Patient barriers to blood pressure control and their implications in low-, middle-, and high-income countries.

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Systematic Review

Keywords: Prevalence, barriers, BP control, Hypertension, LMICs

Posted Date: February 15th, 2022

DOI: https://doi.org/10.21203/rs.3.rs-1353498/v1

Abstract

Blood pressure (BP) control remains a challenge, modulated by significantly differing factors between settings. Hence, this work was undertaken to summarise BP control's prevalence and associated barriers and outline possible implications for customised hypertension care in low- and middle-income countries (LMICs) and high-income countries (HICs). Three scholarly databases—ScienceDirect, PubMed, and Google Scholar—were thoroughly examined using predefined search terms to identify potentially relevant studies. Original research articles published in English between 2011 and 2020 that reported the associated factors and barriers to BP control were included. A total of 24 studies were included in this review. Thirteen studies were primarily conducted in LMICs, while the other eleven studies were conducted in HICs. The BP control in the LMICs studies ranges from 12.5–60%. Meanwhile, the BP control in the HICs ranged from 36.3–62%. Barriers related to disease knowledge and medication adherence more frequently in LMIC studies. Meanwhile, advancing age as a challenge to attaining BP control was more common in HIC studies. There was a relatively consistent reporting of barriers to pharmacotherapy optimisation and lifestyle changes across LMICs and HICs studies. The optimal BP control barriers vary between LMICs and HICs, suggesting the need for customised approaches and interventions. Further studies to implement and evaluate the effectiveness of multifaceted interventions in achieving hypertension therapeutic outcomes are still recommended, particularly in LMICs.

Introduction

Persistent hypertension (HTN) or high blood pressure (BP) is characterised by persistent elevation of pressure in blood vessels and is diagnosed when a persistent reading of 140 mm Hg or higher for systolic BP and/or 90 mm Hg or higher for diastolic BP is measured on two or more different days (WHO, 2019). Primary HTN is more common than secondary HTN, constituting 90% of all hypertensive cases. Meanwhile, secondary HTN resulting from other diseases, including renal, cardiovascular (CVD), and coronary heart diseases, constitutes 10% of the remaining cases (Ibekwe, 2015). HTN is a silent killer that causes myocardial infarction, heart failure, stroke, nephropathy, and retinopathy (Sawicka et al., 2011). Indirectly, HTN is a major contributing factor to the increased CVD mortality rate and one of the major causes of premature mortality (Ab Majid et al., 2018).

HTN is a significant public health concern worldwide and has an estimated world population of nearly 1.13 billion people (WHO, 2019). It is considered a global epidemic disease that imposes considerable health and economic burden on the healthcare system across low-and middle-income countries (LMICs) and high-income countries (HICs) (Gheorghe et al., 2018). The prevalence of HTN nationally has been estimated at 30.0%, where older people and people who reside in rural areas showed a greater HTN prevalence (IPH et al., 2019).

There are modifiable and non-modifiable risk factors concerning HTN control, including high salt intake, obesity, physical inactivity, sedentary lifestyle, cigarette smoking, and alcohol consumption (Ibekwe, 2015). In addition, modifiable risk factors, including obesity (BMI ≥ 27.0 kg/m2), physical inactivity, and low household income, contribute to suboptimal HTN control (Diaz & Shimbo, 2013; Yusuf et al., 2020). Meanwhile, non-modifiable risk factors for HTN may include genetic polymorphism, ethnicity, age, gender, family history, and personal traits (Abdulsalam et al., 2014). According to national reports, the HTN prevalence showed racially based differences, but there was no significant difference between males and females (Institute for Public Health, 2015; IPH et al., 2019).

Poor or suboptimal BP control is defined as having a BP of ≥ 140/90 mm Hg for non-diabetic patients, ≥ 140/80 mm Hg for diabetic patients, and ≥ 150/90 for patients aged 80 years or more (Cheong et al., 2015). Furthermore, although a higher percentage of patients received treatment over time, the control of HTN remained suboptimal, where less than half of patients attained the BP control (Ab Majid et al., 2018). This should be a major concern to the healthcare system since untreated or not optimally controlled HTN may precipitate or worsen CVD, cerebrovascular and renal diseases and lead to mortality (WHO, 2019). Hence, it is imperative to identify the significant barriers that may impede optimal BP control among hypertensive patients. In addition, there is a need for recent data on comparative prevalence values and the patient-related barriers that hinder optimal BP control across both low- and middle-income countries (LMICs) and high-income countries (HICs). Hence, this work was undertaken to summarise BP control's prevalence and associated barriers and outline possible implications for customised hypertension care in LMICs and HICs.

Methodology

Search strategy and identification of the studies

Three scholarly databases—ScienceDirect, PubMed, and Google Scholar—were thoroughly examined to identify potentially relevant studies. The search terms used were " prevalence AND barriers OR factors OR challenges AND blood pressure control OR hypertension control," which were used interchangeably across the databases. Original research articles published in the last ten years (2011–2020) that reported BP control prevalence and provided insights into potential determinants of good and/or suboptimal BP control were included. The decision to restrict the searches to the last ten years was made to avoid redundancy with the already published literature before this period and provide the most recent insight on the research topic. Studies that employed experimental designs to improve BP control with no reporting on the related barriers were excluded. Furthermore, reviews, commentaries, study protocols, book chapters, conference proceedings, and meta-analysis studies were excluded.

Study selection and data extraction

Two independent reviewers screened the studies' titles and abstracts. Then, potentially relevant studies were further reviewed according to the predefined inclusion criteria (Table 1). The two reviewers' results for study selection were gathered and compared. A third reviewer was invited to decide on the studies without agreement between the two main reviewers. The two reviewers conducted a series of meetings to determine the studies that reported all the details specified for data extraction to ensure consistency. Data were extracted from the chosen studies using a predesigned data extraction form that included the main author's name, country, study design, objectives, key findings, and conclusion. Further classification of the included studies regarding their country's economic status was done to compare reported results between LMICs and HICs.

Results

Out of the 21 372 records initially identified through the literature search, a total of 24 studies were eligible to be included in this review. A detailed description of the process of including the studies is provided in Fig. 1. Thirteen studies were primarily conducted in LMICs. Four studies were undertaken in China (Chen et al., 2020; Li et al., 2016; Wang et al., 2013; Xu et al., 2013), two in each of Brazil(de Souza et al., 2014; Wachholz et al., 2016)

and Nigeria (Iloh et al., 2013; Okwuonu et al., 2014), and one study for Ethiopia (Animut et al., 2018), Ghana (Sarfo et al., 2018), Botswana (Gala et al., 2020), Cameron(Menanga et al., 2016) and Iraq (Nassr & Forsyth, 2019). It is noticeable that five out of thirteen studies are African countries denoting the burden and challenges with optimal HTN management in those countries. The other eleven studies were conducted in HICs. Three studies in the United States (Sadeghi et al., 2020; Shelley et al., 2011; Shimboa et al., 2013), two in Australia(Chowdhury et al., 2013; Zhang et al., 2019) and one study for Canada (Nelson et al., 2011), South Korea (Ham & Yang, 2011), Germany(Tiffe et al., 2019), Switzerland (Chmiel et al., 2012), Spain(Cordero et al., 2011) and Singapore (Liew et al., 2019). The BP control in the thirteen studies conducted in LMICs ranges from 12.5–60%. Meanwhile, the BP control value from the eleven studies conducted in the HICs ranged from 36.3–62%. Table 1 summarises all the included studies and their relevant characteristics.

Table 1
Summary of the included studies and their relevant characteristics.

Author & Country	Study design	Population	Primary Objective	Significant findings	Conclusion
(Wang et al., 2013) China	Cross-sectional study (survey).	556 hypertensive patients from a rural community.	To examine the barriers to attaining optimal HTN control.	• 12.5% had their BP controlled among only 429 patients aware of being hypertensive. • Optimal HTN control was hindered by inadequate knowledge (82.8%), omitting therapy because of cost (39.4%), poor medication adherence (65%) and lack of counselling sessions (95.1%).	There is a gap in the HTN knowledge and control due to several factors related to the patients and the care received for HTN.
(Li et al., 2016) China	Cross-sectional study (survey).	31,694 adult respondents were diagnosed with HTN.	To investigate the correlation between BP control and CV behavioural risk factors	• 29.5% had their BP controlled. • Higher BP levels are positively correlated with the number of risk factors in both genders.	Modification of behavioural risk factors showed a direct proportional impact on BP control.
(Xu et al., 2013) China	Cross-sectional study (survey).	3279 HTN & CHD patients.	To investigate potential impediments to appropriate BP control in hypertensive patients with CHD.	• 18% had their BP controlled. Non-dihydropyridine CCB was associated with a low BP control rate. • Independent factors of poor BP control include overweight, stable angina pectoris, family history of diabetes.	Suboptimal BP control in patients with underlying CHD needs careful investigations of BP control barriers.

Author & Country	Study design	Population	Primary Objective	Significant findings	Conclusion
(Chen et al., 2020) China	Nationwide screening program	89, 925 hypertensive patients.	To examine hypertension control and its determinants.	• 25.4% had their BP controlled. Lower odds of uncontrolled BP were reported in women, those with diabetes and CHD. • Higher odds of uncontrolled BP were observed with older patients, current smokers and monotherapy users.	Age, gender, comorbidities and treatment intensification impact the BP control at a population level.
(de Souza et al., 2014) Brazil	Cross-sectional study (Hiperdia Program).	383 adult HTN patients.	To evaluate BP control and its related determinants.	• 33.7% had their BP controlled. Only 54.3% reported adherence to their anti-HTN therapy. • Diabetes mellitus (DM) was observed in 31% of participants, with only 15.7% having their BP controlled.	Diabetic HTN patients showed the most deficient BP control in this study.
(Wachholz et al., 2016) Brazil	Prospective cohort study	213 hypertensive outpatients.	To investigate the interaction between age, gender, diabetes and medication adherence on BP control.	• 60% had their BP controlled. Diabetic patients were more likely to attain BP goals. • Females and those with a higher anti-HTN number faced more challenges of BP control.	Gender, polypharmacy and diabetes might interfere by different patterns with the control of BP.

Author & Country	Study design	Population	Primary Objective	Significant findings	Conclusion
(Okwuonu et al., 2014) Nigeria	Cross-sectional study (survey).	252 adults with HTN.	To identify patient-related challenges to HTN control in a semi-urban region.	• 32.9% had their BP controlled (affected by knowledge and lifestyle changes) • Low medication adherence was reported in 68.7% of patients due to forgetfulness (61.2%), financial barriers (56.6%), a heavy pill burden (22.5%), and side effects (17.3%).	Patient-related challenges were poor HTN knowledge, unrealistic treatment expectations, low adherence, and noncompliance with lifestyle adjustments.
(Iloh et al., 2013) Nigeria	Cross-sectional study.	140 adults with primary HTN who have been on treatment for at least six months.	To investigate medication adherence and blood pressure control in adults with primary HTN.	• 35% had their BP controlled, and 42.9% were adherent. • Adherence, HTN duration (≥ 3 years), and receiving > one anti-HTN therapy were all related to better blood pressure control.	BP control was most likely hindered by low medication adherence (forgetfulness is a common cause).
(Animut et al., 2018) Ethiopia	Retrospective follow-up study (survey).	395 outpatient HTN adults who are under follow-up for at least six months.	To evaluate the prevalence of BP control and its associated factors.	• 50.4% had their BP controlled. Salt intake, overweight and obesity were negatively associated with BP control. • Physical activity, duration on antihypertensive drugs (2–4 or ≥ 5 yrs) and high adherence were positively correlated with BP control.	Initiatives to improve BP control by modulating the associated factors are needed.

Author & Country	Study design	Population	Primary Objective	Significant findings	Conclusion
(Sarfo et al., 2018) Ghana	Cross-sectional study.	2870 hypertensive participants enrolled at five different hospitals.	To assess the BP control and its associated factors among Ghanaian hypertensive subjects.	• 42.3% had their BP controlled. • Uncontrolled BP was attributed to receiving therapy at a tertiary care level, longer HTN duration, poor adherence, number and access to anti-HTN therapy.	Several system-related and individual factors associated with poor BP control should be considered to improve HTN management.
(Gala et al., 2020) Botswana	Cross-sectional study.	280 adult HTN patients on medications.	To assess the BP control and the association between medication errors and uncontrolled HTN.	• 45% had their BP controlled. 34% had ≥ one medication error. • Having ≥ one medication error was significantly associated with uncontrolled HTN compared with no errors.	Interventions to address medication errors could help in improving BP control.
(Menanga et al., 2016) Cameroon	Cross-sectional study (survey).	440 hypertensive patients in an urban city.	To determine the predictors of BP control in HTN patients.	• 36.8% had their BP controlled. • Optimal medication adherence and dietary lifestyle changes are significantly associated with BP control.	Interventions targeting medication adherence and dietary lifestyles could improve BP control
(Nassr & Forsyth, 2019) Iraq	Cross-sectional study (survey).	300 adult patients with hypertension.	To evaluate the magnitude of and factors associated with BP control.	• 38.7% have their BP controlled. • Age < 60 yrs, male gender, and diabetes were predictors of uncontrolled BP.	Effective but feasible interventions could improve BP control.

Author & Country	Study design	Population	Primary Objective	Significant findings	Conclusion
(Nelson et al., 2011) Canada	Post hoc exploratory analysis (STITCH study).	2030 hypertensive patients.	To assess BP control and its determinants.	• 58% had their BP controlled. • Uncontrolled BP was more likely among those with DM and those receiving less intensive anti-HTN therapy.	Failure to escalate therapy is linked to lower odds of attaining BP control in patients with or without DM.
(Chowdhury et al., 2013) Australia	Open-label prospective study.	6010 elderly HTN patients (65–84 years) followed up for at least two visits.	To determine the factors contributing to achieving BP targets in an elderly hypertensive population.	• 50% had their BP under control. Those > 80 yrs. & sought care from multiple physicians were less likely to attain controlled BP. • Males, those living in regional areas, higher serum creatinine, and use of multiple anti-HTN drugs were more likely to attain BP control.	Demographic, clinical and service delivery factors are essential in achieving BP control among elderly hypertensive patients.
(Zhang et al., 2019) Australia	Cross-sectional study (registry-based).	1750 CKD patients with HTN.	To ascertain BP control rates and to investigate contributing factors with HTN control	• 36.3% had their BP controlled. Those with CVD had lower odds of uncontrolled BP. • Participants ≥ 65 years old and those with severe albuminuria or proteinuria were at higher odds of uncontrolled BP.	Age, CKD severity, and comorbid conditions affect BP control among CKD patients.

Author & Country	Study design	Population	Primary Objective	Significant findings	Conclusion
(Liew et al., 2019) Singapore	Cross-sectional study (survey)	10, 215 participants from a multi-ethnic cohort.	To determine the correlation between sociodemographic factors with the awareness, treatment and control of HTN.	• 37.6% had their BP controlled. Older age was associated with uncontrolled HTN. • Younger age, male and lower educational level were associated with untreated HTN.	Educational level and age were determinants for HTN treatment and control across all ethnic groups.
(Tiffe et al., 2019) Germany	Population-based cohort study.	293 adult HTN patients on medications.	To examine the impact of beliefs towards medication on insufficient BP control.	• 50.2% had their BP controlled. • Women who reported higher levels of concern had a higher chance of controlling HTN.	Educational interventions are needed and should consider the sex-related differences.
(Ham & Yang, 2011) South Korea	Cross-sectional study (survey).	690 adult HTN patients on medications.	To evaluate the BP control concerning lifestyle factors.	• 54.3% had their BP controlled. Higher control rates were observed in younger age, ≥ one comorbidity and ≥ 4 days physically active. • Overweight, heavy alcohol consumption, and mild to severe stress reduced BP control.	Interventions for BP control should be more targeted at the elderly, overweight, and unhealthy lifestyle factors such as stress and inactivity.

Author & Country	Study design	Population	Primary Objective	Significant findings	Conclusion
(Cordero et al., 2011) Spain	Multicentre cross-sectional registry-based study.	10743 patients with HTN.	To describe the prevalence of BP control and its associated determinants.	• 55.4% had their BP controlled. BP control rate was similar in those with or without CVD. • Higher rates of poor BP control were reported among males, active smokers, obese and diabetics.	Lifestyle factors especially smoking and obesity, are independently associated with poor BP control.
(Shelley et al., 2011) USA	Database analysis in four community health centres.	2,585 adults with HTN belong to three different ethnicities.	To examine the correlates of BP control in a community setting.	• 49% had their BP controlled. High BMI, black race, male gender, diabetes and clinical encounters were linked to poor BP control. • Blacks had higher BP prevalence and less chance of controlling it than other races.	Although there were differences in BP control among races, there were no racial disparities in the treatment offered.
(Shimboa et al., 2013) USA	Sample of population-based cohort (REGARDS) study.	2,602 patients of apparent treatment-resistant HTN (aTRH) "3 or more anti-HTN meds."	To examine the impact of unhealthy lifestyle factors on the aTRH prevalence	• 49.7% had aTRH. Higher prevalence of unhealthy lifestyle factors observed among those with aTRH, • There was no significant association between any of these factors and aTRH.	Unhealthy lifestyle factors did not independently correlate with BP control among aTRH individuals.

Author & Country	Study design	Population	Primary Objective	Significant findings	Conclusion
(Sadeghi et al., 2020) USA	Quality improvement project applied six-level interventions over 12-months.	1,426 patients with hypertension and multiple comorbidities.	To analyse barriers to BP control and implement an intervention to improve BP control status	• 62% had their BP controlled. Main barriers were physicians' clinical inertia, non-adherence, lack of follow-up and cost of medications. • 72.6% had sustained BP control post project.	Multidisciplinary team involvement in multifaceted interventions could boost BP control in the community.
(Chmiel et al., 2012) Switzerland	Baseline data of pragmatic randomised controlled trial.	122 adult patients with uncontrolled HTN.	To assess HTN control and its associated characteristics in Swiss primary care.	• 53.3% had their BP controlled. The number of anti-HTN meds was positively associated with SBP and negatively associated with DBP. • BMI, smoking and age were independent predictors for elevated systolic BP.	The findings highlight the importance of adequate pharmacological treatment and risk factor control.

Discussion

This work reviewed the BP control prevalence and patient-related barriers in 24 studies conducted in various LMICs (n = 13) and HICs (n = 11). As expected, the average BP control prevalence in HICs (50.5%) was significantly higher than in LMICs (35.4%). We have observed several differences in the common barriers to BP control between the LMICs and HICs. Barriers related to disease knowledge and medication adherence more frequently in LMIC studies. Meanwhile, the advancing age challenge with the attainment of BP control was more common in HIC studies. The barriers related to pharmacotherapy optimisation and lifestyle changes were reported relatively at the same frequency across both the LMICs and HICs studies. We classified and summarised the identified barriers across all studies and provided implications for improving BP control in LMICs and HICs.

Barriers to optimal BP control

Sociodemographic factors

In this review, eleven studies have investigated the correlation between sociodemographic factors and BP control. The identified sociodemographic characteristics include age, gender, geographical area, and

socioeconomic status. For example, an Iraqi study demonstrated that sociodemographic factors, including education and employment, were not linked to poor BP control. Instead, the age of 60 and below and the male gender are among the strongest predictors of uncontrolled HTN. This might be due to high commitment among younger patients with their responsibilities that affect their curiosity about seeking regular healthcare services compared to elderly patients having comorbidities that potentially trigger more opportunities to seek healthcare services (Nassr & Forsyth, 2019). However, some studies suggest that old age is considered a barrier to optimal BP control and a strong predictor of uncontrolled HTN (Chmiel et al., 2012; Liew et al., 2019). Potential explanations include physiological ageing changes, comorbidity, heterogeneity in treatment among elderly patients, social exclusion, a lack of support, and insufficient knowledge about HTN self-management (Liew et al., 2019).

Concerning the gender impact on BP control, several studies reported that male patients were more prone to having poor BP control (Chowdhury et al., 2013; Cordero et al., 2011; Nassr & Forsyth, 2019). Meanwhile, another study showed that female patients were at higher risk of being more prone to having poor BP control (Gee et al., 2012; Wachholz et al., 2016). Men and premenopausal women of similar ages are at greater risk for CVD and renal diseases. However, in postmenopausal women, their BP increases to higher levels than in men (Reckelhoff, 2001). This shows that gender barriers to optimal BP control depend on other risk factors like age and health conditions like menopause. It is also suggested that BP levels in both genders are more likely to increase as the number of risk factors increases (Li et al., 2016).

From the finding by Nassr & Forsyth (2019), socioeconomic status, including education and employment levels, does not significantly affect the control of BP among hypertensive patients (Nassr & Forsyth, 2019). However, a study conducted by Shimbo et al. (2013) contradicts this finding, which reports that their patients who had been resistant to HTN treatment were more likely to have had less than a high school education (Shimboa et al., 2013). Also, it was reported that a higher rate of uncontrolled BP is observed among people with low education levels (Gee et al., 2012). In addition, financial constraints, through their adverse impact on medication adherence, lead to the suboptimal achievement of BP control (Okwuonu et al., 2014).

Overall, socioeconomically disadvantaged people are more likely to have HTN and have a higher likelihood of having poor BP levels despite treatment (Gee et al., 2012). This might underpin the need for customised interventions to target BP control improvement among those individuals with special socioeconomic challenges. Moreover, recent research has highlighted the impact of sociodemographic factors on hypertension control in the era of the COVID-19 pandemic. The findings showed that the pandemic more negatively impacted the overall hypertension control of the younger population, lower income group, unmarried and unemployed individuals (Elnaem et al., 2021).

Comorbidity

Comorbidity with hypertension has various consequences, including the need for complex therapeutic therapy and an increased likelihood of poor adherence to antihypertensives (Krousel-Wood et al., 2009). Several studies have demonstrated a strong association between diabetes mellitus (DM) and poor BP control (de Souza et al., 2014; Kjeldsen et al., 2008). Besides poor BP control resulting from DM as the comorbidity, HTN also plays a significant role in DM progression. In type 2 DM, HTN is often present in the insulin resistance syndrome besides obesity and dyslipidemia. Meanwhile, in type 1 DM, HTN may indicate the onset of diabetic nephropathy (Arauz-

Pacheo et al., 2003). There is a substantial overlap between both diseases (Cheung & Li, 2012). Since HTN and DM's coexistence leads to a crucial need for a multifaceted approach considering the target levels, appropriate therapy selection, and each medication's pharmacological profile (De Boer et al., 2017; Khangura et al., 2018).

Furthermore, inadequate BP control was reported among those with elevated total cholesterol, LDL, and uric acid level (Cordero et al., 2011; Xu et al., 2013; Zhang et al., 2019). The findings from Xu et al. (2013) suggest that stable angina pectoris plays a significant role in interfering with adequate BP control among hypertensive patients (Xu et al., 2013). Meanwhile, Zhang et al. demonstrated a strong association between CKD and poor BP control, particularly those with severe albuminuria or proteinuria (Zhang et al., 2019). Besides, depression may interfere with BP control, with a significant correlation between systolic and diastolic BP levels and depression (Rubio-Guerra et al., 2013).

Medication non-adherence

As highlighted earlier, the impact of suboptimal medication adherence was more pronounced in LMICs. A total of five studies have reported that over 40% of their total study participants had poor adherence to their antihypertensive medications (de Souza et al., 2014; Iloh et al., 2013; Okwuonu et al., 2014; Sarfo et al., 2018; Wang et al., 2013). Also, the evidence showed that poor BP control is significantly associated with poor adherence (Iloh et al., 2013; Sarfo et al., 2018; Wang et al., 2013). Two Nigerian studies reported that forgetfulness was the most common reason for poor adherence among hypertensive patients, followed by financial barriers, high pill burden, and side effects of antihypertensive medications (Iloh et al., 2013; Okwuonu et al., 2014). Another study highlighted that young age, living in rural areas, fear of getting used to the medication, and unsatisfactory treatment are common barriers to optimal adherence (Al-Ramahi, 2015). A study by Gala et al. (2020) reported that patients who omitted their prescribed antihypertensive medications showed more inadequate BP control (Gala et al., 2020). Nonetheless, additional evidence suggests that polypharmacy has a more substantial effect on blood pressure control than medication adherence alone (Wachholz et al., 2016). These findings show that medication non-adherence and BP control are both of multifactorial nature, and most of the time, they need collaborative, multifaceted interventions for positive clinical outcomes (Elnaem, Rosley, et al., 2020).

Lifestyle factors

Our findings highlighted lifestyle-related barriers to BP control frequently in several LMICs and HICs studies. Approximately 60% of the related factors to individual health and quality of life are linked to lifestyle, suggesting that those with unhealthy lifestyles are more likely to encounter morbidity, disability, and mortality (Zeki et al., 2018). The association between lifestyle factors, including physical inactivity, smoking, BMI, salt intake, alcohol consumption, stress, and poor BP control, has been confirmed (Chmiel et al., 2012; Cordero et al., 2011; Ham & Yang, 2011; Li et al., 2016; Shimboa et al., 2013). Patients who perform physical activity at least four days per week are more inclined to have optimal BP control (Ham & Yang, 2011). Besides, smoking and abnormally high BMI are reported as independent predictors of elevated systolic BP (Chmiel et al., 2012). It is worthy of highlighting that the parameters used to measure lifestyle factors vary among the reviewed studies. Also, several factors could coexist in one patient. Therefore, a Chinese study that looked at the impact of lifestyle factors on BP control highlighted that BP control was positively correlated with the number of lifestyle factors being

addressed (Li et al., 2016). Table 2 provide an overview of common barriers to optimal BP control and its examples.

Table 2
Overview of common barriers to optimal BP control and its examples

N	Barriers to optimal BP control	Examples of individual barriers
1	**Sociodemographic factors**	Age: Older age is a strong predictor of uncontrolled HTN
		Gender: The role of gender depends on age and health conditions such as menopause
		Socioeconomic status: Socioeconomically underprivileged patients are more prone to suboptimal BP levels despite treatment
		Geographical area: Patients residing in rural areas are more prone to have poor BP control
2	**Comorbidities**	Diabetes: One of the strong predictors of uncontrolled HTN
		Coronary artery disease
		Chronic kidney disease: Patients with severe albuminuria or proteinuria are at greater risk
		Depression: This shows that mental health is also able to influence BP control
		Hyperlipidemia
		Hyperuricemia
3	**Medication nonadherence**	Forgetfulness: The most reported reason
		Financial barrier
		High pill burden
		Side effects of antihypertensive agents
		Low measured BP
4	**Lifestyle-related**	Smoking
		Obesity
		Salt intake
		Alcohol intake
		Stress
		Physical inactivity

Pharmacotherapy-related barriers

The challenge of optimising HTN pharmacotherapy was highlighted across numerous LMICs and HICs studies. Monotherapy is recommended in those whose blood pressure is less than 20/10 mm Hg above the target; however, combination therapy would benefit those with more than 20/10 mm Hg above the target (Gradman et al., 2010). Failure to intensify and optimise the pharmacotherapy with disease progression is associated significantly with fewer BP control chances (Nelson et al., 2011). However, patients on two or more antihypertensives had a prevalence of uncontrolled BP, indicating a mixed relationship between the number of antihypertensives and BP control. (Chmiel et al., 2012; Shimboa et al., 2013). This may be explained by the potential decline in the synergism between antihypertensive agents with every addition of a new antihypertensive agent (Timbie et al., 2010). Besides being offered monotherapy or combination therapy, antihypertensive agent choice affects BP control. According to a Chinese study aimed to explore BP control barriers among hypertensive patients with CVD, a correlation between non-dihydropyridine CCB and a lower rate of BP control was confirmed (Xu et al., 2013). However, the extent of BP reduction should remain the primary determinant of reducing CVD risk among hypertensive patients, where the role of combination therapy is increasingly needed (Gradman et al., 2010).

Moreover, long-term antihypertensive treatment is reported as a facilitator of medication adherence (Yue et al., 2015). Also, the longer duration of taking antihypertensive drugs is positively associated with adequate BP control (Animut et al., 2018). Avoidance of medication errors is essential for optimising HTN pharmacotherapy, considering that medication errors represent a significant predictor of uncontrolled HTN (Gala et al., 2020). Overall, as pharmacotherapy optimisation is not a one-time intervention in people with chronic diseases, continuous assessment of the effectiveness and safety alongside interventions to boost adherence are increasingly needed to improve clinical outcomes (Elnaem, Rosley, et al., 2020). Table 3 provides a summary of the aspects of HTN pharmacotherapy optimisation.

Table 3
Aspects to consider for HTN pharmacotherapy Optimisation

Aspects to consider for HTN Pharmacotherapy Optimization
Number of antihypertensive agents used
Choice of antihypertensive agents
Duration of taking antihypertensive agents
Medication errors avoidance

Implications for BP control in LMICS & HIC

BP control barriers' distribution appears different due to older age in HICs and knowledge and adherence in LMICs. However, the lifestyle and pharmacotherapy optimisation barriers are shared consistently across several LMICs and HICs studies. Furthermore, HIC studies reported frequently that older age is a determinant of suboptimal BP control (Chowdhury et al., 2013; Liew et al., 2019; Zhang et al., 2019). These findings imply the need for more coordinated hypertension care for the older population that keeps fewer caregiver numbers and regular follow-up and medication optimisation support.

However, disease knowledge and subsequent medication adherence still need to be intervened in, particularly in LMICs, to help hypertensive patients cope with the long-term disease control (Elnaem, Elrggal, et al., 2020). In a systematic review of non-adherence to antihypertensive medications in LMICs, the findings showed that the adherence ranged from 25.4–63.4% depending on using cut-off point scales (80–90%) or the MMAS eight-item scale, respectively (Nielsen et al., 2017). Apart from these relatively special considerations, there is a generic need for community interventions to enforce a healthier lifestyle and pharmacotherapy optimisation in most LMICs and HICs studies. Interventions to optimise the pharmacotherapy for better achieving the outcomes that are also considered simplifications of the individual's drug regimens are desperately needed (Elnaem, Irwan, et al., 2020).

Finally, the findings of the present review assert that BP control needs simultaneous consideration of the individual's level of barriers related to lifestyle, disease knowledge, medication adherence, pharmacotherapy optimisation, and cost of health care services. The evidence showed that multifaceted interventions that analyse all potential barriers and target them in a step-wise customised approach would be associated with significant BP control improvement in the community (Sadeghi et al., 2020; Williams et al., 2012). Care for chronic diseases, including hypertension, requires coordinated interprofessional care that involves multiple health team members. Collaborative models involving physicians, pharmacists, and nurses were feasible and promising in the event of proper design and coverage for all BP control determinants (Carter et al., 2015; Stephen et al., 2019).

Conclusion

The prevalence of BP control is significantly higher in HIC studies than in LMIC studies. Although there are generic barriers, they occur in most settings, including lifestyle and pharmacotherapy optimisation. Barriers to disease knowledge, medication adherence, and the need for better care for the aged population differ across LMICs and HICs. Therefore, appropriate strategies and interventions should be customised and integrated to overcome poor BP control. Further studies to implement and evaluate the effectiveness of multifaceted interventions in achieving the desired therapeutic outcomes for HTN are still recommended, particularly in LMICs.

Limitations

This review provides the most recent and comprehensive insight into the prevalence and patient-related barriers to BP control. However, we did not account for the considerable difference in the study population between studies. Instead, we relied on the number of studies and the country's economic status to classify and compare BP control barriers.

Declarations

Conflict of interest:

Authors declare that no conflict of interest was associated with this work.

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Figures

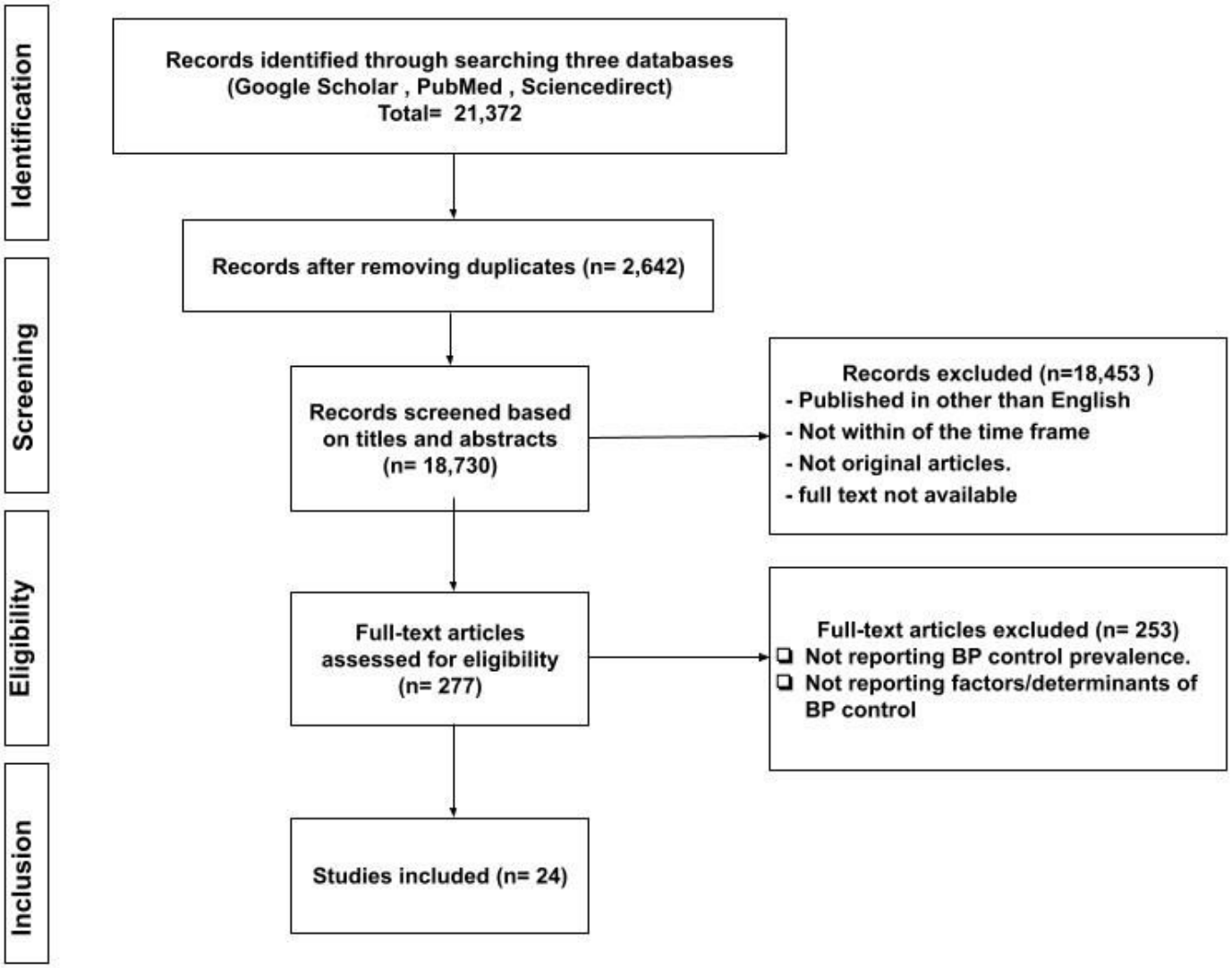

Figure 1

Flowchart of the process of including the review studies.