Outcome	The uncontrolled of elder blood pressure	The method to control blood pressure
Study design	Quantitative study	Qualitative study, literature review, systematic review
Publication year	2018 or later	Before 2018
Language	English	Indonesia or other languages

Two articles were excluded due to duplication and 194 articles were excluded after title screened. The assessment of the remaining 18 articles resulted in 10 articles were removed because does not represent the content of uncontrolled blood pressure of elders. The next stage was identified the 8 articles which included in this systematic review. FIGURE 1 is presented the database searching process.

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 2

TABLE 2
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, Taneapanichskul, Somrongthong, & 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) I: semi-structured questionnaire	- 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 higher
Kanj, Khalil, Kossaify, & Kossaify, 2018	Predictors of Undiagnosed and Uncontrolled Hypertension in the Local Community of Byblos, Lebanon	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	- Significant factors associated with uncontrolled blood pressure: nonadherence to medication, high body mass index, smoking

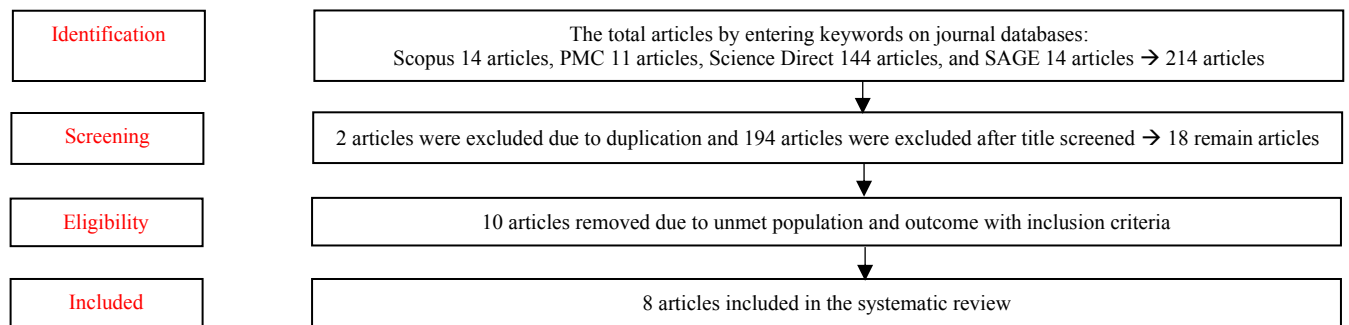


FIGURE 1. Flow diagram of literature searched and selection process

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 3.

TABLE 3
Identification of modifiable and unmodifiable factors of uncontrolled blood pressure among hypertensive elders

Modifiable factors	Unmodifiable factors
<ul style="list-style-type: none"> Obesity/ high Body Mass Index: Leung et al., (2022), Selby et al., (2018), Kanj, Khalil, Kossaify, & Kossaify, (2018) Smoking: Selby et al., (2018), Kanj, Khalil, Kossaify, & Kossaify, (2018) Alcohol consumption: Kothavale, Puri, & Sangani, (2022) Attitude toward treatment program: Selby et al., (2018), Kanj, Khalil, Kossaify, & Kossaify, (2018) High salt diet: Abegaz, Abdela, Bhagavathula, & Teni, (2018) Other social factors: Woodham, Taneepanichskul, Somrongthong, & Auamkul, (2018), Kothavale, Puri, & Sangani, (2022) 	<ul style="list-style-type: none"> Age: Leung et al., (2022), Foti et al., (2021), Sheleme et al., (2022) Comorbidities: Leung et al., (2022), Foti et al., (2021), Sheleme et al., (2022) Gender: Leung et al., (2022), Foti et al., (2021) Family history: 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

High blood pressure in elders contributes to serious vascular disease such as cardiovascular disease, stroke, and kidney disease. High blood pressure is controllable whereas known as “the silent killer” that many patients unaware of the present sign and symptom [15]. The degenerative process of elders it consequence of the decrease of vascular compliance and baroreceptor sensitivity, increase salt-sensitivity, increase total and central adiposity, and neurohumoral changes [16].

The identification of collected articles mentioned that the most common predictor from modifiable factor is obesity. In this systematic review, obesity was accompanied by

smoking. It is indicated that the unhealthy behavior contributed to the hardness of blood pressure control. Leung et al., (2022) found that more than 80% the involved hypertensive obese elders live with at least one comorbid condition. The following comorbid such as diabetes, dyslipidemia, and chronic kidney disease [17]. Selby et al., (2018) found the similar result that obese with BMI ≥ 30 accompanied with current smoker is more likely has uncontrolled blood pressure [18]. The identification by Kanj, Khalil, Kossaify, & Kossaify, (2018) reveals high body mass index noted as a significant factor of uncontrolled hypertension 1,295 times compared to participant who well-controlled hypertension [19].

Obesity or high BMI is recognized as a significant risk factor of certain comorbid condition such as coronary artery disease and hypertension [20]. It is consequent to higher risk of death due to cardiovascular attack that involved complex mechanism of metabolic, kidney and neuroendocrine [21]. Obesity is closely linked to a sedentary lifestyle and uncontrolled diet. Landi et al., (2018) performed the study with the result in line with this systematic review. The study stated obesity grade III was statistically significant as high risk of hypertension compared to normal BMI amount 6,49 times. The gradient of increasing blood pressure was linear

with the level of BMI [22]. The higher prevalence of uncontrolled hypertension among participants with a high body mass of 80 kgs or more also revealed in the research by Chudek et al., (2021). The result proved that obesity limits the effectiveness of antihypertension therapy predominantly in men. The factors that accompanied obesity, which outweigh the controlled blood pressure were sedentary lifestyle, smoking, viscerally obese, length of hypertension therapy and other medical conditions. These facts indicate that the prescription of hypertension medication for obese patient require special consideration to prevent the possibility of resistant hypertension [23]. Elders whose live with obesity revealed in the study by Almalki et al., (2022) that obesity as a significantly higher risk of uncontrolled blood pressure majority of men and smokers [24]. The facts indicate that health care provider considers to develop a specific intervention with the target to achieve ideal body weight maintenance among elders. If the obesity proved as the common cause of uncontrolled blood pressure, it reveals that the strategy to achieve ideal body weight in elder has not gotten more attention in elderly.

The most common unmodifiable predictors of uncontrolled blood pressure among elders in this systematic review were age and comorbidities. The advancing age is closely linked to comorbid condition due to the degenerative process. The researches by Leung et al., (2022), Foti et al., (2021), and Sheleme et al., (2022) identified these two factors as the significant factors of uncontrolled blood pressure. The elders with age from 70 years old and above have difficulties to control blood pressure, which dominate by other medical condition specifically in metabolic system [17]. Foti et al., (2021) proved that the effort to control blood pressure was more difficult in every five years of increasing age and mentioned diabetes and chronic kidney disease as the comorbid [25]. Sheleme et al., (2022) also stated that after 60 years old, the risk of uncontrolled blood pressure might increase by 4,4 times higher than the younger age. The elders who live with comorbidities potentially 2,2 times have uncontrolled blood pressure [26]. These three researches proved that comorbidities as a significant factor of uncontrolled hypertension, whereas the research by Abegaz, Abdela, Bhagavathula, & Teni, (2018) noted differently that not comorbidities but sodium intake.

The increasing of age induced the mechanism of arterial stiffness. Structural and functional changing in vascular affect the systolic and diastolic blood pressure among elders [27]. There are seven mechanisms of age-related hypertension in senior. Start from the changing of large artery elasticity, a rise of collagen and stiffness of myocard, increased the resistance of peripheral vascular, decrease of adrenergic receptor sensitivity, blunting of baroreceptor reflexes, declined of renal function and renin response to sodium and water depletion [28].

It is undeniable that increasing age is the essential factor of many diseases related to deterioration of physical and functional in the elderly. The previous study in Korea highlights the similar finding that advanced age has a

positive correlation with uncontrolled systolic blood pressure, but not in diastolic [29]. The study in Brazil revealed the percentage of uncontrolled blood pressure was high among hypertensive elders and less educated. This condition in line with low adherence to the treatment [30]. Alarming condition of hypertension is when the blood pressure tends to uncontrolled. A cross sectional study in Saudi Arabia involved hypertensive patients with comorbidities such as hyperlipidemia, diabetes mellitus, irritable bowel syndrome, anemia, cancer, kidney disease, asthma, liver disease, migraine and other psychological disorders. The study revealed high prevalence of uncontrolled blood pressure among them even if medicated by hypertension medication [24]. In China, there were top four comorbidities after the analysis among hypertensive patients. Coronary heart disease, diabetes, hyperlipidemia and arteriosclerosis detected as predominant comorbidity in older patients [31]. The comorbidities required aggressive strategy to achieve blood pressure control due to the increased risk of cardiovascular event. It is clear that elders with comorbid conditions such as diabetes and hyperlipidemia demand a combination of antihypertensive medication. Focus on comorbid of hypertension and diabetes, it has the negative effect of potential inappropriate medication in almost one of two individuals with at least taken seven medications [32]. The rule of comorbid as one of the key factors to achieve blood pressure control may not be eliminated, but there are still many strategies that need to be explored as the effort to control the incidence of unpredictable complications.

V. CONCLUSION

The most common predictors of uncontrolled blood pressure among hypertensive elders are divided into modifiable and unmodifiable factors. From those studies, obesity identified as the most common modifiable predictor of uncontrolled blood pressure, whereas the unmodifiable factors are age and comorbidities. The modifiable factor has an essential role in uncontrolled hypertension because it changeable if the elders realize the unhealthy lifestyle. The advance age accompanied with comorbidities is controllable if the elders aware of the severity of comorbid background. The limitation of this study is only assessed the few articles start from 2018 to 2022 without categorized based on different region. Suggestion for further study is to examine the article with the same theme and consider the same region such as specifically in Asia region.

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