Validity of self-reported hypertension and its determinants (the Bambuí study)

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Keywords
Blood pressure, Self-reported hypertension. Sensitivity and specificity.

Abstract

Objective
Assessing the validity of self-reported hypertension and its determinants among adults living in the community was the objective of this study.
Method
A simple random sample of residents in the city of Bambuí, State of Minas Gerais, Brazil aged ≥18 years was selected. Three blood pressure measurements were performed in 970 inhabitants. Sensitivity, specificity as well as positive and negative predictive values of self-reported hypertension were assessed in relation to hypertension (mean blood pressure ≥90 or ≥140 mm Hg and/or present use of antihypertensive drugs).
Results
Sensibility and specificity of self-reported hypertension were 72.1% (95% CI: 69.3-75.0) and 86.4% (95% CI: 84.3-88.6), respectively. Its prevalence was 27.2% (95% CI: 24.4-30.1), being reasonably similar to the prevalence of hypertension (23.3%; 95% CI: 20.7-26.1%). The validity of self-reported hypertension was higher among women, among individuals aged 40-59 and ≥60 years, among those who visited a doctor more recently (< two years) and among those with higher body mass index (≥25 kg/m^2).
Conclusions
The results of this study show that self-reported hypertension is an appropriate indicator of hypertension prevalence, even in a population not living in a large urban center.

INTRODUCTION

Cardiovascular diseases are the leading causes of death in the Brazilian adult population, and of hospital admissions through the *Sistema Único de Saúde* (Brazilian Unified Healthcare System), besides delivery.[10,11] Major causes of death among individuals over age 25 years include cerebrovascular and ischemic diseases (98.2 and 91.5 per 100.000 population, respectively).[10] The major cause of hospital admission is cardiac insufficiency, which accounts for 35% of all hospital admissions due to cardiovascular diseases in the same age group.[11]

Arterial hypertension is the main modifiable risk factor for coronary disease, cerebrovascular diseases, congestive cardiac insufficiency, and other cardiovascular diseases [13] The adequate treatment of arterial hypertension significantly reduces cardiovascular morbidity and mortality.[4,12,15] Thus, knowledge of the distribution of hypertension among the population and the identification of vulnerable groups are of great interest to public health.

To determine the prevalence of hypertension in the population is a complex task, which requires not only the measurement of arterial pressure, but also the verifi-

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cation of the use of medication for its control.[18] This has encouraged the search for simple indicators, capable of being used in population-based studies. The simplest indicator of arterial hypertension is self-reported morbidity. Self-reported hypertension has been used in a number of health surveys, including the National Health and Nutrition Examination Survey (NHANES), in the United States,[19] and the *Pesquisa Nacional por Amostras de Domicílio* (National Household Sample Survey - PNAD 98), in Brazil.[7] In the American survey, information was obtained by means of the following question: "*Have you ever been told by a doctor or other health professional that you had hypertension, also called high blood pressure?*". [19] In the Brazilian survey, the question adopted was: "*Do you have hypertension (high blood pressure)?*".[7] The prevalence of self-reported hypertension found in the United States was 27% among participants ≥25 years old.[20] In Brazil, the corresponding prevalence was 20%.[7]

A number of different efforts have been made in order to validate self-reported morbidity related to arterial hypertension, as well as to discover its determinants. In the United States, high sensitivity (71%), specificity (90%), and positive (72%) and negative (89%) predictive values were found for the data collected in NHANES III.[20] In this survey, validity varied with sex (greater among women), time since last medical appointment (greater among those who had had medical appointments more recently), and presence of overweight.[20] No similar studies have been found in Brazil. A study conducted among the employees of a state bank in Rio de Janeiro showed low sensitivity for self-reported arterial hypertension,[3] ranging form 42 to 50%, depending on the group studied. In another study conducted in the same city, an excellent reliability (Kappa =0.75) was found for the information regarding the history of diagnosis and treatment of arterial hypertension among participants of the baseline of the *Pró-Saúde* Survey cohort.[5]

The present study is aimed at determining the validity of self-reported hypertension among the participants of the Bambuí health survey. An additional aim is to verify whether the validity of this indicator varies with sex, age group, schooling, family income, time since last medical appointment, and body mass index.

METHODS

The 'Bambuí Project' is a population-based study conducted in the town of same name, in the state of Minas Gerais, southeastern Brazil, with approximately 15,000 inhabitants. This project comprises two components: (1) a health survey conducted in a sample representative of the whole population; and (2) a cohort study, in which all elderly inhabitants are included.[8] The present study is part of the former.

A complete census of the town of Bambuí was carried out in November 1994 in order to identify participants for the health survey. A simple probabilistic sample of 1,664 residents aged five years or older was selected, without reposition. The following parameters were used for calculating sample size: (a) size of the population =14,239; (b) precision =0.025; (c) confidence interval =0.95; (d) characteristic prevalence =0.50; and (e) losses =0.20. Of the residents included in the sample, 90.1% were interviewed and 82.5% examined (physical measurements and laboratory exams). The participants of the study, both those interviewed and those examined, were similar to the town's population of same age group in all sociodemographic characteristics analyzed: sex, age, marital status, family income, and schooling. Further details can be found in Lima-Costa et al[8] (2000). The present survey included all participants of the Bambuí health survey aged ≥18 years whose blood pressure had been measured.

The dependent variable in this study is arterial hypertension, as defined by Joint Committee on Detection, Evaluation and Treatment of High Blood Pressure (JNC V)[17] criteria (1993), that is, diastolic pressure ≥90 mmHg and/or systolic pressure 140 mmHg and/or current use of medication for arterial hypertension. Three measurements were performed, the first of which was discarded. Arterial pressure was considered as the arithmetic mean of the second and third measurements. Measurements were taken with the subject seated, after a five-minute rest, and after at least 30 minutes without ingestion of caffeine and/or smoking. Medication use was assessed at the subject's home, through an interview which included the verification of the medication package.[1,8]

Self-reported arterial pressure was determined using a Portuguese translation of the question from NHANES III mentioned above:[19] *"Algum médico ou profissional de saúde já disse que você tinha pressão alta ou hipertensão arterial?"*.

The remaining exploratory variables studied were sex, age group, schooling (in completed years), monthly family income (in current Brazilian minimum wages), and time since last medical appointment (in years), in addition to body mass index (BMI, measured as weight (kg) /height $(m)^2$).

Interviews were conducted at the subject's home, and were composed of pre-coded questions. Interviewers were selected from among members of the community with at least 11 years of schooling and were

trained by the Project team. Health workers, also selected from among the members of the community, were trained to perform the anthropometrical and blood pressure measurements according to pre-established protocols. The equipments used were the following: table sphygmomanometers – Tycos (5097-30, USA), stethoscopes – Littman (Cardiology II, USA), and anthropometers and digital scales – CMS Weighing Equipment Ltd. (UK). Data collection was carried out between August and December 1996.[8]

Validity was determined based on four characteristics: sensitivity, specificity, and negative and positive predictive values. Sensitivity is the proportion of hypertensive subjects who reported a prior diagnosis of hypertension. Specificity is the proportion of normotensive subjects who reported not having previously been diagnosed as having hypertension. The positive predictive value is the proportion of hypertensive subjects among those who reported a prior diagnosis. The negative predictive value is the proportion of normotensive subjects among those who reported never having been diagnosed as having arterial hypertension.

Multiple logistic regression was carried out in order to determine the variables independently associated with hypertension. The initial model included all sociodemographic and anthropometric variables. Only variables which modified the magnitude of the odds ratio of self-reported hypertension to hypertension in at least 10% were maintained in the final model. Statistical analyses were performed using Stata v. 7.0 software.[16]

RESULTS

Of the 1,086 participants of the Bambuí health survey aged 18 years or older, 970 were included in the present study (116 were excluded for lacking blood pressure measurements). Global prevalences of self-reported hypertension and hypertension were 27.2% (95% CI =24.4-30.1) and 23.3% (95% CI =20.7-26.1), respectively.

Sociodemographic and other characteristics of the studied sample are presented in Table 1. The predominant groups in the sample were women (56.5%), young adults (50.1% were in the 18-39 years age group), subjects with schooling ≥8 years (33.3%), with family income ≥4 minimum wages (42.4%), who had had medical appointments less than two years prior to the interview (76.6%), and with BMI >25.0 kg/m^2 (54.9%).

Table 2 presents the sensitivity, specificity, and positive and negative predictive values of self-reported hypertension in relation to hypertension as determined by JNC V[17] criteria. Global sensitivity and positive predictive value were 72.1% (95% CI =69.3-75.0) and 61.7% (95% CI =58.7-64.8), respectively. Global specificity and negative predictive value were 86.4% (95% CI =84.3-88.6) and 91.1% (95% CI =89.3-92.9), respectively. The sensitivity of self-reported hypertension was greater in women than in men, in the 40-59 and ≥60 years age groups in comparison with the younger population, in subjects who had had medical appointments less than two years prior to the interview than in those who had not, and in subjects with BMI ≥25 kg/m^2 in comparison with those with lower BMIs.

Table 1 - Study participants, according to sociodemographic and other selected characteristics, Bambuí Project, 1996.

Characteristics	Number (%)
Sex	
Male	422 (43.5)
Female	548 (56.5)
Age group (years)	
18-39	486 (50.1)
40-59	332 (34.2)
≥60	152 (15.7)
Schooling (complete years)	
None	102 (10.5)
1-3	186 (19.2)
4-7	359 (19.2)
≥8	323 (33.3)
Monthly household income (in 1996 Brazilian minimum wages)	
<2.0	212 (22.1)
2-3.9	340 (35.5)
≥4.0	407 (42.4)
Time since last medical appointment (years)	
≥2.0	227 (23.4)
<2.0	743 (76.6)
Body mass index (kg/m^2)	
<25	525 (54.9)
≥25	431 (45.1)
Total	970 (100.0)

Each Brazilian minimum wage = US 120.00 in 1996

The final results of the multivariate analysis of factors associated with hypertension are presented in Table 3. Independent associations were found for self-reported hypertension, age group (40-59 and ≥60 years), time since last medical appointment (<2 years) and BMI (≥25 kg/m^2).

DISCUSSION

The sensitivity and specificity of self reported hypertension found in the present study are very similar to those observed in the NHANES III survey, conducted in a representative sample of the United States population.[20] Sensitivity and specificity in that survey were 71% and 90%, respectively. In the present study, the corresponding values were 72% and 86%.

Generally speaking, our results confirm prior observations regarding the greater validity of self-reported hypertension among women, overweight individuals, and individuals with more recent medical

Table 2 - Sensitivity, specificity, and positive and negative predictive values of self-reported arterial hypertension in relation to hypertension as determined by JNC V criteria,* according to sociodemographic and other selected characteristics. Bambuí Project, 1996.

Characteristics	Sensitivity % (95%CI)	Specificity value % (95%CI)	Positive predictive Value % (95%CI)	Negative predictive
Global	72.1 (69.3-75.0)	86.4 (84.3-88.6)	61.7 (58.7-64.8)	91.1 (89.3-92.9)
Sex				
Male	60.5 (55.8-65.2)	90.9 (88.2-93.7)	61.3 (56.6-65.9)	90.6 (87.8-93.4)
Female	78.6 (75.2-82.1)	82.6 (79.5-85.8)	62.0 (57.9-66.0)	91.5 (89.2-93.8)
Age group (years)				
18-39	43.8 (39.3-48.2)	91.4 (88.9-93.9)	26.4 (22.5-30.3)	95.8 (94.1-97.6)
40-59	73.3 (68.6-78.1)	78.9 (74.5-83.3)	61.6 (56.4-66.8)	86.5 (82.8-90.2)
≥60	80.9 (74.6-87.2)	77.8 (71.2-84.4)	83.7 (77.9-89.6)	74.2 (67.3-81.2)
Schooling (complete years)				
None	80.0 (72.2-87.8)	76.9 (68.8-85.1)	76.9 (68.8-85.1)	80.0 (72.2-87.8)
1-3	74.3 (68.0-80.6)	75.9 (69.7-82.0)	65.0 (58.2-71.9)	83.0 (77.6-88.4)
4-7	63.9 (58.9-68.9)	86.8 (83.3-90.3)	54.8 (49.6-59.9)	90.6 (87.5-93.6)
≥8	73.6 (68.7-78.3)	92.0 (89.1-95.0)	52.1 (46.6-57.5)	96.7 (94.8-98.7)
Monthly household income (in 1996 minimum wages)				
<2.0	75.7 (69.9-81.5)	83.8 (78.8-88.8)	69.7 (63.6-75.9)	87.5 (83.1-92.0)
2-3	73.3 (68.6-78.0)	82.3 (78.2-86.3)	53.9 (48.6-59.2)	91.6 (88.7-94.6)
≥4.0	68.4 (63.8-72.9)	90.6 (87.7-93.4)	63.5 (58.9-68.2)	92.2 (89.6-94.8)
Time since last medical appointment (years)				
≥2.0	37.2 (30.9-43.5)	92.3 (88.9-95.8)	53.3 (46.8-59.8)	86.3 (81.8-90.8)
<2.0	80.3 (77.5-83.2)	84.5 (81.9-87.1)	62.8 (59.4-66.3)	92.9 (91.1-94.8)
Body mass index (kg/m^2)				
<25	62.7 (58.6-66.8)	87.0 (87.4-92.5)	47.7 (43.5-52.0)	94.3 (92.3-96.3)
≥25	76.6 (72.6-80.6)	80.5 (76.8-84.3)	68.6 (64.2-73.0)	86.1 (82.8-89.4)

*The Fifth Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure (Diastolic pressure ≥90 mm Hg and/or systolic pressure ≥140 mm Hg and/or current history of treatment of arterial hypertension.
95%CI: 95% confidence interval).[17]

appointments.[2,6,14,20] Considering all variables studied, the lowest sensitivity was found among subjects with less recent medical appointments. Vargas et al[20] (1997), in face of similar results, called attention to the possibility that part of this association be explained by the greater probability of the healthcare user receiving medication against hypertension, which is one of the parameters considered in the definition of arterial hypertension. In the present study, 125 subjects (12.9%) were classified as hypertensive based exclusively on the use of medication.

The same authors[20] also point out that the greater validity of self-reported hypertension among women may be due to the greater utilization of the healthcare system and to overweight, both of which are more frequent among women. Our results support this hypothesis. The multivariate analysis showed that the variable *sex*, when included in the logistic model, did not alter the strength of the association between self-reported hypertension and hypertension, whereas time since last medical appointment and BMI modified the magnitude of this association in an independent manner.

Prior studies have shown that the validity of self-reported hypertension is not influenced by age.[9,20] Our results do not confirm these observations. Considering all characteristic studied, the second lowest sensitivity was found among the younger age group (18-39 years). This result cannot be due to confounding, since age modified the magnitude of the association between self-reported hypertension and hypertension regardless of sex, BMI, or use of healthcare services.

Prior observations have consistently shown that socioeconomic status does not affect the validity of self-reported morbidity for hypertension, both among non-Hispanic black and white Americans and among Mexican-Americans.[20] Our results support these observations. The validity of self-reported hypertension was not modified by family income or schooling.

In general, population-based studies of the valid-

Table 3 - Final results of the multivariate analysis of characteristics associated with arterial hypertension according to JNC V criteria.* Bambuí Project, 1996.

Characteristics	Odds ratio (95%CI)**
Self-reported hypertension	
No	1.00
Yes	9.93 (6.58-14.98)
Age group (years)	
18-39	1.00
40-59	3.81 (2.35-6.17)
≥60	10.91 (6.23-19.08)
Time since last medical appointment (years)	
≥2.0	1.00
<2.0	1.83 (1.12-2.99)
Body mass index (kg/m^2)	
<25	1.00
≥25	2.73 (1.82-4.11)

*The Fifth Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure (Diastolic pressure ≥90 mm Hg and/or systolic pressure ≥140 mm Hg and/or current history of treatment of arterial hypertension.
**Odds ratio and 95% confidence interval adjusted for all variables listed on the table (956 subjects participated in the final analysis; $p_{goodness\ of\ fit}$ =0.140).
95%CI: 95% confidence interval.[17]

ity of self-reported hypertension that use measured blood pressure as the gold standard are subject to classification bias due to the tendency towards regression to the mean.[20] In the present study, three blood-pressure measurements obtained on the same day were used, which may have reduced the strength of the associations found.

The results presented above show that self-reported hypertension is an appropriate indicator for arterial hypertension, even in a population living outside large urban centers. The similarity between the present results and those obtained in the NHANES III survey[20] confirm the more universal character of the instrument used, given that the two surveys were conducted in very different populations. Further investigations in other populations from developing countries are required in order to confirm or not the external validity of these findings.

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