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Factors associated with uncontrolled blood pressure in hypertensive Brazilians

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Abstract

Uncontrolled hypertension has a high prevalence and is related to numerous negative health outcomes. This study aimed to investigate the factors associated with the lack of blood pressure control in hypertensive Brazilians treated in public and private services. This is an analytical, multicentric, and national cross-sectional study, carried out with adult hypertensive patients, monitored in 45 outpatient clinics (September 2013 to October 2015) in a prospective record interview, clinical, and anthropometric assessment. Outcome variables included uncontrolled pressure (systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg). Simple and multiple logistic regression analyses were performed. Two thousand six hundred forty-three participants were assessed with a mean age of 61.6 ± 11.9 years, 55.7% of women, and 46.4% with uncontrolled blood pressure (BP). The following were associated

with uncontrolled BP: age over 60 years (OR: 1.31 [1.11–1.55]); practice of irregular physical activity (OR: 1.28 [1.06–1.55]); attending the emergency room for hypertensive crises in the last six months (OR: 1.80 [1.46–2.22]); increased body mass index (OR: 1.02 [1.01–1.04]); low adherence to drug treatment (OR: 1.22 [1.04–1.44]) and menopause (OR: 1.36 [1.07–1.72]). The following were negatively associated: fruit consumption (OR: 0.90 [0.85–0.94]); presence of dyslipidemia (OR: 0.75 [0.64–0.89]), acute myocardial infarction (OR: 0.59 [0.46–0.76]), and peripheral arterial disease (OR: 0.52 [0.34-0.78]). Factors associated with difficult-to-control blood pressure are the same that increase the risk for hypertension, while the presence of atherosclerotic disease and its outcomes were associated with better control.

KEYWORDS
blood pressure, control, hypertension, risk factor

1 | INTRODUCTION

Hypertension (HBP) is considered a multifactorial clinical condition.[1,2] It is often associated with functional and/or structural changes of target organs (heart, brain, kidneys, and blood vessels) and with metabolic changes, increasing the risk of fatal and nonfatal cardiovascular events.[2,3] Its implications reach individual and collective magnitudes, in the social, economic, and political.[3]

About 1.13 billion people worldwide are hypertensive, with an estimated one in four men and one in five women.[4] The global prevalence was 31.1% (1.39 billion people), ranging from 28.5% in high-income countries to 31.5% in middle and low-income countries.[5]

Antihypertensive treatment, with or without drugs, is effective in reducing cardiovascular morbidity and mortality. However, reduced indices of blood pressure (BP) control are found in studies worldwide[3,6] and it is estimated that only one in five people with HBP have their BP under control.[4]

Factors associated with BP noncontrol are widely studied nationally and internationally.[2,6–9] However, there are gaps regarding this assessment in a representative sample of hypertensive Brazilians who had access to health services offered in the public and especially in the private network.

Based on the above, this study aimed to investigate the factors associated with the lack of blood pressure control in hypertensive Brazilians treated at public and private clinics.

2 | METHODS

2.1 | Design and study location

This is an analytical cross-sectional, multicentric, and national study, which assessed hypertensive patients included in a prospective registry and followed up in 45 public and private medical and specialty clinics, in different Brazilian states. The participating centers were chosen by federative unit and city, and the investigator responsible for each center, after being trained for the the protocol, trained its staff.

This is a secondary analysis of the matrix study entitled Brazilian Cardiovascular Registry of Systemic Arterial Hypertension – I RBH (*Registro Brasileiro Cardiovascular de Hipertensão Arterial Sistêmica*), organized by the Department of Arterial Hypertension of the Brazilian Society of Cardiology (*SBC*).[10]

The study met national and international standards of ethics in research involving human beings, was submitted to the Research Ethics Committee (*CEP*) of Hospital das Clínicas of the Universidade Federal de Goiás-GO - GO (HC/UFG) with opinion number 374.758–0 and CAEE 13477313.0.2004.5078.

2.2 | Sample, inclusion, and exclusion criteria

The sample of 1323 participants was calculated in the open software OpenEpi considering a population of 127 832 633 adults , prevalence of HBP of 32.2%,[11] 5% confidence limit, and 99.99% confidence interval. For the present study, the sample consisted of 2643 participants over the age of 18 with a diagnosis of hypertension, included from September 2013 to October 2015.

The following were included: adults (≥ 18 years); diagnosed with hypertension for at least 4 weeks (systolic blood pressure levels greater than or equal to 140 mmHg and/or diastolic blood pressure greater than or equal to 90 mmHg or on antihypertensive medication); regularly enrolled in the participating center/institution. Patients with chronic kidney disease in a dialysis program, or those in hospital at the time of inclusion or in the past 30 days, or in hemodynamic instability requiring the use of vasoactive drugs in the past 30 days, or with heart failure (HF) in functional class III or IV, or pregnant and/or breastfeeding women, or those with severe liver diseases, or HIV carriers, or those diagnosed with psychiatric illnesses that prevented compliance with the protocol, or those with a history of stroke or myocardial infarction (MI) up to 30 days before inclusion in the study, or those with

serious illnesses and/or cancer with a prognosis of less than 1 year were excluded.

2.3 | Data collection

Performed in a single day, data collection took place in a private room at each participating center. After signing the Free Informed Consent Form, the participants underwent an interview to fill out the Electronic Clinical Form (eCRF) with information asked directly to the participant, as well as anamnesis and physical examination.

2.4 | Outcome

The outcome variable was no BP control characterized by SBP greater than or equal to 140 mmHg and/or DBP greater than or equal to 90 mmHg.[1,2] Blood pressure was assessed with the patient seated, following standard procedures. To measure BP, a calibrated sphygmomanometer from the research center was used.

2.5 | Exposure variables

Exposure variables were divided into sociodemographic data, anthropometry, lifestyle habits, personal background, family history, risk factors, associated diseases and conditions, history of HBP, clinical evaluation, and medication adherence.

For anthropometric measurements, participants were instructed to wear light fabric clothes and remove shoes and accessories. To measure weight and height, each participating institution used its own anthropometric scales, all calibrated and validated for use. The body mass index (BMI) corresponded to the ratio between weight and height squared and the following were considered: low weight ≤ 18.5 kg/m^2; eutrophic BMI ≥ 18.5 and < 25 kg/m^2, overweight BMI ≥ 25 and < 30 kg/m^2, and obesity BMI ≥ 30 kg/m^2.[12]

To measure the waist circumference (WC), the participants were standing, normal breathing, arms flexed and crossed in front of the chest, feet apart, in an upright position, exposing the abdominal region. The measurement location was determined by the midpoint between the costal margin and the iliac crest at the level of the axillary midline, using inelastic measuring tapes. Complete inspiration and expiration were requested, and the measurement was performed at the end of expiration.[13]

Variables related to lifestyle (irregular physical activity, smoking and drinking), eating habits (excessive consumption of salt and fat), diseases and associated conditions (diabetes mellitus, dyslipidemia, cerebrovascular disease, MI, angina, myocardial revascularization, heart failure, kidney disease, retinopathy, peripheral arterial disease, secondary HBP, and menopause), family history (premature family history of CVD and history of HBP in father, mother or siblings), knowledge and treatment of HBP (need for emergency care for HBP, regular BP checking, medication purchase, and lack of resources to purchase medication), were evaluated through closed and semistructured questions, during the individual interview, in which the participant expressed a yes-or-no answer.

Fruit consumption was evaluated by an open question on the number of portions ingested per day. The time of knowledge of the diagnosis and treatment of HBP was assessed by open questions and recorded in years. Participants who expressed a lack of resources to purchase the medications were asked about the number of times of this occurrence and the number of days without use in the last six months prior to collection.

Adherence to drug treatment was performed by applying the Morisky scale with four questions ("Have you forgotten to take your medication?", "Are you careless when taking your medication?", "When you feel better, sometimes you stop to take your medication?", "Sometimes, if you feel worse when you take the medication, do you stop taking it?"). Affirmative answers received zero points and negative ones received one point. Then, the answers were summed and the higher the score, the better the adherence. The adherence variable was categorized into high (scores between two and four) and low (scores between zero and one).[14]

The Kolmogorov–Smirnov normality test was applied to identify the distribution of data. Descriptive analysis was presented with mean and standard deviation and absolute and relative frequencies. Bivariate logistic regression was performed and all variables that presented P-value $< .20$ entered the multivariate logistic regression and were included in the model by the stepwise method. Variables associated with the outcome were considered as those that in the final model had $P < .05$. Data were analyzed using the software Stata, version 14.0.

3 | RESULTS

A total of 2643 participants were evaluated, most of them female, nonsmokers, nondrinkers, physically active and with low adherence to drug treatment. The mean BP was 137.2 mmHg (± 21.5) and 82.8 mmHg (± 12.2) for systolic and diastolic pressures, respectively. The frequency of uncontrolled BP was 46.4% (n = 1226) of the participants (Table 1).

In the bivariate analysis, the following indicated a possible association with uncontrolled BP: age group over 60 years; black color; high BMI; altered WC; practice of irregular physical activity, smoking and excessive consumption of fat. Possible negative association factors were smoking and daily fruit consumption greater than two servings (Table 1).

Among the studied diseases, dyslipidemia was the most frequent and the family history of HBP was present in more than half of the sample. It was observed that the presence of angina, diagnosis of secondary HBP, and menopause were factors associated with uncontrolled BP. The presence of dyslipidemia, MI, myocardial revascularization (MR), and peripheral arterial disease (PAD) were possible negative association factors (Table 2).

TABLE 1 Description of the sample and bivariate logistic regression analysis of controlled and uncontrolled blood pressure according to sociodemographic variables, anthropometry, and lifestyle habits, no. = 2643

Variable	No. (%) Mean (±€SD)	Controlled BP No. (%)	Uncontrolled BP No. (%)	OR (95% CI)	*P*
Sociodemographic					
Age (years)	61.6 (11.9)	61.3 (11.9)	61.8 (11.9)	1.00 (0.9-1.01)	.252
Age range					
<60 years	1124 (42.5)	629 (56.0)	495 (44.0)	1	.037
≥ 60 years	1519 (57.5)	788 (51.9)	731 (48.1)	1.17 (1.00 - 1.37)	
Sex					
Female	1472 (55.7)	774 (52.6)	698 (47.4)	1	.233
Male	1171 (44.3)	643 (54.9)	528 (45.1)	0.91 (0.78 - 0.90)	
Color					
Not black	2191 (82.9)	1212 (55.3)	979 (44.7)	1	<.001
Black	452 (17.1)	205 (45.4)	247 (54.7)	1.49 (1.21 - 1.83)	
Anthropometry					
High BMI (no. = 2642)	29.2 (5.3)	28.8 (5.2)	29.7 (5.5)	1.03 (1.01 - 1.04)	<.001
WC with alterations (no. = 1919)	98.9 (12.9)	97.8 (12.3)	100.2 (13.4)	1.01 (1.00 - 1.02)	<.001
Life habits					
Irregular physical activity (no. = 2641)					
No	662 (25.1)	398 (60.1)	264 (39.9)	1	<.001
Yes	1979 (74.9)	1019 (51.5)	960 (48.5)	1.42 (1.18 - 1.69)	
Smoking					
No	2478 (93.8)	1318 (53.2)	1160 (46.8)	1	.090
Yes	165 (6.2)	99 (60.0)	66 (40.0)	0.75 (0.54 - 1.04)	
Alcoholism					
No	2446 (92.6)	1315 (53.8)	1131 (46.2)	1	.591
Yes	197 (7.4)	102 (51.8)	95 (48.2)	1.08 (0.80 - 1.44)	
Eating habits					
Excessive use of salt					
No	2081 (78.7)	1129 (54.3)	952 (45.7)	1	.205
Yes	562 (21.3)	288 (51.2)	274 (48.8)	1.12 (0.93 - 1.36)	
Excessive use of fat					
No	2037 (77.1)	1117 (54.8)	920 (45.2)	1	.021
Yes	606 (22.9)	300 (49.5)	306 (50.5)	1.24 (1.03 - 1.48)	
Amount of fruits eaten (no. = 2641)	2.1 (1.5)	2.2 (1.6)	2.0 (1.5)	0.88 (0.84 - 0.93)	<.001

BMI, body mass index; WC, waist circumference.

The mean time for diagnosis confirmation and HBP treatment was over 10 years and more than half of the sample had low adherence to drug treatment. A possible positive association with uncontrolled BP was identified: knowledge of diagnosis and treatment for more than 10 years; HBP demand for emergency assistance in the last 6 months; lack of resources to buy medication in the last 6 months; 10 days or more without medication and poor adherence to drug treatment. The purchased medication, in its turn, had a possible negative association (Table 3).

In multivariate logistic regression analysis, the following factors were associated with uncontrolled BP: age over 60 years; practice of irregular physical activity; attending the emergency department for hypertensive crises in the last 6 months; low adherence to drug treatment, and menopause. In addition, the increase of 1 kg/m^2 increased the chance of having uncontrolled BP by 1.02 times. Negative association factors were fruit consumption; presence of dyslipidemia, MI, and PAD (Table 4).

TABLE 2 Description of the sample and bivariate logistic regression analysis of controlled and uncontrolled pressure according to variables of associated diseases/conditions and family history, no. = 2643

Variable	No. (%) Mean (±€SD)	Controlled BP No. (%)	Uncontrolled BP No. (%)	OR (95% CI)	*P*
Associated diseases/conditions					
Diabetes					
No	1859 (70.3)	999 (53.7)	860 (46.3)	1	.842
Yes	784 (29.7)	418 (53.3)	366 (46.7)	1.02 (0.86 - 1.20)	
Dyslipidemia					
No	1403 (53.1)	707 (50.4)	696 (49.6)	1	<.001
Yes	1240 (46.9)	710 (57.3)	530 (42.7)	0.76 (0.65 - 0.88)	
Cereb. Disease					
No	2485 (94.0)	1336 (53.8)	1149 (46.2)	1	.542
Yes	158 (6.0)	81 (52.3)	77 (48.7)	1.10 (0.80 - 1.52)	
AMI					
No	2286 (86.5)	1185 (51.8)	1101 (48.2)	1	<.001
Yes	357 (13.5)	232 (65.0)	125 (35.0)	0.58 (0.46 - 0.73)	
Angina					
No	2493 (94.3)	1346 (54.0)	1147 (46.0)	1	.113
Yes	150 (5.7)	71 (47.3)	79 (52.7)	1.30 (0.93 - 1.81)	
MR					
No	2424 (91.7)	1284 (53.0)	1140 (47.0)	1	.028
Yes	219 (8.3)	133 (60.7)	86 (39.3)	0.73 (0.55 - 0.96)	
HF					
No	2521 (96.9)	1349 (53.5)	1172 (46.5)	1	.630
Yes	122 (4.6)	68 (55.7)	54 (44.3)	0.91 (0.63 - 1.31)	
Kidney disease					
No	2561 (96.9)	1378 (53.8)	1183 (46.2)	1	.265
Yes	82 (3.1)	39 (47.6)	43 (52.4)	1.28 (0.82 - 1.99)	
Retinopathy					
No	2606 (98.6)	1399 (53.7)	1207 (46.3)	1	.543
Yes	37 (1.4)	18 (48.7)	19 (51.43)	1.22 (0.63 - 2.34)	
PAD					
No	2523 (95.5)	1336 (53.0)	1187 (47.0)	1	.002
Yes	120 (4.5)	81 (67.5)	39 (32.5)	0.54 (0.36 - 0.80)	
Diagnosis of sec. HBP					
No	2604 (98.5)	1402 (53.8)	1202 (46.2)	1	.060
Yes	39 (1.5)	15 (38.5)	24 (61.5)	1.86 (0.97 - 3.57)	
Menopause					
No	464 (17.6)	267 (57.5)	197 (42.5)	1	.010
Yes	1008 (38.1)	507 (50.3)	501 (49.7)	1.33 (1.07 - 1.67)	
Men	1171 (44.3)	643 (54.5)	528 (45.1)	1.11 (0.89 - 1.38)	.334
Family history					
HBP history					
No	637 (24.1)	343 (53.9)	294 (46.1)	1	.892
Yes	2006 (75.9)	1074 (53.5)	932 (46.5)	1.01 (0.84 - 1.21)	

(Continues)

TABLE 2 (Continued)

Variable	No. (%) Mean (±€SD)	Controlled BP No. (%)	Uncontrolled BP No. (%)	OR (95% CI)	*P*
Father, mother, and siblings' history					
No	637 (24.1)	343 (53.8)	294 (46.2)	1	.892
Yes	2006 (75.9)	1074 (53.5)	932 (46.5)	1.01 (0.84 - 1.21)	
Prem. Fam. Hist. CVD					
No	1876 (71)	993 (53.0)	883 (47.0)	1	.272
Yes	767 (29)	424 (55.3)	343 (44.7)	0.90 (0.76 - 1.07)	

Abbreviations: AMI, acute myocardial infarction; MR, myocardial revascularization; HF, heart failure; PAD, peripheral arterial disease; HBP, hypertension; Prem. Fam. Hist., premature family history; CVD, cardiovascular diseases; Diagnosis of sec. HBP, diagnosis of secondary hypertension; Cereb. Disease, cerebrovascular disease.

TABLE 3 Description of the sample and bivariate logistic regression analysis of controlled and uncontrolled pressure according to HBP knowledge and treatment variables, no. = 2643

Variable	No. (%) Mean (±€SD)	Controlled BP No. (%)	Uncontrolled BP No. (%)	OR (95% CI)	*P*
HBP Knowledge and treatment					
Time of awareness of being hypertensive (no. = 2467)	13.0 (10.4)	12.6 (10.2)	13.5 (10.5)	1.00 (1.00-1.01)	.050
Time of treatment of HBP (no. = 2420)	11.9 (9.9)	11.7(9.8)	12.3 (10.1)	1.00 (0.9 - 1.01)	.129
Need for ED for HBP (no. = 2617)					
No	2150 (82.2)	1213 (56.4)	937 (43.6)	1	<.001
Yes	467 (17.8)	197 (42.2)	270 (57.8)	1.77 (1.44 - 2.17)	
Check BP regularly					
Yes	716 (27.1)	371 (51.8)	345 (48.2)	1	.259
No	1927 (72.9)	1046 (54.3)	881 (45.7)	0.90 (0.76 - 1.07)	
Medication is purchased (no. = 2638)					
No or do not use	1198 (45.4)	619 (51.7)	579 (48.3)	1	.055
Yes	1440 (54.6)	798 (55.4)	642 (44.6)	0.86 (0.73 - 1.00)	
Lack of resources to buy (no. = 2638)					
No or do not use	2236 (84.8)	1215 (54.3)	1021 (45.7)	1	.130
Yes	402 (15.2)	202 (50.3)	200 (49.7)	1.17 (0.95 - 1.46)	
Times that there was no resource to buy medicine in the last 6 months (no. = 352)	2.4 (2.1)	2.5 (2.4)	2.3 (1.7)	0.95 (0.86 - 1.05)	.373
Days without medication (no. = 317)	5.1 (3.7)	4.7 (3.6)	5.4 (3.7)	1.05 (0.99 - 1.12)	.082
Adherence to drug treatment (no. = 2638)					
High	1113 (42.2)	636 (57.1)	477 (42.9)	1	.003
Low	1525 (57.8)	781 (51.2)	744 (48.8)	1.27 (1.08 - 1.48)	

Abbreviations: BP, blood pressure; HBP, hypertension; ED, emergency department.

4 | DISCUSSION

The prevalence found (46.4%) of noncontrolled BP in the investigated sample demonstrates the challenges faced by the secondary level of health care in the Brazilian health system for the monitoring and follow-up of hypertensive patients. This high rate represents important information for managers and health professionals regarding the demands of care for this population. It should also be noted that, among those who underwent drug treatment, about 50% had low adherence.

We identified the following factors that are positively associated with the lack of BP control: advanced age, increased BMI, practice of irregular physical activities, presence of menopause, need for emergency care, and poor adherence to drug treatment.

TABLE 4 Factors associated with uncontrolled pressure in hypertensive patients in multivariate logistic regression analysis, no. = 2643

Variable	OR (95% CI)	*P*
Age group (years)		
< 60	1	.001
≥ 60	1.31 (1.11 - 1.55)	
Body mass index	1.02 (1.01 - 1.04)	<.001
Irregular physical activity		
No	1	.008
Yes	1.28 (1.06 - 1.55)	
Amount of fruits eaten	0.90 (0.85 - 0.94)	<.001
Menopause		
No	1	
Yes	1.36 (1.07 - 1.72)	.011
Men	1.19 (0.95 - 1.50)	.120
Dyslipidemia		
No	1	.001
Yes	0.75 (0.64 - 0.89)	
Myocardial infarction		
No	1	<.001
Yes	0.59 (0.46 - 0.76)	
Peripheral arterial disease		
No	1	.002
Yes	0.52 (0.34 - 0.78)	
Emergency room for HBP in the last 6 months		
No	1	<.001
Yes	1.80 (1.46 - 2.22)	
Adherence to drug treatment		
High	1	.013
Low	1.22 (1.04 - 1.44)	

The association between age over 60 years and lack of BP control represents a finding that is consistent with other studies that evaluated elderly patients in primary care[15] and outpatients over 50 years old.[16] Another study also identified an inverse association between age and BP control in Germans over 75 years old.[17] The high frequency of uncontrolled BP in the elderly was evidenced in a cohort in Iran (51.7%) in the elderly vs 11.1% in young adults).[6] In the elderly, in addition to the presence of simultaneous cardiovascular risk factors and comorbidities, the difficulty in controlling BP is worsened due to physiological changes, especially vascular aging.[2,18,19] Although age is a nonmodifiable factor, preventive action strategies and the promotion of active and healthy aging can contribute to BP control.

The association between increased BMI and uncontrolled BP is reaffirmed by other authors, such as in: hypertensive elderly, in whom the gain of 1 kg/m^2 increased the chance of BP [15]; nonobese hypertensive individuals with BMI values ≥ 23 kg/m^2[20]; in hypertensive patients from a hospital unit with a BMI between 25 and 29.9 kg/m^2[21]; and in several studies with hypertensive elderly.[6,17]

Anthropometric measurements (BMI and WC) are strongly associated with cardiometabolic diseases, elevation of SBP and DBP, and are considered predictors of uncontrolled HBP.[22] This relationship is due to the increase in apolipoproteins B; presence of dyslipidemia[23]; atherosclerosis development[24] and hyperinsulinemia[25] that result in endothelial dysfunction,[26] and when combined, they can increase the risk of BP elevation in obese individuals.

The practice of irregular physical activities was associated with lack of BP control, a fact evidenced in many studies.[3,8,21] The rate of uncontrolled HBP can reach 50.5% in people with irregular physical activity.[6]

In the present study, there was also an association between menopausal women and lack of BP control. Other international studies have identified this association: Hubei (China)[27] and in Southwestern.[16]

The menopause period contributes to the elevation and noncontrol of BP levels[27] due to age-related changes, among which increased arterial stiffness is common,[28] and to hormonal variations,[29] especially reducing exposure to endogenous estrogens,[30] which results in less endothelial protection,[29] increased plasma renin, activation of the renin-angiotensin-aldosterone system (RAAS), and lower arterial compliance.[31]

The occurrence of emergency room care for HBP in the last 6 months was associated with lack of BP control; however, we did not find studies that evaluated this association, although several evidence points to the frequent search for emergency care for BP elevations.[32] High BP levels may be related to the frequency of times an individual goes to the emergency room, due to the presence of symptoms and/or complications, among the most common: headache, vertigo, pain in the precordial region, nausea, vomiting and others, with main focus on the neurological, cardiovascular, and renal systems.[19]

This association can also be justified by factors that accompany hypertensive individuals and the profile of the sample. The frequency of hypertensive crises increases from the fifth decade of life onward, due to a linear increase in blood pressure levels, age progression, and less chance of BP control.[2,19]

The low adherence to drug treatment found, associated with uncontrolled BP, is a behavior also evidenced by other studies with adult hypertensive patients being treated for HBP.[8,9,16,21] Another study showed that good adherence to drug treatment was associated with better BP control in hypertensive patients.[7]

Among the consequences of low/nonadherence, it is possible to highlight the reduction in effective control not only of HBP but of other comorbidities. There are several contributing factors: lack of knowledge about the disease, complex pharmacotherapy and dissatisfaction with the health service[33]; biological and socioeconomic characteristics such as sex, age, marital status, education, economic class, ethnicity,[34] therapeutic regimen, need for third-party assistance for medication use, home therapies, presence of adverse reactions,[35] low expectations of treatment result,[36] and intentional interruption due to improvement or worsening of symptoms.[37]

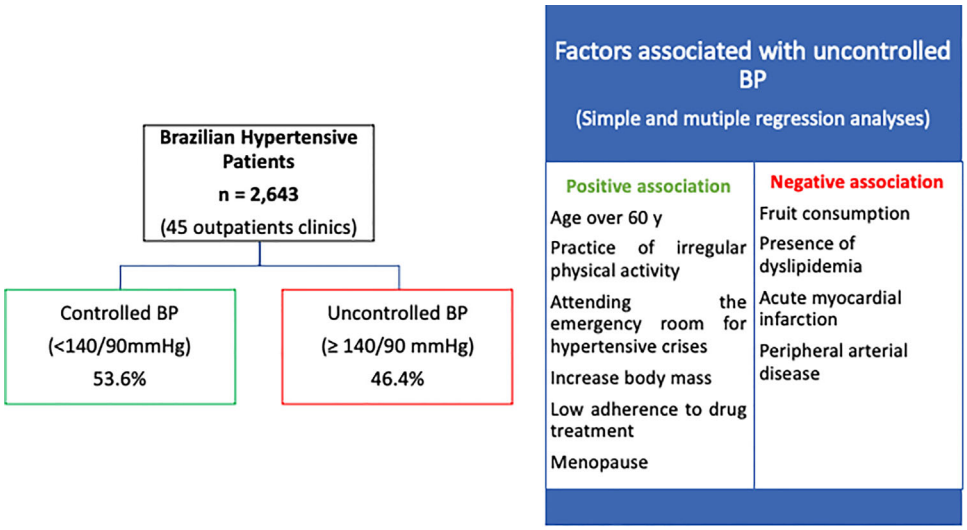

FIGURE 1 Factors associated with uncontrolled BP citation: Factors associated with BP noncontrol are widely studied nationally and internationally.[2,6–10]

We identified that the presence of MI, PAD, dyslipidemia and higher daily fruit intake were negative association factors in the sample of people with uncontrolled BP. Furthermore, the presence of more serious diseases such as MI or PAD can identify individuals in more advanced stages of the cardiovascular continuum when there are often reductions in BP values due to myocardial damage.[15]

This fact can be explained by better awareness, self-care, and frequency of treatment and medical follow-up that individuals tend to present after cardiovascular events.[2] Clarification about conditions and limitations induces healthy behavior.[38]

Another possibility may be related to cardiac remodeling in ischemic cardiomyopathy with a consequent reduction in inotropic capacity and cardiac output. Structural defects are common, such as myocyte hypertrophy; dilation of the ventricular chamber; changes in global ventricular function; and decreased contractility and relaxation properties of cardiac tissue.[39]

Although we have not found yet studies of negative association between the presence of dyslipidemia and lack of BP control, several authors have confirmed that dyslipidemia is a common comorbidity among the hypertensive population, with a prevalence from 41.13%[18] to 69.4%.[40] This association, in our sample, may be related to the patients' healthier lifestyle, influenced by the diagnosis of the disease and its clarification. This behavior may contributes to greater self-care, maintains physiological stability, and interferes with the response to symptoms when they occur.[2,38]

The negative association between consumption of more than two servings of fruit per day and uncontrolled BP that we found is confirmed by other authors. The daily consumption of three kiwifruit for eight weeks was associated with a reduction of -3.5 mmHg in SBP and -1.9 mmHg in DBP, in stage I hypertensive patients[41] and 10 mmHg decrease in SBP and 9 mmHg in DBP in adult smokers.[42] Another study demonstrated a strong association between daily fruit consumption and reduced BP levels, in hypertensive patients[43]

The nutrients present in a controlled diet are effective in preventing and controlling HBP, with effects on both SBP and DBP.[2] The presence of potassium, vitamin C, flavonoids, among others, are able to produce the following in the body: antioxidant action[41];; increased sodium excretion by the kidneys[44]; improvement in endothelial function, through induction of vasodilation and decrease in arterial stiffness; improvement in blood flow; and anti-inflammatory effect.[45]

The care model may be contributing to greater difficulties in the prevention, treatment, and control of HBP. The disease-centered model is prescriptive. It is not heard and considered in the therapeutic context, so they do not adhere to the treatment, which becomes ineffective.[46]

A discussion on a person-centered model that can involve and commit individuals to their own health is required, so that they become capable of practicing self-care. We believe that primary care is the gateway to the policy of reorganizing the care model in a selective or expanded way, and that the connection between levels of care is essential to favor this population's monitoring and follow-up.[47]

Among the limitations of the present study, the nonstandardization of the devices used to check BP and the form of categorization of physical activity that did not follow international guidelines stand out. However, there was training and use of validated and calibrated devices. Regarding physical activity, it was considered a simple and quick way of reporting during data collection. As positive aspects, we highlight: the representative sample of hypertensive patients assisted in public and private institutions and simultaneous evaluation of several associated factors (see Figure 1).

For future designs, we suggest the investigation of genetic factors that may impact BP control and the reasons that make the presence of comorbidities to be negatively associated with uncontrolled BP. Assuming that there is still difficulty in the health services acess and that sociodemographic conditions impact the possibility of treatment, we also suggest the search for the same problematization in the general population, hoping that more unsatisfactory control rates can be found, since the population of this study was supported by assistance services.

5 | CONCLUSION

The lack of blood pressure control was positively associated with age group above 60 years, high body mass index, practice of irregular physical activity, menopause, need for emergency care due to high blood pressure in the last 6 months, and low adherence to drug treatment. The negative association occurred with consumption of more than two servings/day of fruit and the presence of dyslipidemia, acute myocardial infarction, and peripheral arterial disease.

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CONFLICT OF INTEREST

There is no conflict of interest.

AUTHOR CONTRIBUTION

This author contribution form affirms that all individuals listed as authors agree that they have met the criteria for authorship, agree to the conclusions of the study, and that no individual meeting the criteria for authorship has been omitted.

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	Criteria 1		Criteria 2		Criteria 3	Criteria 4
Author (Last name, First Initial) eg, Smith, J	contributed to conception or design	contributed to acquisition, analysis, or interpretation	drafted the manuscript	critically revised the manuscript	gave final approval	Agrees to be accountable for all aspects of work ensuring integrity and accuracy
Araujo, T.	x	x	x			x
Borges, L.	x	x	x			
Barroso, W.	x			x	x	X
Brandão, A.	X					X
Barbosa, E.	X					X
Feitosa, A.	x					X
Malachias, M.	x					x
Gomes, M.	x					X
Amodeo, C.	x					X
Povoa, R.	x					x
Jardim, P.	x					X
Lopes, R.	x					x
Batista, S.		x	x	x		X
Vitorino, P.	x	x	x	x	x	x

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