

## ORIGINAL ARTICLE

## Non-Targeted Self-Measured Blood Pressure and Hypertension Control in Public and Private Health Systems in Brazil

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### Abstract

**Background:** It is estimated that more than 30% of the Brazilian population has systemic arterial hypertension (SAH), and mostly as an uncontrolled disease. The most recent Brazilian Guideline of Hypertension recommends the practice of self-measurement of blood pressure (BP) as one of the strategies for a better control of SAH, but there is no consensus about the efficiency of this tool.

**Objective:** To assess the control of SAH and the practice of non-targeted self-measured BP (SMBP) among hypertensive users of the Unified Health System (SUS) and the Supplementary Network (SN).

**Methods:** This is a cross-sectional, observational, analytical study, with a stratified probability sample. One thousand volunteers were investigated, being 500 from SUS and 500 from the SN. Uni and multivariate analyses were performed considering a 5% significance level.

**Results:** Patients from SUS presented inferior sociodemographic data (schooling, social status) in relation to those of the SN ( $p < 0.001$ ), and showed lower control of SAH ( $p = 0.014$ ), as well as more visits to the emergency room in the past year due to hypertension ( $p = 0.002$ ), and fewer regular appointments with the cardiologist ( $p = 0.004$ ). SMBP was equally present in both assessed groups ( $p = 0.567$ ), even though users of the SN have been more advised to not conduct such a practice ( $p = 0.002$ ). SMBP ( $p < 0.001$ ) was an independent factor for uncontrolled SAH both in SUS (OR = 3.424) and in the SN (OR = 3.474).

**Conclusion:** Patients in SUS presented lower SAH control. The practice of SMBP, mostly practiced with an uncalibrated digital device, was equally present in both groups and became an independent factor of uncontrolled SAH.

**Keywords:** Hypertension; Health Systems; Unified Health System.

### Introduction

The control of systemic arterial hypertension (SAH) is a global public health challenge,<sup>1,2</sup> once it is considered as the main modifiable risk factor for cardiovascular diseases, chronic kidney disease and premature death.<sup>3-6</sup> Besides, there is a significant impact on the direct and indirect costs for the system due to its fatal and non-fatal complications.<sup>7-9</sup> Only in

2018, the direct costs for the Brazilian public health related to SAH were R\$ 2.03 billion.<sup>8,9</sup>

The estimation is that more than 30% of the Brazilian adult population has SAH,<sup>10</sup> and the control rate is below expected. A systematic review showed that the control rate of SAH in Brazil has ranged between 43.7% and 67%.<sup>11</sup> There are many reasons for this number, and one of the most influential elements is the lack of adherence to therapy.<sup>6,12</sup>

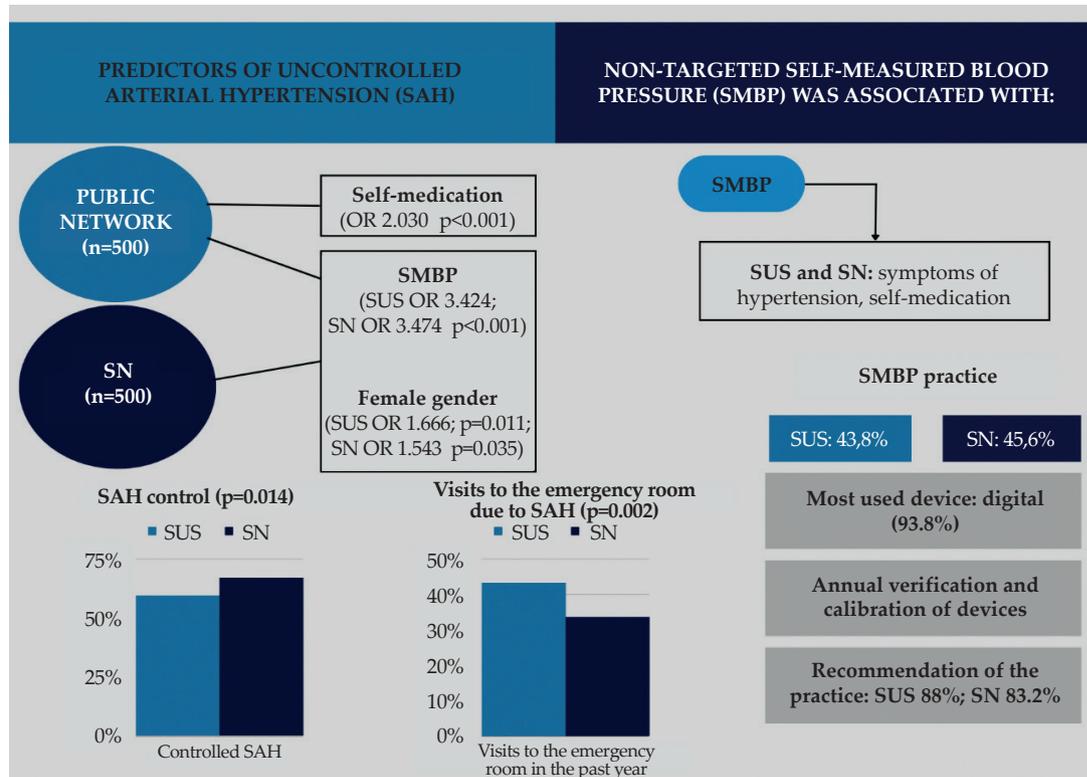
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DOI: <https://doi.org/10.36660/ijcs.202220144>

Manuscript received September 19, 2022; revised manuscript May 16, 2023; accepted June 14, 2023.

**Central Illustration: Non-Targeted Self-Measured Blood Pressure and Hypertension Control in Public and Private Health Systems in Brazil**

Int J Cardiovasc Sci. 2023; 36:e20220144

SAH: systemic arterial hypertension; SN: Supplementary Network./ SMBP: self-measured blood pressure.

As one of the strategies to promote higher adherence to treatment, the most recent Brazilian Guideline of Hypertension recommends the practice of blood pressure (BP) self-measurement, called BPSM.<sup>6</sup> However, even though this methodology is attractive because it is easy to acquire and use the devices, especially digital ones, it presents practical limitations, such as: lack of calibration and unsatisfactory quality of some instruments; non-standardized BP measurement technique; interference of stressful situations, among others. There is no consensus in the literature as to the real benefit of this method in incrementing the adherence to antihypertensive treatment for disease control; besides, there are few studies approaching the impact of this strategy. Therefore, this investigation was conducted aiming at assessing the control of SAH, as well as the influence of non-targeted self-measured blood pressure (SMBP) in chronic hypertension users of the Unified Health System (SUS) and the Health Supplementary Network (SN).

## Methods

### Type of study and data collection

This is an observational, cross-sectional and analytical study that included 1,000 patients assisted at the outpatient cardiology clinics of private and public hospitals between June, 2017, and October, 2019 in Aracaju-Sergipe. The sample was defined by convenience and selected in a non-probability consecutive manner, and evaluated 500 individuals in each group.

We included individuals diagnosed with SAH, defined according to the Brazilian Guidelines of Hypertension,<sup>6</sup> and aged above 18 years. We excluded the ones who presented with psychiatric conditions. The information was obtained through a standardized questionnaire that included sociodemographic and clinical data of the patient, information about SMBP and self-medication, besides information in the medical record.

SAH control was assessed with the ambulatory blood pressure monitoring (ABPM) or the mean of the two last

measurements taken in the ambulatory environment. *BP was considered controlled when*  $<130\text{mmHg} \times 80\text{mmHg}$  or  $<140\text{ mmHg} \times 90$  in high and low-risk patients, respectively, according to the Brazilian Guidelines of Hypertension.<sup>6</sup>

### Ethical aspects

All volunteers signed the Informed Consent Form according to resolution 466/2012, allowing the use of their information, as long as the identification data were confidential. This study was approved by the Human Research Ethics Committee, CAAE number:

### Statistical Analysis

The collected data were stored and analyzed using SPSS Statistics 22.0. The quantitative variables were described as mean and standard deviation, according to the normal distribution of the sample, and qualitative variables were absolute number and frequency. The Shapiro-Wilk test was used to verify the normality of the sample distribution.

Pearson's chi-square or Fisher Exact tests were used, when adequate, to analyze associations, besides the Student's t-test for independent samples, to verify the difference between groups regarding age. Finally, the univariate and multivariate analyses were conducted, which included logistic regression. We considered admission of a model as  $p = 0.25$ , and permanence,  $p = 0.05$ . The method of choice was the backward stepwise, which enabled reaching adjusted odds ratio and 95% confidence intervals. For statistical significance, we considered a two-tailed  $p$  of 0.05 for all tests.

The variables included in the regression model were: sex, color, age, schooling, social status, marital status, depression, peripheral obstructive arterial disease, diabetes mellitus, dyslipidemia, chronic kidney disease, coronary disease, cerebrovascular disease, chronic heart failure, practice of SMBP and self-medication.

## Results

### Descriptive analysis

One Thousand volunteers were assessed, being 500 from SUS and 500 from the SN, with mean age of  $60.9 \pm 11.9$  years and  $61.14 \pm 13$  years, respectively, without differences between both groups ( $p = 0.618$ ). The total sample was formed by 57.1% of women and 42.9% of

men, with no difference between the types of health services ( $p = 0.085$ ).

There were more black people in SUS and more white people in the SN ( $p < 0.001$ ), and no differences regarding yellow and brown users. The prevalent social classes in SUS were D and E, whereas in the SN it was A, B and C ( $p < 0.001$ ). Besides, there was prevalence of higher education in the SN, whereas illiteracy and lower schooling levels were prevalent in SUS ( $p < 0.001$ ), as demonstrated in Table 1.

As to the comorbidities, the patients in SUS presented with diabetes ( $p = 0.021$ ) and dyslipidemia more often ( $p < 0.001$ ) than users in the SN. However, it was not possible to observe discrimination between groups regarding the occurrence of coronary disease, heart failure, peripheral obstructive arterial disease, cerebrovascular disease, chronic kidney disease, chronic obstructive pulmonary disease and depression (Table 1).

### Control of SAH and SMBP in the SN and SUS

As to the behavior of SAH, the patients cared for in SUS had less control of the disease, more visits to the emergency room in the past year due to hypertension, and attended fewer regular appointments with the cardiologist ( $p < 0.05$ ). Besides, patients in the SN self-medicated more often ( $p < 0.001$ ) (Table 2).

Of the total population, 44.7% did SMBP, mostly using a digital device (93.8%). Besides, 21.1% were aware of the need for the annual calibration of the device, which was performed in only 10.7% of the devices.

There were no differences regarding the practice of SMBP between groups ( $p = 0.567$ ), which was performed by 43.8% of SUS users and 45.6% of SN users. However, in the SN there were more discussions about the positive and negative aspects of self-measurement with an assistant physician, as well as more advice against that practice ( $p < 0.05$ ). In general, most patients were advised to do SMBP, both in SUS (88%) and in the SN (83.2%).

The practice of SMBP was associated with more symptoms of hypertension and self-medication, both in SUS and in the SN. Among users of the SN, those belonging to higher social classes performed less SMBP. Among volunteers of SUS, the discussion with the physician about SMBP was more common among those who practiced it (Tables 3 and 4).

**Table 1 – Sociodemographic analysis and comorbidities in the population of the SUS and SN**

	SUS	SN	P value
<b>Color</b>			<0.001
White	10.80%	27.40%	
Black	29%	11.80%	
Yellow	1%	0.60%	
Brown	58.80%	60.80%	
<b>Social Class</b>			<0.001
A	0%	15.60%	
B	0.40%	25.80%	
C	1%	35%	
D	31.40%	17.20%	
E	67.20%	6.40%	
<b>Schooling</b>			<0.001
Elementary School	46.60%	11.60%	
High school	33.40%	29.60%	
Higher Education	3%	51.20%	
Post-graduation	0.80%	7.40%	
Illiteracy rates	16.20%	0.20%	
<b>Comorbidities</b>			
Diabetes	24,60%	18,60%	0,021
Dyslipidemia	42,60%	25,40%	<0,001
CAD	9,6%	13,6%	0,06
CKD	1%	1%	1
CVA	5,2%	4%	0,45
Depression	2,2%	2,2%	1
CHF	4,8%	4,2%	0,64
COPD	1,6%	1,6%	1
PAD	2,4%	2,6%	0,83

CAD: coronary artery disease; CKD: chronic kidney disease; CVA: cerebrovascular accident; CHF: chronic heart failure; COPD: peripheral obstructive pulmonary disease; PAD: peripheral obstructive arterial disease; SUS: Unified Health System; SN: Supplementary Network.

## Variables that are independently associated to the non-control of BP in the groups

In multivariate analyses, SMBP and the female gender were predictors of uncontrolled SAH in patients of SUS and the SN. In SUS, another predictor of uncontrolled SAH was self-medication (Tables 5 and 6).

## Discussion

The main findings of this investigation were: a) the practice of SMBP was an independent predictor for the non-control of BP, both in individuals assisted by the public and the private health system; b) there was a recommendation for SMBP for most members in both groups, and the encouragement to not practice it was more prevalent in those belonging to the SN; c) most users are unaware of the need for the annual calibration of the device, and finally, d) SMBP was associated with more self-medication in both assessed groups – Central Figure.

The most recently published Brazilian Guidelines of Hypertension (2020) indicates self-measured BP as one of the possible strategies for the control of BP, with level of recommendation I.<sup>6</sup> In fact, randomized and standardized studies, with only one type of specific and well-calibrated device, and skilled volunteers regarding the technique of BP checking and frequency of measurements, back up this methodology for better BP control.<sup>13,14</sup> However, in the daily practice, self-measurement is not advised and is carried out with different types of devices, many of which are not properly calibrated. In our study population, of those who did SMBP, 93.8% used a digital device, and only 21.1% of them were aware of the need for its annual calibration, which was performed in only 10.7% of the devices.

Similar findings were observed in other investigations which were not able to demonstrate the benefits of SMBP for the control of pressure levels.<sup>15,16</sup> We can speculate that these observations would be a result of false BP values generated by an unsatisfactory measurement technique and/or use of uncalibrated devices,<sup>16</sup> which encourage improper behaviors, such as self-medication, especially in anxious individuals.<sup>15</sup> Therefore, it is important that the patient be aware of the technical details of BP measurement, as well as the frequency with which it should be done, besides aspects regarding tensiometers (type, calibration), before recommending SMBP.

Besides, it was observed that black individuals, those with lower schooling levels, in lower social classes were

**Table 2 – Control of hypertension, self-measured BP and self-medication in the SUS and the SN**

Variables	Public	Private	OR for the public group	95% CI	P Value
Uncontrolled SAH	203	165	1.172	1.035-1.326	0.014
Regular appointments with the cardiologist	446	471	0.748	0.630-0.887	0.004
Visits to the emergency room in the past year	216	168	1.220	1.079-1.379	0.002
SMBP	219	228	–	–	0.567
Self-medication	178	235	0.786	0.688-0.897	<0.001
Discussion about SMBP with the physician	27	60	0.599	0.435-0.824	<0.001
<b>Medical indication for SMBP:</b>			–	–	0.002
Did not talk about it	26	18	–	–	
Recommended	440	416	–	–	
Not recommended	34	66	–	–	

SAH: systemic arterial hypertension; SMBP: self-measured blood pressure.

**Table 3 – Variables associated with self-measured BP in patients of the Health SN**

Variables	BP Self-measurement		P value
	Practices self-measurement	Does not practice self-measurement	
Social class			0.006
A	29	49	
B	45	84	
C	89	86	
D	48	38	
E	17	15	
Symptoms of hypertension	180	127	<0.001
Self-medication	161	74	<0.001

BP: Blood pressure.

**Table 4 – Variables associated with SMBP in patients of the SUS**

Variables	Practices self-measurement	Does not practice self-measurement	P Value
Symptoms of hypertension	161	140	<0.001
Self-medication	98	80	<0.001
Discussion with the physician about SMBP	22	5	<0.001

BP: Blood pressure; SMBP: self-measured blood pressure.

**Table 5 – Predictive factors of uncontrolled hypertension in the Health SN**

Factor	OR	95%CI	P Value
Female gender	1.543	1.030-2.312	0.035
SMBP	3.474	2.322-5.195	<0.001

BP: blood pressure; SMBP: self-measured blood pressure.

**Table 6 – Predictive factors of uncontrolled hypertension in patients of the SUS**

Factor	OR	95%CI	P Value
Female gender	1.666	1.122-2.474	0.011
SMBP	3.424	2.331-5.029	<0.001
Self-medication	2.030	1.366-3.015	<0.001

BP: blood pressure; SMBP: self-measured blood pressure.

more prevalent in SUS, which was the group associated with 172% more chances of not controlling SAH. Also, they attended fewer regular appointments with the cardiologist and attended the emergency room more often in the past year due to hypertension. The existence of inequalities regarding both BP control and access to health is a well-established reality.<sup>17-20</sup> Certainly, the investment in more intense actions in primary care may help reduce the overload of more complex sector, for example, reducing the visits to the emergency room.<sup>21,22</sup>

The limitations of the study are intrinsic to a cross-sectional study, such as the inability of pointing out causes to the outcomes, which would be possible in a cohort study. Besides, other factors not considered in the analysis may impact the assessed events. Finally, the results refer only to patients assisted in cardiology services of private and public hospitals of Aracaju-Sergipe, which limits the generalization of data.

## Conclusions

In the assessed sample, patients in SUS, with lower socioeconomic indexes, showed lower SAH control, fewer regular appointments with the cardiologist and more visits to the emergency room due to hypertension.

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The non-targeted SMBP, mostly performed with an uncalibrated digital device, was equally present among SUS and SN users, and presented itself as an independent predictor of uncontrolled SAH in both groups, besides being associated with the practice of self-medication.

## Author Contributions

Conception and design of the research: Salazar GO, Almeida GO, Barreto Filho JAS, Sousa ACS; acquisition of data: Almeida GO, Sousa ACS; analysis and interpretation of the data: Salazar GO, Almeida-Santos MA, Melo EV, Cruz JIN; statistical analysis: Salazar GO; writing of the manuscript: Salazar GO, Sousa ACS; critical revision of the manuscript for intellectual content: Barreto Filho JAS, Almeida-Santos MA, Aida FJ, Oliveira JLM, Baumworcel L, Sousa ACS.

## Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

## Sources of Funding

There were no external funding sources for this study.

## Study Association

This study is not associated with any thesis or dissertation work.

## Ethics Approval and Consent to Participate

This study was approved by the Ethics Committee of the CEP da Universidade Federal de Sergipe (UFS) under the protocol number 60473316.9.0000.5546. All the procedures in this study were in accordance with the 1975 Helsinki Declaration, updated in 2013. Informed consent was obtained from all participants included in the study.

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