Validity of self-reported hypertension is inversely associated with the level of education in Brazilian individuals

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Abstract

Background: **Self-reported hypertension is an important piece of information for public health that is available in epidemiological studies. For proper use of this information, such studies should be validated.**

Objective: **To validate self-reported hypertension and associated factors in adults and elderly individuals in São Paulo, Brazil.**

Methods: **Participants were selected from the sample of a population-based cross-sectional health survey carried out in São Paulo (ISA Capital-2008). Their age was 20 years or older, they were from both genders, and had their blood pressure measured (n = 535). Hypertension was defined as blood pressure ≥ 140/90 mmHg and/or use of medication for hypertension. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and Kappa coefficient were calculated. Poisson regression was used to identify factors associated with sensitivity of self-reported hypertension.**

Results: **Sensitivity of self-reported hypertension was 71.1% (95%CI: 64.8 to 76.9), specificity 80.5% (95%CI: 75.6 to 84.8), PPV 73.7% (95%CI: 67.4 to 79.3), and NPV 78.5% (95%CI: 73.5 to 82.9). There was moderate agreement between self-reported hypertension and hypertension as diagnosed by blood pressure measurement (kappa = 0.52, 95%CI: 0.45 to 0.59). Body mass index and level of education were independently associated with sensitivity (body mass index ≥ 25 kg/m²: PR = 1.42, 95% CI: 1.15 to 1.76; schooling ≥ 9 years: PR = 0.71 95%CI: 0.54-0.94).**

Conclusion: **Self-reported hypertension was shown to be valid in adults and the elderly in the city of São Paulo, and is thus an appropriate indicator for the surveillance of hypertension prevalence in the absence of blood pressure measurement. Overweight was positively associated with validity of self-reported hypertension. Further studies are needed to elucidate the inverse association between the validity of self-reported hypertension and level of education. (Arq Bras Cardiol. 2013;100(1):52-59)**

Keywords: **Hypertension; cardiovascular diseases / prevention & control; validation studies; Brazil / epidemiology; educational status.**

Introduction

Hypertension is an important cardiovascular disease (CVD) due to its high prevalence and significant impact on morbidity and mortality. It affected approximately two-fifths of the adult population worldwide in 2008[1]. In Brazil, there was a 15% increase in the prevalence of hypertension in adults between 2003 and 2008 (12% to 14%) and the same trend was found in the city of São Paulo (17% and 22% in 2003 and 2008, respectively)[2,3].

There is an increasing association between blood pressure (BP) levels and CVD, which are the leading causes of death worldwide. From a starting BP level > 115/75 mmHg, the risk of developing CVD increases two-fold for each 20/10 mmHg increase[4]. In 2009, approximately 14% of hospital admissions in the Brazilian Unified Health System (SUS) and more than 30% of deaths occurred due to circulatory diseases in Brazil[5].

The World Health Organization (WHO) emphasizes the surveillance of hypertension with early and valid diagnosis as an important tool for the control of CVD[1]. However, due to the high cost and complexity of measuring BP in large population surveys, epidemiological studies have been using data from self-reported hypertension, whose validity should be investigated for appropriate use of this information[2,3,6,7].

Several international studies on hypertension have used the term "awareness" to express the individual's knowledge regarding the disease diagnosis and his/her ability to report it, thus acting as an indicator of sensitivity[8]. In a systematic review, it was observed that the sensitivity of self-reported hypertension was 7% higher in individuals from developed countries when compared to that found in individuals from developing countries, but the difference was not statistically significant[9].

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Data from the National Health and Nutrition Examination Survey (NHANES) in 1988/1994 and 1999/2008 indicate that the sensitivity of self-reported hypertension increased from 69% to 81%, which resulted in better disease control[6].

Validation studies on self-reported hypertension in Brazil indicate sensitivity from 51% to 84%[10-14]. However, data regarding the population of the city of São Paulo is not available.

The aim of this study was to assess the validity of self-reported hypertension and associated factors in adults and elderly living in the city of São Paulo, State of São Paulo, Brazil.

Methods

Sample and study design

Data from the São Paulo Health Survey (ISA - Capital 2008), a cross-sectional study with a population-based probability sample of residents of the urban area of São Paulo, were used[3]. For this study, we selected individuals aged 20 years or older, of both genders, and who had their BP measured (n = 535).

Data collection

Data collection occurred in 2008 and 2010, in home visits. On the first visit, a questionnaire was administered to collect demographic, socioeconomic data and information on lifestyle, health status, weight, height and use of health services. Self-reported hypertension was verified by asking the questions: "Do you have any chronic disease, any long-term illness or one that repeats itself with some frequency?"; "Hypertension (high blood pressure)?". Those who reported having hypertension were also asked: "Who told you that you have high blood pressure?"

Individuals who participated in the first data collection were contacted to schedule the second home visit (if they were not found after five attempts by phone, a home visit was made). When scheduling the visit, the individuals were instructed to refrain from practicing physical activity 60 to 90 minutes before BP measurement, and not to eat, drink or smoke within 30 minutes prior to the measurement. During the visit, the individuals were kept at rest for five minutes after receiving an explanation on the measurement procedure and confirming that their bladder was not full and that the previous instructions had been followed. BP was measured on the right and left arms, both free of clothes, with the subject in the sitting position and in silence, observing a one-minute interval between measurements, according to the recommendations of the V Brazilian Guidelines on Hypertension[15].

Blood pressure was measured using an automatic blood pressure monitor (Omron HEM-712C, USA) handled by a nursing technician, who also collected data on medication use. Two other measurements were taken, with the same interval, on the arm that showed the highest BP level. There was database consistency. BP values of each individual were recorded, 1% showed difference in BP between the arms > 20/10 mmHg and < 45/45 mmHg (which may have been due to inherent BP variability)[16], and only individuals with all three BP measurements were considered in the analyses. The final BP value was obtained by calculating the simple arithmetic mean of the last two measurements. Individuals were classified as hypertensive when they had BP ≥ 140/90 mmHg and/or used antihypertensive medication[4].

Although not the gold standard, BP measurement based on a single visit has been used in several studies, since more than one visit is often unfeasible in large population studies. Moreover, three BP readings made at home by a skilled nursing professional, disregarding the first measurement (thus attenuating the white coat effect) becomes an appropriate strategy[6,9-12].

Data analysis

The explanatory variables used in this study were gender, age, level of education, family income, smoking, body mass index (BMI - calculated based on the reported weight and height, according to the equation: BMI = weight/height^2) self-reported diabetes mellitus (DM), self-reported skin color, marital status, health insurance, hospitalization in the past 12 months and use of health services in the past 15 days.

Validity of self-reported hypertension was assessed by sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV), considering the diagnosis of hypertension based on BP measurement and/or drug use as reference. The Kappa coefficient was calculated to analyze the correlation between self-reported hypertension and diagnosed hypertension. Multiple Poisson regression with robust variance was used to identify factors independently associated with the sensitivity of self-reported hypertension.

To identify possible biases regarding the loss of segment, the study sample was compared to the original sample. Statistical analyses were carried out using the Stata software program (version 10). The statistical significance level was set at 5%.

This study was approved by the Institutional Research Ethics Committee. Participation was voluntary, after giving informed consent. The study was financially supported by the Municipal Department of Health of São Paulo (SP-SMS), the Foundation for Research Support of the State of São Paulo (FAPESP protocol #2009/15831-0) and the National Council for Scientific and Technological Development (CNPq protocol #503128/2010-4).

Results

There was a predominance of women (63.2%), adults (51.2%), individuals with less than nine years of schooling (60.8%), a per capita income > 1 minimum wage (61.1%) and BMI ≥ 25 kg/m^2 (58.8%). The prevalence of hypertension based on BP measurement or antihypertensive drug use was 43.4% (95%CI: 39.1 - 47.7), while the prevalence of self-reported hypertension was 41.9% (95% CI: 37.7 - 46.2) (Table 1). This study sample was similar to the original sample as regards gender, age, income and level of education (Table 2).

The sensitivity of self-reported hypertension was 71.1% (95% CI: 64.8 - 76.9), specificity of 80.5% (95% CI: 75.6 - 84.8), PPV of 73.7% (95%CI: 67.4 - 79.3) and NPV of 78.5% (95%CI: 73.5 - 82.9). There was moderate agreement between self-reported hypertension and hypertension as defined based on measured values of BP and/or use of antihypertensive drugs (kappa = 0.52, 95%CI: 0.45 - 0.59).

Table 1 – Demographic, socioeconomic, lifestyle, and health status characteristics of and use of health services by the study participants (n = 535), Brazil, 2008

Characteristics	N	%
Gender		
Male	197	36.8
Female	338	63.2
Age (years)		
20 – 60	274	51.2
≥ 60	261	48.8
Education (years)		
< 9	325	60.8
≥ 9	210	39.2
Per capita* family income		
< R$ 415.00	197	38.9
≥ R$ 415.00	309	61.1
Smoking status		
Nonsmoker	294	54.9
Ex-smoker	141	26.4
Smoker	100	18.7
Body mass index (kg/m²)†		
< 25	213	41.2
≥ 25	304	58.8
Hypertension diagnosis		
No	303	56.6
Yes	232	43.4
Self-reported hypertension		
No	311	58.1
Yes	224	41.9
Self-reported Diabetes *mellitus*		
No	469	87.7
Yes	66	12.3
Self-reported skin color		
White	333	62.2
Non-white	202	37.8
Marital status		
With partner	312	58.3
No partner	223	41.7
Health insurance		
No	350	65.4
Yes	185	34.6
Hospitalization in the past year		
No	496	92.7
Yes	39	7.3
Use of health services in the past 15 days‡		
No	386	73.8
Yes	137	26.2

(*) n = 506; (†) n = 517; (‡) n = 523.

Sensitivity was higher among individuals with less than nine years of schooling when compared to those with higher schooling; among participants with BMI ≥ 25 kg/m² when compared to those with lower BMI values; and among those who reported having DM when compared to those who reported not having it. Specificity was higher among adults with BMI < 25 kg/m² and among those who reported not having DM. For NPV, higher values were observed in adults compared with the elderly (Table 3).

In the multiple regression model, BMI and level of education were independently associated with sensitivity: overweight individuals showed a 42% higher probability of referring hypertension than non-overweight individuals (OR = 1.42, 95%CI: 1.15 - 1.76), and individuals with more than nine years of schooling were 29% less likely to refer the disease, when compared to those with a lower level of education (OR = 0.71, 95% CI: 0.54-0.94), after adjustment for gender, age, DM and use of health services in the past 15 days (Table 4).

Discussion

This study suggests that self-reported hypertension is valid and can be used to estimate the prevalence of this disease in adults and the elderly in the city of São Paulo. Nutritional status, as measured by BMI, and level of education were factors associated with the validity of self-reported hypertension.

The prevalence of hypertension observed in the sample (diagnosed: 43%, and self-reported: 42%) was high and consistent with the values found in other studies previously carried out in the country, considering the methodological differences, the growing number of patients with the disease and its higher prevalence in Sao Paulo[2,7,10,12,14,17-19]. The validity of self-reported hypertension and its association with overweight was similar to that of other national and international studies, although methodological differences between the validation studies on self-reported hypertension can make it difficult to compare the results[8,11,13]. It is possible that individuals with overweight and/or other comorbidities undergo a greater number of medical visits, thus increasing the opportunity for hypertension to be diagnosed. Moreover, the well-known risks related to weight gain would urge obese patients to be more concerned about their health, and therefore seek medical care more often[12,13].

An inverse association between level of education and validity has been observed in a few studies[11,13,20-24], although without statistical significance. It may be supposed that the validity of self-reported hypertension was higher among individuals with fewer years of schooling due to a higher prevalence of this and other diseases in this group, or even to the fact that medical services had been used in the period prior to the survey (i.e., before the last 15 days), thus influencing the sensitivity of the indicator[2,20].

Also of note is the study carried out with a probability sample representative of adults in the city of Chicago, United States, which showed significantly higher validity of hypertension in individuals with a lower level of education. The authors suggest that these findings may be attributed to more frequent monitoring of BP in areas where individuals with a lower level of education live[25].

Table 2 – Comparison between the study sample (n = 535) and the original sample (n = 1102) according to demographic and socioeconomic characteristics, Brazil, 2008

Characteristics	Present study sample (n = 535)		Original study sample (n = 1.102)		
	N	%	N	%	p
Gender					
Male	197	36.8	424	38.5	0.518
Female	338	63.2	678	61.5	
Age (years)					
20 – 60	274	51.2	585	53.1	0.477
≥ 60	261	48.8	517	46.9	
Education (years)					
< 9	325	60.8	655	59.4	0.612
≥ 9	210	39.2	447	40.6	
Per capita* family income					
< R$ 415.00	197	38.9	382	37.5	0.605
≥ R$ 415.00	309	61.1	636	62.5	

P values based on chi-square; (*) n = 506 for the present study sample and n = 1018 for the original sample.

In Brazil, the Family Health Strategy (FHS) is the healthcare model of primary health care directed primarily at populations at higher biological and socioeconomic risk. The multidisciplinary teams of the Basic Health Care Units are in charge, among their other responsibilities, of the prevention, control and diagnosis of the most common diseases, such as hypertension in adults. The percentage of hypertensive individuals undergoing follow-up is one of the indicators for monitoring and evaluation of this strategy[26,27]. In São Paulo, where the estimated coverage of the FHS is 30%, we observed a distinct pattern in the morbidity profile in areas covered and not covered by the program, suggesting greater awareness of the health status regarding chronic diseases in the areas covered by the FHS[28].

Another study has shown that the presence of FHS in poor areas of São Paulo decreased the effect of inequality of social conditions on the profile of access to and use of health services[29]. In addition to the FHS, the Popular Pharmacy Program can also lead to a greater demand for medical visits because of the need for a prescription for the purchase of antihypertensive medication[30].

Information on the validity of self-reported hypertension and associated factors are useful to correct the estimate of hypertension prevalence and to highlight groups in the population that are susceptible to the awareness campaigns about the disease, since hypertension can be asymptomatic and lead to complications such as cerebrovascular accidents[4,11,31-33].

Awareness campaigns may be conducted in the context of health services, beginning with the accurate diagnosis of hypertension and appropriate communication with the patient, so that the individual can understand his/her health condition. Moreover, the mass campaigns of continuous and systematic surveillance can be useful for individuals who have limited access to these services and/or those who are asymptomatic[21,33,34]. In the context of São Paulo, we emphasize the importance of expanding the FHS program to control this and other diseases.

There is no ideal diagnostic test. Establishing a diagnosis is a process subject to systematic and random errors, which results in the probability of certainty, and not in absolute certainty[20]. The diagnosis of hypertension is complex, as it is influenced by BP variability – episodic hypertension is very common – equipment and techniques; body position; time of the day; environment (office, home, clinic); part of the body (arm, wrist, finger) where it is measured; and the person responsible for the measurement (doctors, nurses)[16]. The recommended approaches for providing reasonable estimates of usual BP, such as to measure BP in duplicate twice a day for seven days, are not feasible in large population studies[31]. As for self-reported morbidity, it is influenced by the diagnosis, the individual's awareness regarding his/her health status, ability to recall it and desire to report it[32].

The present study has limitations that should be considered. The difficulties in locating the study participants to schedule and carry out the second data collection at home considerably reduced the sample size used in this study. This can be attributed to the intense geographic mobility observed in São Paulo, a city of great economic development where hundreds of people move daily from their homes. The reduction in sample size could compromise the accuracy of the stratified analyses[20]; however, considering the similarity between this and the original sample, it is also possible to generalize the findings for the population participating in this phase of ISA - Capital.

The use of a suitable cuff for adults with arm circumference between 22 cm and 32 cm is another study limitation, since the ideal solution would be the use of a longer and wider cuff for obese individuals[15]; however, this procedure is commonly adopted in clinical practice by physicians[16,35], which were the

Table 3 – Sensitivity, specificity, positive predictive value, negative predictive value and Kappa coefficient for self-reported hypertension according to demographic, socioeconomic, lifestyle, and health status characteristics of and use of health services by the study participants (n = 535), Brazil, 2008

Characteristics	SE (%)	95%CI (%)	SP (%)	95%CI (%)	PPV (%)	95%CI (%)	NPV (%)	95%CI (%)	Kappa	95%CI
Gender										
Male	64.0	53.2 - 73.9	82.4	73.9 - 89.1	75.5	63.7 - 84.2	73.6	64.8 - 81.2	0.47	0.35 -0.59
Female	75.5	67.6 - 82.3	79.5	73.1 - 84.9	73.0	65.1 - 79.9	81.6	75.3 - 86.8	0.55	0.46 - 0.64
Age (years)										
20 - 60	59.5	47.4 - 70.7	90.0	85.0 - 93.8	68.8	55.9 - 79.8	85.7	80.2 - 90.1	0.52	0.40 - 0.63
≥ 60	76.6	69.2 - 82.9	62.1	52.0 - 71.5	75.6	68.2 - 82.1	63.4	53.2 - 72.7	0.39	0.27 - 0.50
Education (years)										
< 9	77.9	71.0 - 83.9	70.6	62.7 - 77.7	74.9	67.8 - 81.0	74.0	66.1 - 80.9	0.49	0.39 - 0.58
≥ 9	51.7	38.4 - 64.8	90.7	84.8 - 94.8	68.9	53.4 - 81.8	82.4	75.7 - 87.9	0.46	0.32 - 0.59
Per capita* family income (tertiles)										
1st tertile	77.3	66.2 - 86.2	73.4	63.3 - 82.0	69.9	58.8 - 79.5	80.2	70.2 - 88.0	0.50	0.37 - 0.63
2nd tertile	74.1	63.1 - 83.2	81.8	72.2 - 89.2	78.9	68.1 - 87.5	77.4	67.6 - 85.4	0.56	0.44 - 0.69
3rd tertile	63.2	50.7 - 74.6	87.0	78.8-92.9	76.8	63.6 - 87.0	77.7	68.8 - 85.0	0.52	0.39 - 0.65
Smoking status										
Nonsmoker	73.3	64.8 - 80.6	79.1	72.1 - 85.1	73.8	65.4 - 81.2	78.7	71.6 - 84.7	0.53	0.43 - 0.62
Ex-smoker	76.2	63.8 - 86.0	74.4	63.2 - 83.6	70.6	58.3 - 81.0	79.5	68.4 - 88.0	0.50	0.36 - 0.64
Smoker	55.3	38.3 - 71.4	91.9	82.2 - 97.3	80.8	60.6 - 93.4	77.0	65.8 - 86.0	0.50	0.33 - 0.68
BMI (kg/m²)†										
< 25	54.4	42.8 - 65.7	90.3	84.0 - 94.7	76.8	63.6 - 87.0	77.1	69.7 - 83.4	0.48	0.35 - 0.60
≥ 25	78.3	70.7 - 84.8	73.3	65.8 - 79.9	72.3	64.5 - 79.1	79.2	71.8 - 85.4	0.52	0.42 - 0.61
Self-reported Diabetes *mellitus*										
No	66.8	59.6 - 73.5	83.3	78.5 - 87.5	72.7	65.4 - 79.2	79.1	74.1 - 83.6	0.51	0.43 - 0.59
Yes	88.9	75.9 - 96.3	42.9	21.8 - 66.0	76.9	63.2 - 87.5	64.3	35.1 - 87.2	0.35	0.11 - 0.59
Self-reported skin color										
White	65.6	56.9 - 73.7	81.2	75.1 - 86.3	69.4	60.4 - 77.3	78.5	72.3 - 83.8	0.47	0.38 - 0.57
Non-White	78.2	68.9 - 85.8	79.2	70.0 - 86.6	79.0	69.7 - 86.5	78.4	69.2 - 86.6	0.57	0.46 - 0.69
Marital status										
With partner	72.0	63.5 - 79.4	81.1	74.6 - 86.5	73.6	65.2 - 81.0	79.8	73.2 - 85.3	0.53	0.44 - 0.63
No partner	70.0	60.0 - 78.8	79.7	71.5 - 86.4	73.7	63.6 - 82.2	76.6	68.3 - 83.6	0.50	0.39 - 0.61
Health Insurance										
No	72.4	64.7 - 79.3	80.9	74.7 - 86.2	75.3	67.6 - 82.0	78.5	72.2 - 84.0	0.54	0.45 - 0.63
Yes	68.4	56.7 - 78.6	79.8	71.1 - 86.9	70.3	58.5 - 80.3	78.4	69.6 - 85.6	0.48	0.36 - 0.61
Hospitalization in the past year										
No	70.8	64.1 - 76.9	81.2	76.2 - 85.5	73.3	66.6 - 79.2	79.3	74.2 - 83.7	0.52	0.45 - 0.60
Yes	73.9	51.6 - 89.8	68.8	41.3 - 89.0	77.3	54.6 - 92.2	64.7	38.3 - 85.8	0.42	0.14 - 0.71
Use of health services in the past 15 days‡										
No	66.9	59.0 - 74.1	81.9	76.2 - 86.7	72.3	64.3 - 79.3	77.7	71.9 - 82.9	0.49	0.40 - 0.58
Yes	81.5	70.0 - 90.1	76.4	64.9 - 85.6	75.7	64.0 - 85.2	82.1	70.8 - 90.4	0.58	0.44 - 0.71

SE: sensitivity; SP: specificity; PPV: positive predictive value; NPV: negative predictive value; 95%CI: 95% confidence interval.
BMI: body mass index; (*) n = 506; (†) n = 517; (‡) n = 523.

Table 4 – Factors associated with sensitivity of self-reported hypertension (n = 215), Brazil, 2008

Characteristics	Sensitivity prevalence ratio *	95%CI
Gender		
Male	1	-
Female	1.11	0.92 - 1.33
Age (years)		
20 – 60	1	-
≥ 60	1.10	0.88 - 1.37
Education (years)		
< 9	1	-
≥ 9	0.71†	0.54 - 0.94
Body Mass Index (kg/m²)		
< 25	1	-
≥ 25	1.42‡	1.15 - 1.76
Self-reported Diabetes *mellitus*		
No	1	-
Yes	1.15	0.99 - 1.33
Use of health services in the past 15 days		
No	1	-
Yes	1.09	0.93 - 1.28

95%CI: 95% confidence interval; (*) prevalence ratio obtained by Poisson regression of the probability that the hypertensive individual correctly reported his or her condition; (†) p < 0.05; (‡) p < 0.01.

professionals who reported high BP in all study subjects. The possible overestimation of BP among obese individuals caused by the cuff used in the study could lead to an overestimated prevalence of diagnosed hypertension, alterations in sensitivity, and attenuation of the association measure[15] in this group of individuals.

However, there was no significant difference between the prevalence of self-reported and diagnosed hypertension, and there was a significant association between sensitivity and nutritional status.

Conclusions

Self-reported hypertension is valid in the population studied in the city of São Paulo, which makes it an appropriate indicator for the monitoring of hypertension prevalence in the absence of BP measurement. Overweight was positively associated with the validity of self-reported hypertension. Further studies are needed to clarify the inverse relationship between self-reported hypertension and the level of education.

Potential Conflict of Interest

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

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