Prevalence of self-reported systemic arterial hypertension in urban and rural environments in Brazil: a population-based study

Prevalência de hipertensão arterial sistêmica autorreferida nos ambientes urbano e rural do Brasil: um estudo de base populacional

Prevalencia de hipertensión arterial sistémica autorreferida en los ambientes urbano y rural de Brasil: un estudio de base poblacional

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Abstract

The aims of this paper were to estimate the prevalence rates of self-reported high blood pressure among adults in urban and rural environments in Brazil and identify possible associations stratified according to household location. Data from the Brazilian National Household Sample Survey *(PNAD) was used, incorporating information from the sampling plan. Logistic regression was used to obtain the odds ratio (OR) as a measure of association between variables and the outcome. The prevalence of self-reported high blood pressure in Brazil was 20.9%: 21% in urban areas and 20.1% in rural areas (OR = 1.06). In both areas, the likelihood of reporting high blood pressure increased with age and women, former smokers, migrants and individuals with morbidities, non-white individuals and individuals with health insurance were more likely to report this disease. Also, in both rural and urban areas, prevalence of high blood pressure was lower among workers and decreased with increasing levels of schooling. All variables showed an association with self-reported high blood pressure in both rural and urban areas, but differences in magnitude were observed in relation to sex and age group. These differences could help justify the promotion of better access and intervention methods at prevention clinics for different population groups.*

Hypertersion; Blood Pressure; Rural Population; Urban Population

Resumo

Este artigo objetiva estimar as prevalências da hipertensão arterial sistêmica autorreferida de adultos nos ambientes urbano e rural do Brasil e identificar possíveis associações, estratificadas por situação do domicílio. Utilizou-se a Pesquisa Nacional por Amostra de Domicílios *(PNAD), incorporando as informações do plano amostral. Regressões logísticas foram utilizadas para obter as medidas de associação* odds ratio *(OR). A prevalência da hipertensão arterial sistêmica autorreferida no Brasil foi 20,9%, sendo 21% (urbana) e 20,1% (rural) (OR = 1,06). Em ambas as áreas, a chance de referir hipertensão arterial sistêmica aumentou com a idade, foi maior entre as mulheres, ex-fumantes, migrantes, portadores de morbidade, os de cor/raça não branca e portadores de plano de saúde. Também nas duas áreas, a hipertensão arterial sistêmica foi menor entre os trabalhadores e diminuiu com o aumento do número de anos de estudo. Todas as variáveis se mostraram associadas com hipertensão arterial sistêmica autorreferida, em ambas as áreas, entretanto puderam ser observadas diferenças nas magnitudes em sexo e faixa etária. Essas diferenças podem auxiliar na melhor forma de intervir nos serviços de prevenção e acesso de cada população.*

Hipertensão; Pressão Arterial; População Rural; População Urbana

Introduction

High blood pressure is considered both a disease and a risk factor, especially for cardiovascular diseases, and is one of the most serious public health problems [1]. Today, 25% of the world's population suffers from this disease and it has been estimated that this figure will have risen by 60% by 2025, reaching a prevalence of 40% [2]. In addition to deaths due to circulatory system diseases, the socioeconomic burden of hypertension is high, with productive lives cut short through temporary or permanent disability [3,4].

According to the National Heart Lung and Blood Institute (NHLBI), the risk factors for high blood pressure are older age, race/ethnicity, gender, overweight or obesity and unhealthy lifestyle habits, such as lack of physical activity, smoking and eating too much salt [5]. The NHLBI also considers that other risk factors are associated with high blood pressure, such as genetic predisposition and stress.

The most effective parameter for determining prevalence of hypertension in the population is indirect measurement of arterial blood pressure. However, because of the high cost and complexity of surveys using indirect measurement, self-reported morbidity may be used, i.e., reports of medical diagnoses of high blood pressure [6]. In the Bambuí study, in Brazil, this method was found to have a sensitivity of 72.1% and specificity of 86.4% [7]. In the Pelotas study, also in Brazil, sensitivity was 72.7% and 92.2% and specificity was 91% and 84.7% among men and women, respectively [8]. In Spain sensitivity and specificity were 82.3% and 85.4%, respectively [9].

The *Brazilian National Household Sample Survey* (*Pesquisa Nacional por Amostra de Domicílios* – PNAD, acronym in Portuguese) carried out by the Brazilian Institute for Geography and Statistics (IBGE, acronym in Portuguese), used self-reported high blood pressure to measure the prevalence of high blood pressure among the Brazilian population. This population-based household survey had the aim of producing basic information to assess the country's socioeconomic development [10]. Information made available by this study includes detailed data on access to health insurance, work activities and migration, which may contribute towards a better understanding of high blood pressure.

During the first half of the 20th century, the urban environment came to be regarded as an important contributing element to a population's health [11]. Vlahov et al. [11] indicated that certain aspects of urbanization, such as ease of access to healthcare services, might have a positive effect on an individuals' health. However, they also suggested that urbanization might have a negative impact, as health hazards tend to expand because of lack of social organization, poor urban and working conditions, lack of governance, lack of opportunities and lack of capacity to develop effective policies [12]. Urbanization is also accompanied by changes in the environment which have impacts on behavior relating to diet, physical activity and smoking, and influence emotional factors, especially stress. All of these factors have an influence on high blood pressure [5,13,15,16].

Using representative data on the Brazilian population from 2008, the aims of the present study were to: (1) estimate the prevalence of self-reported high blood pressure among adults aged 20 years and over in urban and rural environments in Brazil; and (2) identify possible associations between certain factors and self-reported high blood pressure, with stratification of households according to location (urban or rural).

Material and methods

Study population

Data from the 2008 PNAD, a survey with national coverage conducted by IBGE, was used. In addition to basic annual information, every five years the PNAD provides supplement data on the health conditions of the Brazilian population. This study used the most recent supplement survey carried out in 2008 and covering 391,868 individuals living in 150,591 households. The present study selected only individuals from this sample aged 20 years and over (257,816 people). When individuals are aware that they have high blood pressure, members of their family or others living in the same household are also generally aware of their condition. All information on self-reported high blood pressure was therefore taken into consideration, including that given by third parties. Individuals were excluded from the sample if data relating to any of the variables was not available; as a result the final sample was reduced to 256,583 individuals.

The PNAD uses a complex sampling method that combines traditional sampling methods, such as stratification and clustering, with unequal selection probabilities in two or three stages, depending on whether or not the selected municipalities are self-representative. Technical details on the PNAD sampling plan are described by Silva et al. [17] and IBGE [10].

Variables studied

Household location (urban or rural) was defined as a stratification variable to facilitate the presentation of results by area. The following explanatory variables obtained from the PNAD data were used in the analysis of prevalence of high blood pressure: geographical region, sex, age group, color/race, number of years of schooling, per capita family income, whether the household was registered in the Family Health Program (FHP), work activity, smoking, self-reported morbidity, physical activity, migration and access to health insurance.

High blood pressure was self-reported and measured by means of the following question: "Has any healthcare professional ever told you that you have hypertension (high blood pressure)?". Household location was defined as urban by aggregating the three urban categories defined by the IBGE [10], namely: (1) urban – city or small town, urbanized area; (2) urban – city or small town, non-urbanized area; and (3) Urban – isolated urban area. Household location was defined as rural by aggregating the following five rural categories defined by the IBGE: (1) rural – rural agglomeration of urban extent; (2) rural – isolated rural agglomeration with population; (3) rural – isolated rural agglomeration with nucleus; (4) rural – isolated rural agglomeration of other type; and (5) rural – exclusively rural zone of rural agglomeration.

The work activity variable, was defined according to the work carried out during the reference week, defined as the period 21st to 27th September, 2008, based on the following categories: not working, agriculture, industry, domestic services or others. The last category included construction, commerce, repair work, accommodation, catering, transportation, storage, communication, public administration, education, health and social services, other public services, social and personal services, other activities and poorly defined activities.

Physical activity was defined as the following four levels: non-practicing, light practice (i.e., sports or physical exercise practiced once or twice a week), moderate practice (i.e., three to four times a week), and intense practice (i.e., five or more times a week).

With regard to the variable migration, individuals were considered non-migrants if they currently lived in the municipality where they were born.

Self-reported morbidity was defined as individuals that reported having at least one of the following groups of diseases: (1) diabetes, heart disease or chronic kidney failure; or (2) other diseases (spinal or back complaints, arthritis or rheumatism, cancer, bronchitis or asthma, depression, tuberculosis, tendinitis, tenosynovitis or cirrhosis). Those that did not report one or more of these diseases were classified as "no morbidity". Given that self-reported high blood pressure was the outcome of this study, this element was not included in the construction of the variable self-reported morbidity.

Statistical analysis

The SPSS statistics software for Windows, version 17.0 (SPSS Inc., Chicago, USA) was used to incorporate information on the strata used, the primary sampling unit and the relative sampling weighting. Relative weighting was the ratio between the weighting defined in the sample design and the mean weighting, so as to maintain sample size and the accuracy of the estimates [15]. Prevalence of self-reported high blood pressure was estimated for urban and rural areas of Brazil and for the entire country and the association between variables and high blood pressure was measured using the odds ratio (OR). The frequency of each variable was also calculated and univariate logistic regression was performed to identify the association between each variable and high blood pressure stratified by household location. Crude ORs and the respective 95% confidence intervals were then estimated and multivariate logistic regression was performed simultaneously with all variables to obtain adjusted ORs stratified according to household location. The logistic model was used to estimate the proportion of self-reported hypertensive and non-hypertensive individuals according to household location.

Results

Table 1 shows that the proportion of the study population living in urban areas (85%) was much larger than the proportion residing in rural areas (15%). The prevalence of self-reported high blood pressure for the whole of Brazil was 20.9%; 21% in urban areas and 20.1% in rural areas. There was also a weak association between the urban areas and the prevalence of self-reported high blood pressure [OR = 1.06 (1.02-1.10)].

Crude data presented in Table 2 shows that the prevalence of self-reported high blood pressure was higher among individuals living in southern and southeastern Brazil and among women, and that self-reported high blood pressure increased significantly with age, both in urban and rural areas. When compared to the 20

Table 1

Prevalence of self-reported high blood pressure, according to household location in Brazil according to data from the *Brazilian National Household Sample Survey* (PNAD 2008) (N = 257,816).

Household location	Relative distribution %	Prevalence of high blood pressure %	Association with high blood pressure OR (95%CI)
Urban area	85.0	21.0	1.06 (1.02-1.10)
Rural area	15.0	20.1	1.00
Total	100.0	20.9	-

OR: odds ratio; 95%CI: 95% confidence interval.

Table 2

Associations between demographic, socioeconomic, occupational, behavioral and health characteristics with self-reported high blood pressure in urban and rural areas according to data from the *Brazilian National Household Sample Survey* (PNAD 2008).

Conditions	Relative distribution (%)	Proportion of residents in urban areas (%)	Association with self-reported high blood pressure			
			Urban		Rural	
			Prevalence of high blood pressure (%)	OR * (95%CI)	Prevalence of high blood pressure (%)	OR * (95%CI)
Geographical region						
North	7.1	79.4	15.1	1.00	14.4	1.00
Northeast	26.5	74.2	19.6	1.36 (1.27-1.46)	18.0	1.31 (1.08-1.57)
Southeast	44.2	92.7	22.6	1.64 (1.53-1.75)	24.4	1.92 (1.58-2.32)
South	15.0	83.2	21.6	1.55 (1.44-1.66)	23.2	1.79 (1.47-2.19)
Center-west	7.2	87.8	19.4	1.35 (1.25-1.46)	20.1	1.49 (1.22-1.82)
Sex						
Male	47.5	83.5	17.7	1.00	15.6	1.00
Female	52.5	86.4	23.9	1.46 (1.43-1.49)	24.9	1.79 (1.69-1.90)
Age group (years)						
20-35	39.8	85.4	4.6	1.00	4.9	1.00
36-50	30.5	85.6	17.8	2.21 (2.14-2.28)	16.6	3.84 (3.48-4.24)
51-64	18.2	84.4	40.6	8.72 (8.45-8.99)	36.1	10.89 (9.81-12.09)
65 and over	11.5	83.5	56.4	22.68 (21.77-23.62)	50.4	19.60 (17.57-21.86)
Color/Race						
White	50.2	87.9	21.0	1.00 (0.98-1.02)	21.6	1.17 (1.11-1.25)
Non white	49.8	82.2	21.0	1.00	19.0	1.00
Number of years of schooling						
No schooling or less than 1	12.3	67.5	40.2	1.00	29.3	1.00
1-7	34.4	78.5	28.6	0.50 (0.48-0.52)	20.1	0.61 (0.56-0.65)
8-14	44.5	92.6	13.4	0.20 (0.19-0.21)	9.2	0.24 (0.22-0.27)
15 or more	8.8	96.9	15.1	0.22 (0.21-0.23)	16.1	0.46 (0.37-0.58)

(continues)

Table 2 (continued)

Conditions	Relative distribution (%)	Proportion of residents in urban areas (%)	Association with self-reported high blood pressure			
			Urban		Rural	
			Prevalence of high blood pressure (%)	OR * (95%CI)	Prevalence of high blood pressure (%)	OR * (95%CI)
Per capita family income (minimum wage)						
Without income or even 1	49.7	77.4	20.7	1.00	18.3	1.00
1-5	41.4	92.2	21.3	1.03 (1.01-1.06)	25.5	1.53 (1.42-1.64)
Over 5	5.2	97.4	20.7	1.00 (0.94-1.06)	25.6	1.53 (1.20-1.97)
No information	3.7	91.1	21.5	1.05 (0.98-1.12)	23.8	1.39 (1.16-1.68)
Migration						
Non migrant	48.6	81.6	16.5	1.00	18.5	1.00
Migrant	51.4	88.3	25.0	1.66 (1.62-1.71)	22.4	1.27 (1.18-1.37)
Work activity						
Not working	36.1	86.4	32.7	1.00	29.8	1.00
Agricultural	9.4	30.4	19.6	0.50 (0.47-0.54)	17.0	0.48 (0.45-0.52)
Industrial	10.0	91.7	13.1	0.31 (0.30-0.33)	11.3	0.30 (0.26-0.35)
Domestic services	4.7	89.9	20.2	0.52 (0.49-0.55)	15.5	0.43 (0.36-0.51)
Others	39.8	94.5	13.4	0.32 (0.31-0.33)	11.8	0.32 (0.28-0.35)
Smoking						
Never smoked	54.0	86.0	18.0	1.00	17.2	1.00
Current smoker	16.1	82.7	18.6	1.03 (1.00-1.07)	17.1	0.99 (0.92-1.07)
Ex-smoker	15.6	83.8	33.0	2.47 (2.40-2.54)	30.8	2.13 (1.98-2.30)
Do not know or not reported	14.3	85.4	22.1	1.28 (1.24-1.32)	21.2	1.29 (1.20-1.39)
Physical activity						
Non-practicing	71.9	83.0	21.3	1.00	20.1	1.00
Light practice	11.0	87.4	12.4	0.52 (0.50-0.55)	9.7	0.43 (0.37-0.49)
Moderate practice	7.2	93.8	18.4	0.83 (0.79-0.87)	16.8	0.80 (0.66-0.98)
Intense practice	6.6	93.2	21.4	1.01 (0.97-1.06)	25.1	1.33 (1.14-1.55)
No information	3.3	85.1	50.1	3.72 (3.50-3.95)	46.3	3.42 (2.98-3.92)
Household registered within the FHP						
Yes	48.7	79.2	22.1	1.12 (1.09-1.15)	20.3	1.05 (0.98-1.13)
No	51.3	90.6	20.2	1.00	19.5	1.00
Access to health insurance						
Yes	28.4	96.1	21.0	1.00 (0.97-1.03)	23.9	1.27 (1.14-1.43)
No	71.6	80.7	21.0	1.00	19.8	1.00
Self-reported morbidity						
Diabetes/Heart disease/ Chronic renal failure	4.8	86.7	54.1	13.08 (12.41-13.79)	53.7	8.70 (7.75-9.76)
Other disease **	29.8	85.3	36.4	4.49 (4.38-4.60)	34.1	3.87 (3.64-4.12)
No morbidity ***	65.4	84.8	11.5	1.00	11.8	1.00

FHP: Family Health Program; OR: odds ratio; 95%CI: 95% confidence interval.

* Hypertension *vs.* without hypertension;

** Spinal or back problem, arthritis or rheumatism, cancer, bronchitis or asthma, depression, tuberculosis, tendonitis or tenosynovitis or cirrhosis;

*** Hypertension was not considered.

to 35 year age category, the chances of having high blood pressure in the 65 years and over age category was 22 times higher in urban areas and 20 times higher in rural areas. In both urban and rural areas, individuals who had attended school for more than one year were less likely to report high blood pressure than those who had never been to school or who had attended school for less than one year. In relation to per capita family income, no association was observed in urban areas, while in rural areas there was an association of 1.53 (1.42-1.64) (Table 2).

The relationships attributed to most of the variables were modified by multiple analysis. As shown in Table 2, after controlling for the other variables, the chance of women reporting high blood pressure in relation to the chance of men reporting the disease was lessened in urban areas, changing from crude OR = 1.46 (1.43-1.49) to adjusted OR = 1.25 (1.22-1.29).

The variables geographical region, age group, number of years of schooling, migration, work activity, smoking and self-reported morbidity also showed reductions in the degree of association after multiple analysis. In the crude analysis, the variable color/race did not show any association in urban areas [crude OR = 1.00 (0.98-1.02)] and showed a weak association in rural areas [crude OR = 1.17 (1.11-1.25)]. After multivariate analysis (Table 3) the association changed in urban areas [adjusted OR = 0.83 (0.81-0.86)] and in rural areas [adjusted OR = 0.92 (0.85-0.98)]. The associations of the variables per capita family income and physical activity in rural areas were lost after multivariate analysis. The same can also be said for the association of the variable access to health insurance in rural areas [crude OR = 1.27 (1.14-1.43) and adjusted OR = 1.06 (0.92-1.22)].

In relation to the variable access to health insurance in urban areas, a weak association was observed only according to the adjusted analysis [crude OR = 1.00 (0.97-1.03) and adjusted OR = 1.07 (1.03-1.11)]. The fact that the household was registered in the FHP did not influence the magnitude of the chance of reporting high blood pressure in both rural and urban areas according to the multivariate analysis (Table 3).

Discussion

Overall prevalence of high blood pressure among individuals aged 20 years and over was 20.9%; rates differed slightly between urban areas (21%) and rural areas (20.1%). This result is similar to findings from other countries in the Americas where prevalence rates range between 14% and 40%, among both rural and urban populations. However, it should be noted that indirect measurement was used by these studies conducted in different countries and the populations considered were over 35 years of age [1]. Although there is sparse population-based data on the prevalence of hypertension in Brazil, estimates based on data obtained from some population-based studies suggest that the disease affects around a quarter of the Brazilian population across all age groups [6]. This difference in prevalence rate may be partially due to the self-reporting method of measurement used by the PNAD.

Information from self-reported measurements is not checked and is therefore subject to information bias. In the case of hypertension, in which patients only recognize the problem after medical diagnosis, surveys that use self-reported morbidity tend to underestimate prevalence [18]. However, studies on this topic have found that the results obtained from using self-reporting methods for assessing prevalence of high blood pressure in large populations have relative validity [7,8,9,19]. In a study on the validity of self-reporting of chronic diseases among elderly people in Taiwan, in which the clinical diagnoses were taken to be the gold standard, Wu et al. [20] observed that self-reported high blood pressure tended to underestimate prevalence by four percentage points.

The highest incidence of reporting high blood pressure was among individuals living in urban and rural areas in the Southeastern Region of the country. This may be related to the fact that access to healthcare services in this region is greater and therefore a larger proportion of the population has knowledge about the disease and is, consequently, more likely to report this morbidity.

Women were more likely to report high blood pressure in both urban and rural areas (adjusted OR = 1.25 for urban areas and adjusted OR = 1.73 for rural areas). It is well known that women generally seek healthcare services more frequently than men, and are therefore more likely to have a greater awareness of the disease. Two reasons for this behavior have been put forward: women have a greater interest in their health and have different healthcare needs, including demands relating to pregnancy and delivery. It has also been shown that women are more likely to report health problems than men [21]. In the *Chennai Urban Rural Epidemiology Study* (CURES), a cross-sectional study conducted among the urban population of Chennai, India, using indirect measurement of high blood pressure, it was found that the prevalence of this condition was lower in women than in men. However, when systolic pressure was analyzed separately in individuals aged 60 years and over prevalence of

Table 3

Logistic models to detect the presence of self-reported high blood pressure according to household location (data from the *Brazilian National Household Sample Survey* (PNAD 2008)).

Conditions	Multivariate logistic models	
	Urban	Rural
	$OR_{adjusted}$ * (95%CI)	$OR_{adjusted}$ * (95%CI)
Geographical region		
North	1.00	1.00
Northeast	1.24 (1.15-1.33)	1.19 (0.99-1.42)
Southeast	1.46 (1.36-1.56)	1.85 (1.52-2.24)
South	1.35 (1.25-1.40)	1.49 (1.22-1.83)
Center-West	1.29 (1.20-1.40)	1.31 (1.07-1.61)
Sex		
Male	1.00	1.00
Female	1.25 (1.22-1.29)	1.73 (1.60-1.87)
Age group (years)		
20-35	1.00	1.00
36-50	3.60 (3.45-3.76)	3.11 (2.79-3.47)
51-64	8.89 (8.49-9.31)	7.36 (6.54-8.28)
65 or more	12.62 (11.94-13.33)	11.17 (9.79-12.73)
Color/Race		
White	1.00	1.00
Non white	0.83 (0.81-0.86)	0.92 (0.85-0.98)
Number of years of schooling		
No schooling or less than 1	1.00	1.00
1-7	0.95 (0.91-0.99)	0.98 (0.91-1.06)
8-14	0.74 (0.71-0.78)	0.69 (0.60-0.78)
15 or more	0.69 (0.64-0.74)	0.75 (0.58-0.98)
Per capita family income (minimum wage)		
Without income or even 1	1.00	1.00
1-5	0.97 (0.94-1.00)	1.03 (0.95-1.13)
Over 5	0.92 (0.86-0.99)	0.97 (0.73-1.30)
No information	0.94 (0.87-1.01)	1.19 (0.98-1.44)
Migration		
Non migrant	1.00	1.00
Migrant	1.04 (1.01-1.07)	1.12 (1.05-1.20)
Work activity		
Not working	1.00	1.00
Agricultural	0.73 (0.67-0.79)	0.78 (0.72-0.84)
Industrial	0.77 (0.73-0.81)	0.81 (0.67-0.97)
Domestic services	0.88 (0.83-0.94)	0.74 (0.62-0.88)
Others	0.78 (0.75-0.80)	0.79 (0.70-0.90)
Smoking		
Never smoked	1.00	1.00
Current smoker	0.85 (0.82-0.89)	0.82 (0.75-0.89)
Ex-smoker	1.20 (1.16-1.24)	1.24 (1.14-1.35)
Do not know or not reported	1.02 (0.98-1.06)	1.04 (0.95-1.14)

(continues)

Table 3 (continued)

Conditions	Multivariate logistic models	
	Urban	Rural
	$OR_{adjusted}$ * (95%CI)	$OR_{adjusted}$ * (95%CI)
Physical activity		
Non-practicing	1.00	1.00
Light practice	0.88 (0.84-0.93)	1.08 (0.93-1.25)
Moderate practice	1.03 (0.97-1.08)	1.12 (0.91-1.39)
Intense practice	1.03 (0.98-1.09)	1.37 (1.15-1.63)
No information	1.39 (1.30-1.48)	1.43 (1.24-1.66)
Household registered within the FHP		
Yes	1.11 (1.07-1.14)	1.08 (1.00-1.16)
No	1.00	1.00
Access to health insurance		
Yes	1.07 (1.03-1.11)	1.06 (0.92-1.22)
No	1.00	1.00
Self-reported morbidity		
Diabetes/Heart disease/Chronic renal failure	4.43 (4.20-4.67)	4.61 (4.08-5.22)
Other disease **	2.39 (2.32-2.46)	2.22 (2.08-2.38)
No morbidity ***	1.00	1.00

FHP: Family Health Program; OR: odds ratio; 95%CI: 95% confidence interval.

* $OR_{adjusted}$ (hypertension *vs.* without hypertension);

** Spinal or back problem, arthritis or rheumatism, cancer, bronchitis or asthma, depression, tuberculosis, tendonitis or tenosynovitis or cirrhosis;

*** Hypertension was not considered.

high blood pressure was greater in women than in men [22].

White people were less likely to report high blood pressure in both urban and rural areas, with greater magnitude in urban areas, thus suggesting that non-white individuals are more likely to report high blood pressure. This result corroborates findings in the literature [23,24].

Individuals with greater per capita family income and schooling levels were less likely to report high blood pressure in both urban and rural areas. However, the likelihood of reporting the disease among the 15 years and over age category in rural areas increased slightly. This result indicates that socioeconomic factors are associated with reporting of high blood pressure, as has already been demonstrated in studies by Lethbridge-Cejku et al. [25] and Westert et al. [26].

All workers were less likely to report high blood pressure than non-workers regardless of the type of activity. Some studies have shown that prevalence of hypertension increases with the level of work activity [27]. With regard to the present study, this relationship may have been inverted, given the high proportion of non-workers, particularly retired individuals. Consequently, the prevalence of hypertension is related to advanced age, or co-morbidities in the case of early retirement due to disability. Furthermore, the healthy worker effect may influence prevalence. As a result of being employed, individuals are likely to go through admission examinations, and healthier individuals are generally hired. In a study conducted in England (black report), it was found that morbidity and mortality were higher among unskilled or semi-skilled workers, and that individuals in the unskilled group used healthcare services, especially those of a preventive nature, less frequently than those in other occupational groups [28].

In the present study, it was observed that individuals born outside the place where they were living were more likely to report high blood pressure. Although other studies have corroborated this association [27], Madrigal et al. [29] state that this relationship may change depending on the stress conditions faced by the migrant.

Former smokers were more likely to report high blood pressure, than individuals who had never smoked, in both urban and rural areas. However, it is interesting to note that this association was not observed among current smokers. In fact, prevalence of high blood pressure was greater among individuals who had never smoked than in current smokers. This result may have been

due to survival bias or to reverse causality, which is common in cross-sectional studies.

In general, the present study showed that individuals that practiced physical activity were more likely to report high blood pressure, in both urban and rural areas. Scientific evidence shows the importance of physical activity in treating high blood pressure, since physical activity promotes weight control and good health [30]. This result may also be due to reverse causality: hypertensive individuals may have started to undertake greater amounts of physical activity than non-hypertensive individuals because of recommendations from health professionals as a form of treatment for the disease.

Individuals with health insurance and/or who lived in households registered with the FHP were more likely to report high blood pressure. This may be explained by the fact that these individuals enjoy greater access to healthcare services and in turn have greater knowledge about the disease, therefore increasing the likelihood of reporting morbidities [31]. There was a large similarity between OR values for urban and rural areas for certain variables. However, wider confidence intervals in rural areas, which sometimes exceeded the limit of statistical significance, were due to the sample size, which was smaller in rural areas, encompassing only 15% of the population surveyed.

The present study was conducted using secondary data, optimizing the use of existing survey data, thereby saving time and expense. Moreover, the PNAD covers a very large sample that is representative of the Brazilian population across the entire national territory.

Although several health-related studies have used data from the PNAD, few have explored the difference between urban and rural locations. Furthermore, the present study differs from most of the other studies that have used the PNAD data [18,32] in that it uses a complex sampling scheme. This type of data cannot be dealt with as independent and identically distributed observations, as is common under the analytical procedures available in statistical packages [17,33]. The present study also used relative weightings, which maintain the sample size and ensures the accuracy of estimates [34].

In the present study, several variables showed weak associations with the outcome. However, this does not mean that this health problem is irrelevant from a public policy perspective [35].

One of the limitations of the present study is the use of urban/rural comparisons as a proxy for differences in living conditions which may result in serious exposure classification errors [36]. Distinguishing urban from rural is easy if the objective is to identify opposite poles. However, drawing an exact line between what is urban and what is rural is not a simple exercise and varies greatly from country to country [37]. In Brazil, the definitions of urban and rural are a matter of concern in studies on urban health, given their strictly administrative definition [38]. Cities are defined by law and, as a result of this definition, the percentage of the total population living in urban areas in Brazil is close to 90% [10]. This may not necessarily be a true expression of the situation in this country and may not be in line with the reality of the lifestyles of the Brazilian population.

Other risk factors known to be related to high blood pressure, such as obesity, abusive alcohol consumption, family history and salt intake, could not be incorporated into this study because the PNAD does not include these variables. Future studies should include a sensitivity analysis that incorporates these overlooked variables and testing of new classifications of urban and rural areas to ascertain the impact of these changes on results.

From the results of this study, it can be inferred that the prevalence rates of self-reported high blood pressure are generally similar in urban and rural areas, with a slight increase in rates in urban areas. Moreover, all the variables showed an association with self-reported high blood pressure, in both urban and rural areas, with differences in magnitude in relation to sex and age group. These differences could help to justify the promotion of better access and intervention methods at prevention clinics for different population groups.

Resumen

Este artículo tiene por objetivo estimar las prevalencias de la hipertensión arterial sistémica autorreferida de adultos, en los ambientes urbano y rural de Brasil, e identificar posibles asociaciones, estratificadas por situación del domicilio. Se utilizó el Estudio Nacional por Muestra de Domicilios *(PNAD), incorporando la información del mismo. Se utilizaron regresiones logísticas para obtener las medidas de asociación* odds ratio *(OR). La prevalencia de hipertensión arterial sistémica autorreferida en Brasil fue de un 20,9%, siendo un 21% (urbana) y un 20,1% (rural) (OR = 1,06). En ambas áreas, la oportunidad de informar sobre hipertensión arterial sistémica aumentó con la edad, fue mayor entre las mujeres, ex-fumadores, emigrantes, portadores de enfermedades, los de color/raza no blanca e individuos con plan de salud. También en las dos áreas, la hipertensión arterial sistémica fue menor entre los trabajadores y disminuyó con el aumento del número de años de estudio. Todas las variables se mostraron asociadas con la hipertensión arterial sistémica autorreferida, en ambas áreas, no obstante, pudieron ser observadas diferencias en las magnitudes en sexo y franja de edad. Estas diferencias pueden ayudar a encontrar la mejor forma de intervenir en los servicios de prevención y acceso de cada población.*

Hipertensión; Presión Arterial; Población Rural; Población Urbana

Contributors

J. P. L. Moreira, J. R. Moraes and R. R. Luiz made an equal contribution to all stages of the elaboration of this article.

Acknowledgments

This project was partially funded by FAPERJ (process n. E-26/100.682/2007 and E-26/101.506/2010).

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Submitted on 12/Mar/2102
Final version resubmitted on 14/Aug/2012
Approved on 11/Sep/2012