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# Frequency of arterial hypertension and associated factors: Brazil, 2006

## ABSTRACT

**OBJECTIVE:** To analyze the frequency of self-reported systemic arterial hypertension and associated factors.

**METHODS:** Study based on data provided by the system of *Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico* (VIGITEL – Telephone-based surveillance of risk and protective factors for chronic diseases), collected in 2006 in Brazil's capitals and Federal District. The frequency of systemic arterial hypertension was estimated in 54,369 adults, stratified by sex, geographic region, socio-demographic and behavioral variables and self-reported morbidities. Crude odds ratios of hypertension were calculated, as well as odds ratios adjusted for the study's variables.

**RESULTS:** The frequency of self-reported hypertension was 21.6%. It was higher among women (24.4% *versus* 18.4%), lower in the North and Central-West regions and higher in the Southeast region. The frequency of hypertension increased with age, decreased with level of schooling, was higher among blacks and widowed subjects, and lower among singles. The chance of hypertension, adjusted for confounding variables, was higher in subjects with overweight, diabetes, dyslipidemia and cardiovascular events.

**CONCLUSIONS:** Around one fifth of the population reported suffering from systemic arterial hypertension. The high frequencies of modifiable risk factors indicate the population segments on which intervention should be targeted, aiming to prevent and control hypertension.

**DESCRIPTORS:** Hypertension, epidemiology. Risk Factors. Chronic Disease, prevention & control. Health Surveys. Brazil. Telephone interview.

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## INTRODUCTION

Systemic arterial hypertension (SAH) affects approximately 25% of the world's population, and the forecast is that the disease's cases will increase by 60% in 2025.<sup>7</sup> It is estimated that 62% of cerebrovascular disease and 49% of ischemic coronary artery disease can be attributed to suboptimal blood pressure, with a small variation between sexes.<sup>19</sup> Besides the impact on the morbidity and mortality of populations, SAH is related to high socioeconomic costs.<sup>1</sup>

Other cardiovascular risk factors are commonly associated with SAH, like obesity and glucose and lipids metabolism disorders. Others can be causally associated with the increase in blood pressure levels, such as inadequate diet, excess of salt, excessive alcohol consumption, physical inactivity, overweight and smoking. Based on this knowledge, lifestyle changes have been indicated in SAH prevention and treatment.

According to the World Health Organization (WHO), in the Americas sub-region, SAH is among the three main risk factors that concur to the total disease load.<sup>19</sup> In Brazil, the prevalence of SAH in the urban adult population varied from 20% to 30%.<sup>4,11,13,14,a</sup> In a household survey carried out in 15 capitals and the Federal District about risk factors and self-reported morbidity for non-communicable diseases (NCD), the frequency of SAH varied from 16% to 45%.<sup>b</sup>

Methodological differences like non-representative sampling, distinct population groups, restricted geographic inclusion, criteria, quality of the diagnosis and different approaches to data analysis hamper the comparison between studies and, consequently, their utilization as a decision tool for public health.

Surveillance of risk factors and diseases enables to detect trends in time and geographic space and to plan preventive actions in public health. Self-reported morbidity, without the specific diagnostic parameter, represents an alternative to estimate the frequency of diseases in populations.

Telephone-based surveys have proved to be useful tools to monitor aspects related to the population's

health, like the Behavioral Risk Factor Surveillance System,<sup>c</sup> in the United States, which monitors risk factors, diabetes and hypertension, among others. Analysis of data from another survey, the National Health and Nutrition Examination Survey III (1988-1991),<sup>d</sup> showed good sensitivity (71%) and specificity (92%) in the identification of risk factors and health problems, and it has been suggested that the frequency of SAH in the United States' population could be quantified by that instrument.<sup>17</sup> A similar experience was already reported in Brazil in 2004.<sup>8</sup>

The aim of this study was to analyze the frequency of self-reported systemic arterial hypertension and associated factors.

## METHODS

Cross-sectional study based on data from the system of Telephone-based Surveillance of Risk and Protective Factors for Chronic Diseases (VIGITEL) carried out in 2006. The objective of the system is to monitor, on a regular basis, the frequency and distribution of risk and protective factors for NCD in the capitals of the 26 Brazilian states and in the Federal District. To perform this, computer-assisted, telephone-based interviews were conducted in probabilistic samples of the adult population living in households served by fixed telephone lines of each city.<sup>e</sup>

The sampling process of VIGITEL was based on the draw of 5,000 households with fixed telephone line per city, followed by the draw of one dweller aged  $\geq 18$  years per household, who had accepted to be interviewed, until the minimum figure of 2,000 interviews per city was obtained. A total of 54,369 interviews were conducted. Further details about the methodology employed in VIGITEL can be obtained from other published studies.<sup>10,e</sup> The questionnaire administered by VIGITEL included questions about demographic and socioeconomic characteristics, dietary and physical activity pattern associated with NCD, weight and height, use of cigarettes and alcohol, self-rate of the health status and report of medical diagnosis of SAH,

<sup>a</sup> Ministério da Saúde. Secretaria de Vigilância em Saúde. Saúde Brasil 2005: uma análise da situação de saúde no Brasil. Brasília; 2005. [cited 2009 Oct 01]. Available from: [http://bvsms.saude.gov.br/bvs/publicacoes/saude\\_brasil\\_2005.pdf](http://bvsms.saude.gov.br/bvs/publicacoes/saude_brasil_2005.pdf)

<sup>b</sup> Ministério da Saúde. Instituto Nacional de Câncer. Coordenação de Prevenção e Vigilância. Inquérito domiciliar sobre comportamentos de risco e morbidade referida de doenças e agravos não transmissíveis: Brasil, 15 capitais e Distrito Federal, 2002-2003. Rio de Janeiro, 2004. [cited 2009 Oct 01]. Available from: [http://bvssp.icict.fiocruz.br/lildbi/docsonline/0/1/410-inquerito\\_comportamentos.pdf](http://bvssp.icict.fiocruz.br/lildbi/docsonline/0/1/410-inquerito_comportamentos.pdf)

<sup>c</sup> National Center for Chronic Disease Prevention and Health Promotion. Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System. Atlanta; 2008 [cited 2008 Jan 20]. Available from: <http://www.cdc.gov/BRFSS/>

<sup>d</sup> Centers for Disease Control and Prevention. National Center for Health Statistics. National Health and Nutrition Examination Survey. Hyattsville; 2008 [cited 2008 Jan 20]. Available from: <http://www.cdc.gov/nchs/about/major/nhanes/nh3data.htm>

<sup>e</sup> Ministério da Saúde. Secretaria de Vigilância em Saúde. VIGITEL Brasil 2006. Vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico: estimativas sobre frequência e distribuição sócio-demográfica de fatores de risco e proteção para doenças crônicas nas capitais dos 26 estados brasileiros e no Distrito Federal em 2006. Brasília; 2007 [cited 2008 May 10]. Available from: [http://bvsms.saude.gov.br/bvs/publicacoes/relatorio\\_vigitel\\_2006\\_marco\\_2007.pdf](http://bvsms.saude.gov.br/bvs/publicacoes/relatorio_vigitel_2006_marco_2007.pdf)

**Table 1.** Standardized frequencies<sup>a</sup> of arterial hypertension, stratified by sex according to sociodemographic characteristics. Brazil, 2006. (N=54,369)

Variable	Total N = 54,369	Men N = 25,064	Women N = 29,305
Age (years)			
18 to 24	5.7 (5.3;6.1)	4.5 (4.0;5.1)	6.8 (6.2;7.5)
25 to 34	10.4 (9.9;10.9)	9.7 (9.0;10.4)	11.1 (10.4;11.9)
35 to 44	18.1 (17.4;18.8)	16.2 (15.2;17.2)	19.8 (18.8;20.8)
45 to 54	31.7 (30.7;32.7)	30.0 (28.5;31.5)	33.1 (31.7;34.5)
55 to 64	48.1 (46.7;49.5)	38.4 (36.3;40.5)	55.7 (53.8;57.6)
≥65	57.7 (56.3;59.1)	51.7 (49.4;54.0)	61.5 (59.7;63.3)
Skin color			
White	21.1 (20.6;21.6)	19.0 (18.2;19.8)	22.7 (22.0;23.4)
Mixed-ethnicity	21.1 (20.6;21.5)	17.0 (16.4;17.6)	24.9 (24.2;25.6)
Black	27.7 (26.2;29.2)	24.0 (21.9;26.2)	30.7 (28.7;32.8)
Others	29.0 (24.6;33.7)	33.8 (27.3;40.9)	24.4 (18.7;30.9)
Years of schooling			
0 to 4	35.1 (34.2;36.0)	26.2 (24.9;27.5)	41.8 (40.5;43.1)
5 to 8	20.4 (19.8;21.0)	16.3 (15.5;17.1)	24.5 (23.6;25.4)
9 to 11	15.1 (14.5;15.7)	14.9 (14.1;15.8)	15.2 (14.5;16.0)
≥ 12	16.0 (15.3;16.8)	18.7 (17.5;19.9)	13.6 (12.7;14.6)
Marital status			
Single	10.6 (10.2;11.0)	7.5 (7.0;8.0)	13.5 (12.8;14.2)
Married	25.4 (24.9;25.9)	24.9 (24.2;25.6)	26.0 (25.3;26.7)
Separated/divorced	26.9 (25.3;28.5)	21.6 (19.3;24.0)	30.0 (28.0;32.1)
Widowed	54.4 (52.5;56.3)	45.3 (40.0;50.7)	55.8 (53.8;57.8)
Total	21.6 (21.3;21.9)	18.4 (17.9;18.9)	24.4 (23.9;24.9)

<sup>a</sup> Sociodemographic distribution of the sample of VIGITEL adjusted to that of the adult population of each city in the 2000 Demographic Census, considering the population weight of each city.

diabetes mellitus (DM) and high cholesterol.

The analyzed data refer to SAH that was previously diagnosed by a doctor, considered as response variable and categorized as yes or no. The independent variables were divided into sociodemographic (age, skin color, level of schooling and marital status), behavioral (physical activity during leisure time, dietary habits and smoking) and associated diseases (obesity, DM, dyslipidemia and cardiovascular events). Physical activity during leisure time was considered present if it was of light or moderate intensity and practiced for ≥ 30 minutes, on at least five days a week, or the practice of ≥ 20 minutes of vigorous physical activity on three or more days a week; walking was also considered, when practiced for ≥ 30 minutes, at least five days a week. Smoking was stratified in three categories (never smoked, smoker or ex-smoker); alcohol consumption, in two (yes for consumption higher than five doses for men and four doses for women in at least one occasion in the last 30 days); and addition of salt to the prepared meal in three (no, sometimes, yes).

Body mass index (BMI = weight in kilograms divided by height in meters squared) was classified according to WHO criteria (eutrophia if BMI < 25 kg/m<sup>2</sup>, pre-obesity if BMI between 25 and 29.9 kg/m<sup>2</sup>, and obesity for BMI ≥ 30 kg/m<sup>2</sup>).<sup>18</sup> All individuals with BMI ≥ 25 kg/m<sup>2</sup> were considered with excessive weight. The variables DM, dyslipidemia and cardiovascular events (myocardial infarction or cerebrovascular accident) were analyzed as present or absent.

For continuous variables, means and standard deviations were calculated. Frequencies of SAH by point and 95% confidence interval were calculated and stratified by sex, geographic region and the variables mentioned above. As the VIGITEL sample is limited to adults with home telephone, expansion factors were used to estimate prevalence in the overall population. A weighting factor corresponding to the number of adults and the inverse of the number of telephone lines of the household was employed. Then, a factor was used to correct possible sociodemographic differences between the adult population that has telephone and

**Table 2.** Standardized frequencies<sup>a</sup> of arterial hypertension, stratified by sex according to behavioral characteristics. Brazil, 2006. (N=54,369)

Variable	Total	Men	Women
Active in leisure time			
No	21.8 (21.4;22.2)	18.7 (18.2;19.2)	24.2 (23.7;24.7)
Yes	20.7 (19.8;21.6)	16.9 (15.8;18.0)	25.7 (24.3;27.2)
Active walking in leisure			
No	19.9 (19.6;20.3)	16.3 (15.8;16.8)	23.3 (22.8;23.8)
Yes	30.3 (29.3;31.3)	32.2 (30.6;33.9)	29.2 (27.9;30.4)
Habit of smoking			
Never smoked	19.5 (19.1;19.9)	15.0 (14.4;15.6)	22.5 (21.9;23.1)
Smoker	18.9 (18.1;19.7)	16.6 (15.6;17.6)	22.1 (20.8;23.5)
Ex-smoker	29.5 (28.6;30.3)	26.6 (25.5;27.7)	32.9 (31.7;34.2)
Significant alcohol consumption			
No	22.7 (22.3;23.1)	19.3 (18.7;19.9)	25.1 (24.6;25.6)
Yes	15.8 (15.0;16.6)	15.7 (14.8;16.6)	15.9 (14.4;17.4)
Addition of salt to meals			
No	22.4 (21.9;22.9)	18.7 (17.9;19.5)	25.4 (24.6;26.2)
Yes, sometimes	22.1 (21.6;22.6)	19.0 (18.3;19.7)	24.8 (24.1;25.5)
Yes	14.2 (13.2;15.3)	13.8 (12.4;15.2)	14.8 (13.2;16.4)

<sup>a</sup> Sociodemographic distribution of the sample of VIGITEL adjusted to that of the adult population of each city in the 2000 Demographic Census, considering the population weight of each city.

the overall population of the municipality according to the 2000 census.<sup>10,a</sup>

Logistic regression models provided the odds ratio (OR) of SAH, adjusted for possible confounding variables. Three adjustment models were considered: 1) for age, skin color, level of schooling and marital status; 2) for age, skin color, level of schooling, marital status, leisure physical activity, smoking, alcohol consumption and addition of salt to prepared meals; and 3) for age, skin color, level of schooling, marital status, leisure physical activity, smoking, alcohol consumption, addition of salt to prepared meals, overweight, diabetes and dyslipidemia. The SPSS software, version 12.0, and Stata, version 8.02, were used and *p* values < 0.05 were considered significant.

As we used telephone-based interviews, the signed consent document was replaced by the verbal consent provided during the telephone contacts with the interviewees. VIGITEL was approved by the *Comitê Nacional de Ética em Pesquisa para Seres Humanos* (National Committee for Ethics in Research with Human Beings) of the Ministry of Health.

## RESULTS

Stratifying by the Brazilian capitals, the lowest frequency of self-reported SAH was verified in Palmas (Central-West region of Brazil) (15.1%; CI 95% 10.1;21.7) and the highest in Recife (Northeast region) (24.9%; CI 95% 23.0;26.9).

The distribution of the SAH frequencies across geographic regions shows that the report of medical diagnosis of SAH was lower in the North (18.9%) and Central-West (19.4%) regions and higher in the South (20.9%) and Southeast (22.8%) regions.

Of the 54,369 interviewees, 46.1% were men. The mean age of the studied sample was 39.1 years (sd=16.0). Mixed-ethnicity individuals predominated (52.0%), followed by white (40.6%) and black (6.6%) individuals. The yellow and red skin colors were reported with frequencies of 0.6% and 0.1%, respectively, and were grouped into the category "others". The majority of the individuals (53%) reported having between zero and eight years of schooling (data not shown).

The frequency of self-reported SAH was 21.6% (CI 95% 20.9;22.4), adjusted for the population of the 27 cities. Women reported SAH more frequently than

<sup>a</sup> Ministério da Saúde. Secretaria de Vigilância em Saúde. VIGITEL Brasil 2006. Vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico: estimativas sobre frequência e distribuição sócio-demográfica de fatores de risco e proteção para doenças crônicas nas capitais dos 26 estados brasileiros e no Distrito Federal em 2006. Brasília; 2007 [cited 2008 May 10]. Available from: [http://bvsms.saude.gov.br/bvs/publicacoes/relatorio\\_vigitel\\_2006\\_marco\\_2007.pdf](http://bvsms.saude.gov.br/bvs/publicacoes/relatorio_vigitel_2006_marco_2007.pdf)

**Table 3.** Standardized frequencies<sup>a</sup> of arterial hypertension, stratified by sex according to the presence of self-reported morbidities. Brazil, 2006. (N=54,369)

Variable	Total	Men	Women
Adiposity level			
Eutrophia	13.6 (13.2;14.0)	11.9 (11.3;12.5)	14.9 (14.3;15.5)
Pre-obesity	27.5 (26.8;28.2)	22.6 (21.7;23.5)	33.8 (32.7;34.9)
Obesity	43.1 (41.8;44.4)	35.8 (34.0;37.6)	50.1 (48.2;51.9)
Diabetes			
No	19.2 (18.9;19.5)	16.6 (16.1;17.1)	21.5 (21.0;22.0)
Yes	64.3 (62.5;66.0)	56.8 (53.8;59.7)	69.1 (66.9;71.3)
Dyslipidemia			
No	16.4 (16.1;16.7)	14.2 (13.7;14.7)	18.5 (18.0;19.0)
Yes	47.9 (46.9;48.9)	43.0 (41.4;44.6)	51.2 (49.8;52.6)
Cardiovascular events			
No	20.3 (20.0;20.6)	17.2 (16.7;17.7)	23.0 (22.5;23.5)
Yes	66.8 (64.4;69.2)	56.9 (53.2;60.6)	75.6 (72.4;78.5)

<sup>a</sup> Sociodemographic distribution of the sample of VIGITEL adjusted to that of the adult population of each city in the 2000 Demographic Census, considering the population weight of each city.

men (24.4% *versus* 18.4%), resulting in a prevalence ratio of 1.33. SAH frequency increased with age, decreased with level of schooling, was higher among black individuals and in widowed subjects and was lower among singles (Table 1). These findings were the basis for the adjustments in the analysis of the associations with SAH.

Table 2 shows SAH frequencies according to sex and behavioral characteristics. Among men, SAH was more frequent in individuals who did not practice physical activity during leisure time. A statistically significant association was found between the presence of SAH and the practice of walking for both sexes. Higher SAH frequency was found among ex-smokers and among the subjects who did not consume alcohol. Among individuals who added salt to the meals, the frequency of SAH was lower.

SAH frequency increased as BMI increased, occurring in approximately half of the obese women (Table 3). The prevalence ratio of SAH between obese and normal weight individuals, independently of the sex, was 3.18 (CI 95% 3.05;3.32) (data not shown).

As for association with other diseases, it was observed that the frequency of SAH was higher among individuals who reported diagnosis of DM and dyslipidemia. Similarly, cardiovascular events (myocardial infarction and stroke) were more frequent among individuals with self-reported SAH (Table 3).

Table 4 shows crude and adjusted OR of SAH. In the block of the behavioral variables, it was verified that the OR of SAH was higher among individuals who practiced physical activity during leisure time, ex-

smokers and men who reported excessive consumption of alcohol. On the other hand, this ratio was lower for those who added salt to prepared meals. It was found that there was association of SAH with the variables overweight, DM, dyslipidemia and cardiovascular events. Even after adjustment for other cardiovascular risk factors, like overweight, DM and dyslipidemia (model 3), SAH remained independently associated with the presence of cardiovascular events.

## DISCUSSION

The present study estimated that the frequency of self-reported hypertension was 21.6%, being higher among women (24.4% *versus* 18.4%), lower in the North and Central-West regions and higher in the Southeast region. The frequency of hypertension increased with age, decreased with level of schooling, was higher among black and widowed individuals and lower among singles. The chance of hypertension, adjusted for confounding variables, was higher for individuals with overweight, diabetes, dyslipidemia and cardiovascular events.

The comparison between SAH frequencies based on self-reported information and those provided by studies with blood pressure measurement shows that the subjects have a high degree of knowledge of their hypertensive state, meaning that the initiatives of health organs and professionals concerning SAH detection have produced the desired result. However, knowledge of health status does not imply change in behavior and the present study does not inform the level of blood pressure control of these Brazilians. The SAH frequency variation reflects the potential of

**Table 4.** Crude and adjusted odds ratios of arterial hypertension, stratified by sex, according to behavioral characteristics and associated diseases (N=54,369)

Variable	Men		Women	
	OR	95% CI	OR	95% CI
<b>Behavioral</b>				
Active in leisure time				
No	1		1	
Yes	0.89	0.81;0.96	1.08	1.00;1.17
Model 1	1.06	0.97;1.17	1.20	1.10;1.32
Active walking in leisure				
No	1		1	
Yes	2.44	2.25;2.65	1.36	1.27;1.45
Model 1	1.48	1.35;1.62	1.22	1.13;1.31
Habit of smoking				
Never smoked	1		1	
Smoker	1.12	1.03;1.23	0.98	0.90;1.07
Ex-smoker	2.05	1.91;2.21	1.69	1.58;1.81
Model 1				
Smoker	0.89	0.81;1.00	0.94	0.85;1.03
Ex-smoker	1.09	1.00;1.18	1.34	1.24;1.45
Alcohol consumption				
No	1		1	
Yes	0.78	0.72;0.84	0.56	0.50;0.63
Model 1	1.19	1.09;1.29	1.03	0.91;1.16
Addition of salt to meals				
No	1		1	
Yes, sometimes	1.02	0.95;1.09	0.97	0.92;1.02
Yes	0.69	0.61;0.79	0.51	0.45;0.58
Model 1				
Yes, sometimes	0.93	0.86;1.00	0.86	0.80;0.91
Yes	0.67	0.59;0.77	0.66	0.57;0.77
<b>Morbidity</b>				
Overweight				
Eutrophia	1		1	
Pre-obesity	2.91	2.72;3.11	2.16	2.01;2.33
Obesity	5.72	5.25;6.24	4.13	3.76;4.54
Model 1				
Pre-obesity	1.84	1.70;1.99	1.92	1.78;2.07
Obesity	3.67	3.30;4.08	3.73	3.38;4.10
Model 2				
Pre-obesity	1.82	1.67;1.97	1.89	1.75;2.04
Obesity	3.57	3.21;3.97	3.64	3.30;4.01
Diabetes				
No	1		1	
Yes	6.61	5.84;7.48	8.14	7.33;9.05
Model 1	3.48	3.04;3.99	3.62	3.20;4.08
Model 2	3.37	2.94;3.87	3.56	3.15;4.02

To be continued

**Table 4** continuation

Variable	Men		Women	
	OR	95% CI	OR	95% CI
Dyslipidemia				
No	1		1	
Yes	4.58	4.24;4.94	4.63	4.35;4.94
Model 1	3.24	2.98;3.53	2.44	2.27;2.63
Model 2	3.14	2.88;3.41	2.40	2.23;2.58
Cardiovascular events				
No	1		1	
Yes	6.35	5.46;7.39	10.41	8.83;12.28
Model 1	3.86	3.24;4.61	5.78	4.78;6.99
Model 2	3.89	3.25;4.66	6.05	4.99;7.33
Model 3	3.30	2.73;4	5.11	4.15;6.31

Model 1: OR adjusted for: age, skin color, level of schooling and marital status

Model 2: model 1 plus adjustments for walking during leisure time, habit of smoking, excessive alcohol consumption and addition of salt.

Model 3: model 1 plus model 2 plus adjustment for overweight, diabetes and dyslipidemia.

access to the healthcare services and to the diagnosis of the disease in these regions. The proportion of primary healthcare services per inhabitant is lower in the North and Central-West regions and higher in the Southeast region,<sup>a</sup> coinciding with the values of SAH frequency obtained in these regions of Brazil.

SAH has been pointed as being more frequent among men up to 50 years of age.<sup>7</sup> However, in the present study, SAH frequency was higher among women, probably because the study deals with self-reported frequency, which is compatible with the fact that women attend more the healthcare services, resulting in a higher proportion of medical diagnoses in this gender.<sup>8,15,b</sup>

The present study confirmed the increase in SAH frequency with age, with alarming percentages in younger age groups. Although cross-sectional studies do not allow to establish cause-effect relations, it is reasonable to suppose that this finding is due to the increasing role of the weight gain of the Brazilian population.<sup>c</sup> The association of SAH with the BMI categories corroborates this hypothesis. Obesity is considered a risk factor for SAH<sup>5</sup> and its genesis implies environmental factors, such as inadequate dietary habits and physical inactivity.

Information collected by VIGITEL enabled to investigate some associations between SAH and other variables, which may be of causal nature. Associations

with skin color could represent a genetic predisposition, while the excessive consumption of certain foods or inactivity might reflect previous habits that favor the increase in blood pressure. On the other hand, associations with DM and dyslipidemia might express a common physiopathological mechanism. Finally, finding a greater chance of cardiovascular events among hypertensive subjects would indicate predisposition to the main complication of SAH: thromboembolic phenomena in the atherosclerotic disease.

Results of the present study showed that SAH frequency was higher among black individuals, followed by those of mixed-ethnicity, and among subjects with low level of schooling. Stratification according to skin color, similarly to the majority of the studies conducted in Brazil, presents some degree of inaccuracy, and it should be seen with caution. To eliminate the possible influence of the level of schooling on the frequency of SAH among African descendants, the estimates were adjusted, and the differences remained significant. These results confirmed findings in other populations.<sup>13</sup>

In relation to physical activity during leisure time, smoking (ex-smokers) and salt consumption, the associations found in the present study were opposed to the ones that would be expected in longitudinal studies. This effect possibly derives from reverse causality, i.e., individuals diagnosed as hypertensive reported

<sup>a</sup> Ministério da Saúde. Saúde Brasil 2006: uma análise da desigualdade em saúde. Brasília; 2006 [cited 2009 Oct 01]. Available from: [http://portal.saude.gov.br/portal/arquivos/pdf/saude\\_brasil\\_2006.pdf](http://portal.saude.gov.br/portal/arquivos/pdf/saude_brasil_2006.pdf)

<sup>b</sup> Centers for Disease Control and Prevention. National Center for Health Statistics. National Health and Nutrition Examination Survey. Hyattsville; 2008 [cited 2008 Jan 20]. Available from: <http://www.cdc.gov/nchs/about/major/nhanes/nh3data.htm>

<sup>c</sup> Instituto Brasileiro de Geografia e Estatística. Pesquisa de Orçamentos Familiares - POF 2002-2003. Primeiros resultados - Brasil e Grandes Regiões. Brasília; 2003 [cited 2008 Jan 25]. Available from: <http://www.ibge.gov.br/home/estatistica/populacao/condicaoodevida/poi/2002/default.shtm>

more frequently that they practice exercises, stopped smoking and reduced the amount of salt added to prepared meals. This finding may reflect effective communication about the importance of improving life habits in order to minimize the cardiovascular risk.

As for alcohol consumption, the hypothesis of reverse causality remained for the female sex, but not for the men. In this sense, it is possible that women are more compliant than men regarding changes in life habits.

In the present study, SAH was associated with DM and dyslipidemia. These three diseases are among the main cardiovascular risk factors. Therefore, finding that hypertensive individuals presented higher frequency of myocardial infarction and cerebrovascular disease was expected, confirming results of studies conducted in Brazil and in other countries.<sup>2,6,9,15</sup>

Despite the limitations deriving from self-reported morbidity data, self-reported SAH has proved to be an adequate indicator to estimate its frequency in populations, with the advantage that the information is quickly obtained at a low cost.<sup>8,a</sup> Another criticism regarding the use of self-reported morbidity is related to the influence of the access to the medical services; therefore, it may be underestimated. However, the SAH frequency observed in the present study (21.6%) was close to those obtained in prevalence studies involving blood pressure measures<sup>4,13</sup> and was similar to the one observed in the 2003 national survey, which also used self-reported information.<sup>b</sup> On the other hand, it is also

found in the literature a percentage of self-reported SAH that is higher than the one found in the present study, which can be attributed, at least in part, to the higher mean age of the studied population.<sup>16</sup>

Another limitation of this study is the representativeness of the sample, which is restricted to individuals who own a fixed telephone line. The frequency of fixed telephone line varies across Brazil's regions (40% to 85%), being lower in the Northeast region and higher in the Southeast region.<sup>10,c</sup> However, this bias was minimized through the utilization of expansion factors to represent the overall adult population of the studied cities, according to the sociodemographic distribution of the 2000 census.

Another limitation was the utilization of self-reported weight and height for the BMI calculation; nevertheless, studies have confirmed the validity of this kind of measure.<sup>3,12</sup>

In conclusion, 21.6% of the Brazilian population of the cities included in VIGITEL reported suffering from SAH. VIGITEL proved to be a useful tool in the monitoring of this disease and of its associated factors. The high frequencies of modifiable risk factors reveal potential intervention targets, aiming at the prevention and control of SAH. The continuity of data collection about SAH by the VIGITEL system will enable to assess trends and to provide subsidies to evaluate the impact of detection and intervention public policies on SAH.

<sup>a</sup> Centers for Disease Control and Prevention. National Center for Health Statistics. National Health and Nutrition Examination Survey. Hyattsville; 2008 [cited 2008 Jan 20]. Available from: <http://www.cdc.gov/nchs/about/major/nhanes/nh3data.htm>

<sup>b</sup> Ministério da Saúde. Instituto Nacional de Câncer. Coordenação de Prevenção e Vigilância. Inquérito domiciliar sobre comportamentos de risco e morbidade referida de doenças e agravos não transmissíveis: Brasil, 15 capitais e Distrito Federal, 2002-2003. Rio de Janeiro, 2004 [cited 2009 Oct 01]. Available from: [http://bvssp.iciet.fi.ocruz.br/lildbi/docsonline/0/1/410-inquerito\\_comportamentos.pdf](http://bvssp.iciet.fi.ocruz.br/lildbi/docsonline/0/1/410-inquerito_comportamentos.pdf)

<sup>c</sup> Ministério da Saúde. Secretaria de Vigilância em Saúde. VIGITEL Brasil 2006. Vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico: estimativas sobre frequência e distribuição sócio-demográfica de fatores de risco e proteção para doenças crônicas nas capitais dos 26 estados brasileiros e no Distrito Federal em 2006. Brasília; 2007 [cited 2008 May 10]. Available from: [http://bvsm.s.saude.gov.br/bvs/publicacoes/relatorio\\_vigitel\\_2006\\_marco\\_2007.pdf](http://bvsm.s.saude.gov.br/bvs/publicacoes/relatorio_vigitel_2006_marco_2007.pdf)

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