

# Epidemiological Profile of Arterial Hypertension in the Municipality of Rio de Janeiro, Brazil, 2011 and 2019

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## Abstract

**Background:** Cardiovascular diseases are currently the leading global cause of morbidity and premature mortality. High blood pressure is one of the precursors to the disease, which, when undetected, can lead to other serious complications such as thrombosis, acute myocardial infarction, and stroke.

**Objective:** To analyze the profile of hypertension and associated factors in the municipality of Rio de Janeiro in the years 2011 and 2019.

**Method:** This is a population-based cross-sectional study that used data from the Vigitel telephone survey implemented by the Ministry of Health. The eligible population was that of the municipality of Rio de Janeiro, aged eighteen or older, in 2011 and 2019. To analyze the association between the outcome and the independent variables, multivariate logistic regression was used, estimating the Odds Ratio and its respective 95% confidence intervals.

**Results:** The predominant sociodemographic profile remained similar in 2011 and 2019: a majority of women, 18-39 years, and with 9-12 years of schooling. Education level in 2011 appeared as a protective factor among individuals with 12 or more years of schooling (OR: 0.64, 95% CI: 0.43; 0.97). Obese individuals had a 2.81- and 2.96-times greater chance, in 2011 and 2019, respectively, of reporting hypertension, compared to non-obese individuals.

**Conclusion:** The study highlights the need to expand the healthcare network to implement more effective strategies that consider the determinants of hypertension in order to achieve a greater impact on the management and control of the disease.

**Keywords:** Hypertension; Health Surveys; Risk Factors; Delivery of Health Care.

## Introduction

Cardiovascular diseases (CVDs) are currently the leading global cause of morbidity and premature mortality.<sup>1</sup> High blood pressure (HBP) is one of the main precursors in the genesis of the disease, which, when undetected, can lead to other serious complications such as thrombosis, acute myocardial infarction, and stroke.<sup>2</sup>

In 2020, the number of individuals diagnosed with HBP reached 1.13 billion worldwide, and this is projected to increase by 15 to 20% by 2025.<sup>3</sup> This scenario is particularly concerning given that two-thirds of those with the disease live in low- and middle-income countries, generating a substantial impact on the health system.<sup>4</sup> Social determinants partly explain the high burden of the disease in these

countries, whose investments in prevention and control programs remain insufficient, especially where financial resources and staff are limited.<sup>5,6</sup>

In the Americas region, the prevalence of HBP has been increasing in recent years, which contributes, directly or indirectly, to the emergence of disabilities and a decrease in quality of life.<sup>3</sup> A cross-sectional analysis of data collected in urban and rural communities in six Latin American countries (Argentina, Brazil, Chile, Colombia, Peru, and Uruguay) from 2003, 2010, and 2017 showed significant variations in the prevalence of hypertension (18-52%), knowledge (52-65%), treatment (47-63%), and control (16-30%), however, it was not possible to present trends in these indicators over time.

In Brazil, the most recent report from the Ministry of Health (MH) indicated that the prevalence of adults diagnosed with HBP has increased by almost 4% in the last 15 years, signaling the need for progress in strategies for managing the disease and its risk factors.

In March 2021, Brazil joined the HEARTS initiative, promoted by the Pan American Health Organization, intending to enhance care for people with chronic non-communicable diseases (NCDs), especially HBP, dyslipidemia, and diabetes.<sup>7</sup> Given the challenges in managing NCDs, this article aims to analyze the prevalence of HBP and factors

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associated with its behavior in the municipality of Rio de Janeiro in the years 2011 and 2019.

## Methods

This population-based cross-sectional study used data from Vigitel, a system implemented by the MH in 2006, whose objective is to promote the continuous monitoring of the frequency and distribution of risk and protective factors for Non-Communicable Chronic Diseases in adults (age  $\geq 18$  years). The telephone survey, conducted in households served by at least one landline in the capitals of the 26 Brazilian states and the Federal District, includes three-stage probabilistic sampling.<sup>8</sup>

Data regarding the population of the municipality of Rio de Janeiro were used for the years 2011 and 2019, with 3,640 and 2,950 respondents aged eighteen or older, respectively. The data up to 2019 were chosen for analysis because it was the last year before the COVID-19 pandemic. In Vigitel, the first stage is conducted through a systematic random selection of telephone lines in each city, divided into replicates or subsamples of 200 lines each, reproducing the same proportion by city region or telephone prefix, based on the electronic registry of fixed residential lines covering the studied cities; the second stage includes the identification of active residential lines, and the third stage is where an adult resident of the household is randomly selected to answer the interview.<sup>9</sup>

## Dependent variable

Prior medical diagnosis of HBP, defined by the *Sociedade Brasileira de Cardiologia* as systolic blood pressure (SBP)  $\geq 140$  mmHg and/or diastolic blood pressure (DBP)  $\geq 90$  mmHg.<sup>10</sup> The question included in the Vigitel survey to map the scenario of HBP in the country's capitals is: "Has any doctor ever told you that you have high blood pressure?"

## Covariates

Sex: male and female; Age range: 18-39 years, 40-59 years, 50-69 years, 70+ years; Marital status: not married/married; Race/color: white, black/brown, yellow, indigenous; Education: 0 to 8 years of schooling, 9 to 11 years of schooling, 12 years or more of schooling; Has health insurance: yes, no; Smoking - individuals who smoke, regardless of the frequency and intensity of the smoking habit: yes, no; Alcoholism - excessive consumption of alcoholic beverages (individuals who, in the last thirty days, have consumed, in a single day, more than four (women) or five (men) doses of alcoholic beverages): yes, no; Obesity - individuals with a body mass index (BMI) equal to or greater than 30 kg/m<sup>2</sup>: yes, no; Leisure-time physical inactivity - physically inactive individuals who have not practiced any physical activity in their free time in the last three months and have not performed intense physical efforts at work, have not commuted to work or school walking or cycling for a minimum of 10 minutes per trip per day and have not been responsible for heavy cleaning of their home: yes, no; and Regular consumption of fruits and vegetables 5x or more/week: yes, no.

## Statistical analysis

A descriptive analysis of the outcome variable and the selected covariates was performed to present the absolute and relative frequencies. Bivariate analyses between the selected variables and the outcome (HBP) were conducted using the chi-square test. For the pre-selection of covariates in the multivariate model, those with a p-value less than or equal to 0.20 in the bivariate analysis were included. Finally, in order to investigate the joint association between HBP and the independent variables, multivariate logistic regression was used, estimating the Odds Ratio (ORs) and their respective 95% confidence intervals (95% CI). The analyses were performed using the survey command for complex samples.

Since the present study is based on secondary data, it obtained exemption from the Research Ethics Committee. Vigitel was approved by the National Research Ethics Committee on Human Beings (processes no. 13.081/2008 and 355.590/2013).

## Results

Table 1 presents the sociodemographic profile and the frequency of risk and protective factors of the respondents in the years 2011 and 2019. The majority of respondents in both years were women (54.4% in 2011 and 2019), 18-39 years (43.75% in 2011 and 42.9% in 2019), and with 9-12 years of schooling (46.58% in 2011 and 48.53% in 2019). Approximately 51% had a partner, about 50% identified as white, and 52% had health insurance.

To better understand the factors associated with self-reported HBP, Table 2 highlights that the frequency of the disease was higher in females in both years of analysis and was concentrated in the 40-59 age group; a predominance of the disease was also observed among those who reported 9 to 12 years of schooling, identified as white, and had health insurance ( $p < 0.001$ ).

Between 2011 and 2019, among those who reported HBP, there was a reduction in the prevalence of smoking (11.64% to 8.22%), but alcohol consumption increased (29.27% to 34.19%), as did obesity (28.16% to 35.33%) and physical inactivity (17.50% to 19.92%); during this period there was a reduction in fruit consumption (66.89% to 59.42%). Table 3 presents the final multivariate regression model with the variables associated with the outcome in adult individuals. In both years, women showed a higher odds ratio of reporting HBP, and a statistically significant one, when compared to men, OR: 1.39 (95% CI: 1.04; 1.85) and OR: 1.50 (95% CI: 1.07; 2.10), respectively. The odds of self-reporting HBP were elevated with increasing age in both 2011 and 2019. For the age group of 60 years or older, the data should be viewed with caution, as the CI is wider, which may make the OR estimate imprecise. This is due to the small number of participants in this age group.

Education level in 2011 appeared as a protective factor among individuals with 12 or more years of schooling, OR: 0.64 (95% CI: 0.43; 0.97). Married individuals had a 1.71 (95% CI: 1.22; 2.40) greater chance of having a medical diagnosis of HBP in 2019, when compared to

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**Table 1 – Characteristics of the population that self-reported HBP in the municipality of Rio de Janeiro - Vigitel, 2011 and 2019**

| Characteristics            | 2011 (n=2004) |       | 2019 (n=2059) |       |
|----------------------------|---------------|-------|---------------|-------|
|                            | n             | %     | n             | %     |
| <b>Sex</b>                 |               |       |               |       |
| Male                       | 746           | 45.63 | 730           | 45.64 |
| Female                     | 1258          | 54.37 | 1329          | 54.36 |
| <b>Age range</b>           |               |       |               |       |
| 18-39 years                | 604           | 43.75 | 394           | 42.91 |
| 40-59 years                | 767           | 36.45 | 580           | 33.72 |
| 60-69 years                | 332           | 10.80 | 523           | 13.48 |
| 70+ years                  | 301           | 9.00  | 562           | 9.89  |
| <b>Education</b>           |               |       |               |       |
| 0 - 8 years                | 442           | 26.89 | 437           | 19.73 |
| 9-12 years                 | 945           | 46.58 | 884           | 48.53 |
| 12+ years                  | 611           | 26.27 | 738           | 31.74 |
| <b>Marital status</b>      |               |       |               |       |
| Not married                | 1061          | 51.33 | 1072          | 52.75 |
| Married                    | 943           | 48.67 | 987           | 47.25 |
| <b>Race/color</b>          |               |       |               |       |
| White                      | 1012          | 50.42 | 1069          | 50.00 |
| Black/brown                | 919           | 45.72 | 824           | 42.94 |
| Yellow                     | 31            | 1.67  | 9             | 0.41  |
| Indigenous                 | 24            | 1.48  | 17            | 0.73  |
| <b>Health insurance</b>    |               |       |               |       |
| No                         | 854           | 47.28 | 920           | 46.79 |
| Yes                        | 1145          | 52.55 | 1130          | 52.77 |
| <b>Smoking</b>             |               |       |               |       |
| No                         | 1756          | 87.43 | 1867          | 89.89 |
| Yes                        | 248           | 12.57 | 192           | 10.11 |
| <b>Alcoholism</b>          |               |       |               |       |
| No                         | 1311          | 64.45 | 1273          | 56.45 |
| Yes                        | 693           | 35.55 | 786           | 43.55 |
| <b>Obesity</b>             |               |       |               |       |
| No                         | 1488          | 74.59 | 1474          | 71.08 |
| Yes                        | 334           | 15.69 | 395           | 20.16 |
| No information             | 182           | 9.72  | 190           | 8.75  |
| <b>Physical inactivity</b> |               |       |               |       |
| No                         | 1709          | 86.66 | 1657          | 84.50 |
| Yes                        | 295           | 13.34 | 402           | 15.50 |
| <b>Fruit consumption</b>   |               |       |               |       |
| No                         | 712           | 40.50 | 707           | 43.68 |
| Yes                        | 1292          | 59.50 | 1352          | 56.32 |

| Vegetables consumption |      |       |      |       |
|------------------------|------|-------|------|-------|
| No                     | 950  | 46.20 | 968  | 47.78 |
| Yes                    | 1054 | 53.80 | 1091 | 52.22 |

Source: Ministry of Health. Brazil, Vigitel - Vigitel: Surveillance System for Risk and Protective Factors for Chronic Non-Communicable Diseases through Telephone Survey.

**Table 2 – Prevalence of self-reported HBP according to characteristics of adult individuals residing in the municipality of Rio de Janeiro - Vigitel, 2011 and 2019**

| Characteristics  | HBP - 2011 |       | p-value* | HBP - 2019 |       | p-value* |
|------------------|------------|-------|----------|------------|-------|----------|
|                  | n          | %     |          | n          | %     |          |
| Sex              |            |       |          |            |       |          |
| Male             | 235        | 38.14 | 0.00     | 253        | 36.44 | 0.00     |
| Female           | 503        | 61.86 |          | 593        | 63.56 |          |
| Age range        |            |       |          |            |       |          |
| 18-39 years      | 68         | 0.16  | 0.00     | 32         | 14.09 | 0.00     |
| 40-59 years      | 281        | 44.35 |          | 201        | 38.42 |          |
| 60-69 years      | 193        | 20.26 |          | 274        | 25.87 |          |
| 70+ years        | 196        | 19.31 |          | 339        | 21.62 |          |
| Education        |            |       |          |            |       |          |
| 0 - 8 years      | 250        | 41.04 | 0.00     | 265        | 32.91 | 0.00     |
| 9-12 years       | 326        | 41.22 |          | 358        | 45.90 |          |
| 12+ years        | 161        | 17.75 |          | 223        | 21.19 |          |
| Marital status   |            |       |          |            |       |          |
| Not married      | 392        | 54.84 | 0.00     | 419        | 38.15 | 0.00     |
| Married          | 346        | 45.16 |          | 427        | 61.85 |          |
| Race/color       |            |       |          |            |       |          |
| White            | 365        | 50.02 | 0.88     | 406        | 52.78 | 0.87     |
| Black/brown      | 346        | 47.14 |          | 349        | 45.60 |          |
| Yellow           | 9          | 1.49  |          | 3          | 0.52  |          |
| Indigenous       | 8          | 1.36  |          | 8          | 1.10  |          |
| Health insurance |            |       |          |            |       |          |
| No               | 337        | 48.53 | 0.03     | 411        | 43.19 | 0.09     |
| Yes              | 398        | 51.47 |          | 433        | 56.81 |          |
| Smoking          |            |       |          |            |       |          |
| No               | 656        | 88.36 | 0.47     | 778        | 91.78 | 0.17     |
| Yes              | 82         | 11.64 |          | 68         | 8.22  |          |
| Alcoholism       |            |       |          |            |       |          |
| No               | 525        | 70.73 | 0.00     | 582        | 65.81 | 0.00     |
| Yes              | 213        | 29.27 |          | 264        | 34.19 |          |
| Obesity          |            |       |          |            |       |          |
| No               | 480        | 71.84 | 0.00     | 520        | 64.67 | 0.00     |
| Yes              | 178        | 28.16 |          | 230        | 35.33 |          |

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|                        |     |       |      |     |       |      |
|------------------------|-----|-------|------|-----|-------|------|
| Physical inactivity.   |     |       |      |     |       |      |
| No                     | 586 | 82.50 | 0.00 | 642 | 80.08 | 0.01 |
| Yes                    | 152 | 17.50 |      | 204 | 19.92 |      |
| Fruit consumption      |     |       |      |     |       |      |
| No                     | 224 | 33.11 | 0.00 | 265 | 40.58 | 0.18 |
| Yes                    | 514 | 66.89 |      | 581 | 59.42 |      |
| Vegetables consumption |     |       |      |     |       |      |
| No                     | 347 | 49.07 | 0.13 | 380 | 47.93 | 0.06 |
| Yes                    | 391 | 50.93 |      | 466 | 52.07 |      |

\*Chi-square test with correction for complex samples. Source: Ministry of Health, Brazil, Vigitel – Vigitel: Surveillance System for Risk and Protective Factors for Chronic Non-Communicable Diseases through Telephone Survey.

**Table 3 – Multivariate logistic regression between self-reported HBP and characteristics of adult individuals (>= 18 years) residing in the municipality of Rio de Janeiro - Vigitel, 2011 and 2019**

| Characteristics            | HBP - 2011 |             |         | HBP - 2019 |             |         |
|----------------------------|------------|-------------|---------|------------|-------------|---------|
|                            | OR         | 95% CI      | p-value | OR         | 95% CI      | p-value |
| <b>Sex</b>                 |            |             |         |            |             |         |
| Male                       | 1          | -           | -       | 1          | -           | -       |
| Female                     | 1.39       | 1.04; 1.85  | 0.02    | 1.50       | 1.07; 2.10  | 0.02    |
| <b>Age range</b>           |            |             |         |            |             |         |
| 18-39 years                | 1          | -           | -       | 1          | -           | -       |
| 40-59 years                | 3.96       | 2.71; 5.78  | 0.00    | 3.52       | 2.04; 6.09  | 0.00    |
| 60-69 years                | 9.88       | 6.39; 15.29 | 0.00    | 8.97       | 5.10; 15.77 | 0.00    |
| 70+ years                  | 12.94      | 7.89; 21.22 | 0.00    | 13.46      | 7.77; 23.32 | 0.00    |
| <b>Education</b>           |            |             |         |            |             |         |
| 0 - 8 years                | 1          | -           | -       | 1          | -           | -       |
| 9-12 years                 | 0.8        | 0.56; 1.15  | 0.22    | 0.91       | 0.63; 1.33  | 0.64    |
| 12+ years                  | 0.64       | 0.43; 0.97  | 0.03    | 0.72       | 0.46; 1.15  | 0.17    |
| <b>Marital status</b>      |            |             |         |            |             |         |
| Not married                | 1          | -           | -       | 1          | -           | -       |
| Married                    | 1.01       | 0.77; 1.34  | 0.93    | 1.71       | 1.22; 2.40  | 0.00    |
| <b>Smoking</b>             |            |             |         |            |             |         |
| No                         | -          | -           | -       | 1          | -           | -       |
| Yes                        | 0.87       | 0.65; 1.14  | 0.16    | 0.81       | 0.48; 1.38  | 0.44    |
| <b>Alcoholism</b>          |            |             |         |            |             |         |
| No                         | -          | -           | -       | 1          | -           | -       |
| Yes                        | -          | -           | -       | 0.89       | 0.65; 1.23  | 0.49    |
| <b>Obesity</b>             |            |             |         |            |             |         |
| No                         | 1          | -           | -       | 1          | -           | -       |
| Yes                        | 2.82       | 2.03; 3.90  | 0.00    | 2.94       | 2.07; 4.21  | 0.00    |
| <b>Physical inactivity</b> |            |             |         |            |             |         |
| No                         | 1          | -           | -       | 1          | -           | -       |
| Yes                        | 1.13       | 0.77; 1.66  | 0.45    | 1.03       | 0.70; 1.52  | 0.87    |

|                                                          |      |            |      |      |            |      |
|----------------------------------------------------------|------|------------|------|------|------------|------|
| <b>Health insurance</b>                                  |      |            |      |      |            |      |
| Yes                                                      | 1    | -          | -    | 1    | -          | -    |
| No                                                       | 1.13 | 0.85; 1.50 | 0.34 | 1.21 | 0.87; 1.69 | 0.25 |
| <b>Fruit consumption<br/>(5x or more/week)</b>           |      |            |      |      |            |      |
| Yes                                                      | 1    | -          | -    | 1    | -          | -    |
| No                                                       | 0.79 | 0.59; 1.07 | 0.14 | 1.09 | 0.79; 1.51 | 0.60 |
| <b>Vegetables consumption<br/>(5 times or more/week)</b> |      |            |      |      |            |      |
| Yes                                                      | 1    | -          | -    | 1    | -          | -    |
| No                                                       | 1.18 | 0.89; 1.55 | 0.25 | 0.81 | 0.60; 1.10 | 0.18 |

Source: Ministry of Health, Brazil, Vigitel - Vigitel: Surveillance System for Risk and Protective Factors for Chronic Non-Communicable Diseases through Telephone Survey.

single individuals. Individuals classified as obese had a 2.82 (95% CI: 2.03; 3.990) and 2.94 (95% CI: 2.07; 4.21) greater chance in 2011 and 2019, respectively, of reporting HBP compared to non-obese individuals.

## Discussion

In the capital of the State of Rio de Janeiro, data from Vigitel showed that women reported higher blood pressure in both 2011 and 2019. Authors have shown that since the 1940s, the trajectory of blood pressure between the sexes has not been uniform, but an understanding of the mechanisms or clinical relevance of these differences is only now beginning to emerge.<sup>12,13</sup>

Mauvais-Jarvis et al. highlighted that blood pressure is a sexually dimorphic trait and its prevalence can vary significantly between men and women throughout life, resulting mainly from a combination of biological and psychosocial factors. In general, healthy young women have lower blood pressure than men of the same age, mainly due to estrogen, which protects both blood pressure and cholesterol control, but blood pressure increases from the third decade of life, becoming more pronounced after age 50.<sup>14</sup>

Malta et al. (2019) found in Brazil a prevalence of HBP of 21.4% using the self-reported criterion, 22.8% for measured HBP, and 32.3% for reported medication use; women showed higher prevalences in the self-reported criterion, and among men, the measured criterion was higher.<sup>15</sup> In another cross-sectional study, conducted in India, women demonstrated a higher prevalence and awareness of HBP compared to men,<sup>16</sup> a result similar to the survey in China, recently published (2022), which demonstrated higher awareness (51.9% vs. 42.5%), treatment (46.6% vs. 35.6%), and disease control (17.7% vs. 13.2%) among women.<sup>17</sup>

Some other hypotheses for the higher frequency of the disease among women may be hormonal changes, mainly during menopause, with an increase in BMI, in addition to the stress of having to reconcile various roles and responsibilities.<sup>18</sup> It should be considered that, as this study

addresses self-reported disease, opportunities for specific health interventions differ between men and women, and since women tend to frequent health services more often, they seem to have greater access to information for a better understanding of their health status and disease control. In this sense, it is necessary to strengthen the role of primary care as a motivating factor for self-care, for the institution of lifestyle changes, and for adherence to treatment in both sexes.<sup>18,19</sup>

Participatory strategies that include valuing popular knowledge can help to positively impact health education, making it more effective in controlling HBP. The proportion of individuals recognizing HBP showed a statistically significant increase with age, which is corroborated by several studies. Research conducted in Brazil indicated that people aged 60 or older had a 22 times higher prevalence of HBP compared to those in younger age groups.<sup>7</sup> An article on the prevalence of HBP in adults in the municipality of São Paulo showed that the main factors associated with the disease were female sex, age 60 or older, low education level, and being a former smoker.<sup>18</sup>

Malta et al. (2016) found a prevalence of HBP greater than 60% in the age group over 65 years, and according to the authors, this finding can be explained by biological changes inherent to aging, such as stiffening of the aorta and increased peripheral vascular resistance.<sup>15</sup> Other factors may also explain this profile, such as increased obesity and physical inactivity during leisure time in older people.<sup>5,7</sup>

The Framingham Study demonstrated that over 90% of participants with normal blood pressure at age 55 develop the disease at older ages.<sup>20</sup> Evidence shows that treating HBP in the elderly brings benefits in terms of reducing cardiovascular disease and its sequelae, highlighting that early recognition of the disease and appropriate treatment should be a priority for physicians.<sup>8,15</sup> Some studies indicate that many specialists do not initiate treatment or do not adequately adjust the medication dose for hypertensive patients, which contributes to disparities associated with disease control.<sup>8</sup> Another important aspect is ensuring risk stratification of the population developing HBP within the

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healthcare network to screen opportunistically, manage the disease in therapeutic care, and refer those with greater severity to specialized care.

This study found a higher frequency of self-reported illness among white individuals, however most articles identify associations with black skin color.<sup>21-23</sup> Other studies in Brazil have also identified higher prevalences among black women when compared to white women.<sup>21,24</sup>

Ethnic/racial differences and their impact on blood pressure and vascular disease are not yet fully understood, and one of the keys to understanding these disparities may lie in the pathophysiology underlying the health-disease process and the response to therapy.<sup>21</sup> Data from the Centers for Disease Control and Prevention (CDC) from 2013/2014 revealed in the United States that HBP control rates are higher among non-Hispanic whites (55.7%) and lower among non-Hispanic blacks (48.5%) and Hispanics (47.4%).<sup>22</sup>

Regarding education, the analysis model showed an association with years of study in 2011, with the chance of self-reporting HBP being 36% (OR=0.64; 95% CI= 0.43; 0.97) lower among those with 12 or more years of schooling, showing this variable as a possible protective factor. A population-based health survey in the Municipality of São Paulo found that individuals with more than nine years of schooling were 29% less likely to report the disease when compared to those with less schooling (PR = 0.71; 95% CI: 0.54-0.94), after adjusting for the variables sex, age, and care in health services.<sup>18</sup>

This scenario reveals inequity in treatment, which may reflect less frequent blood pressure monitoring in areas where people with lower purchasing power live and have greater difficulty accessing health services and preventive measures. Furthermore, it is important to ensure a care plan that understands the user's needs in order to generate greater adherence to treatment.<sup>24</sup>

In the final logistic regression model, the higher likelihood of obesity among those who reported HBP in the adult population of the municipality of Rio de Janeiro was noteworthy. A study in the capital of the State of São Paulo indicated that overweight individuals were 42% more likely to report HBP than those with normal weight (PR = 1.42; 95% CI: 1.15-1.76).<sup>15</sup> American research showed that for overweight people between 40 and 64 years of age, the prevalence of HBP was 50% higher than for those with normal weight and 100% higher compared to underweight people.<sup>25</sup>

Other studies highlight that overweight and obesity can favor arterial HBP, where excess body mass is responsible for 20 to 30% of blood pressure cases, which also fluctuate due to hormonal changes caused by the disease.<sup>26,27</sup> From this perspective, it is important to invest in the training of health teams in an approach that goes beyond blaming the individual, which may help to recognize obesogenic environments within the family and enhance the organization of care for these patients.

In the municipality of Rio de Janeiro, although there is reasonable coverage by primary health care teams, encompassing 44% of the population, there are possibly difficulties in projects such as community-based blood pressure

screening and prioritization of systematic measurement in all consultations to maximize the benefits in controlling risk factors in the population.

Other aspects, such as regular weight monitoring, nutritional counseling, and referral to specialists when necessary, are essential measures to implement effective approaches and promote actions in favor of a healthy and balanced life. Campbell et al. highlight that the use of blood pressure records with periodic performance reports can help optimize disease management.<sup>12</sup>

Corroborating these findings, meta-analyses indicate that a 10 mmHg reduction in SBP, or a 5 mmHg reduction in DBP, decreases the relative risk of all major cardiovascular events by approximately 20%.<sup>5,16</sup> It is also important to consider that many hypertensive individuals are unaware of their condition, and some of those who know they have the disease remain untreated, and even when treated, the control is unsatisfactory.

Recent studies have highlighted the need to incorporate other digital technologies to add value in addressing challenges in HBP management. Smartphones with applications for disease management and the use of telemetry to transmit values recorded during home visits to health units can enhance disease treatment and reduce therapeutic inertia.<sup>28,29</sup> Digital interventions can facilitate lifestyle modifications recommended by ministerial guidelines, such as reducing salt, body weight, alcohol, and stress, as well as assisting in increasing physical exercise and improving sleep. Other options include health education by telephone, online group sessions, and interactive digital tools, which can be selected according to the patient's preference, promoting better blood pressure monitoring at home.

In South America, the introduction of the HEARTS Program, already implemented in countries such as Chile and Argentina, has promoted improvements in the treatment and control of the disease. It is a package of actions that involves training, team care, a risk-based approach, clinical control of the disease, and a system for monitoring and evaluating actions.<sup>30,31</sup> Brazil joined the program 3 years ago, but few municipalities have managed to advance with the strategy, showing that it is necessary to accelerate the dissemination of evidence-based protocols, ensuring greater access to essential medicines and technologies.

## Conclusion

The findings of this study highlight that HBP needs to be given greater priority on the municipal public agenda, considering that it is a multifactorial condition. To mitigate potential disabilities and improve disease detection and control rates, primary health care must assume its central role as coordinator of care for people with chronic diseases.

Given that women, older individuals, and those with a high BMI stand out among those who reported the disease in this research, it is necessary to invest more in interventions such as identifying risk groups, early diagnosis, and therapeutic management. Actions that facilitate the adoption of healthier choices need to be more widely disseminated in consultations and in society in general, such as reducing excess sugar, salt,

and ultra-processed foods, as well as encouraging regular physical activity.

Further qualitative studies, emphasizing behavioral determinants, may be needed to better understand the issues underlying the quantitative results of this research, in order to promote the adoption of more cost-effective practices in disease management.

## Author Contributions

Conception and design of the research, obtaining financing: Oliveira CMC; acquisition of data: Silva ACP, Campos AC; analysis and interpretation of the data: Oliveira CMC, Campos AC; statistical analysis: Campos AC; writing of the manuscript: Paixão ACC, Silva ACP, Campos AC; critical revision of the manuscript for intellectual content: Oliveira CMC, Silva ACP, Silva BRM, Campos AC.

## Potential Conflict of Interest

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

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## Ethics Approval and Consent to Participate

This article does not contain any studies with human participants or animals performed by any of the authors.

## Use of Artificial Intelligence

The authors did not use any artificial intelligence tools in the development of this work.

## Availability of Research Data

All datasets supporting the results of this study are available upon request from the corresponding author.

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