Rev Saúde Pública 2009;43(Supl. 2)

Maria Ines Schmidt[I]

Bruce B Duncan[I]

Juliana Feliciati Hoffmann[II]

Lenildo de Moura[II,III]

Deborah Carvalho Malta[III,IV]

Rosa Maria Sampaio Vilanova de Carvalho[V]

Prevalence of diabetes and hypertension based on self-reported morbidity survey, Brazil, 2006

ABSTRACT

OBJECTIVE: To estimate the prevalence of self-reported diabetes and hypertension and their absolute numbers in Brazil.

METHODS: Data from 54,369 individuals aged ≥18 years, interviewed by the *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), conducted in 27 Brazilian state capitals in 2006, and who responded positively to questions about high blood pressure and diabetes, were analyzed. Percentages of self-reported hypertension and diabetes, estimated in the sample, were projected to the Brazilian population, according to age, sex and nutritional status, using the direct standardization method.

RESULTS: Prevalence of diabetes was 5.3% higher in women (6.0% vs. 4.4%), varying from 2.9% in Palmas (Northern Brazil) to 6.2% in São Paulo (Southeastern Brazil). Prevalence of hypertension was 21.6% (21.3; 22.0) higher in women (24.4% vs. 18.4%), varying from 15.1% in Palmas to 24.9% in Recife (Northeastern Brazil). Prevalences increased with age and nutritional status. It was estimated that there were 6,317,621 adults who reported having diabetes and 25,690,145 adults who reported having hypertension in Brazil.

CONCLUSIONS: Prevalence of self-reported diabetes and hypertension are high in Brazil. Monitoring of these and other health conditions can be performed using strategies such as the VIGITEL, especially if followed by validation studies, aiming to generalize results.

DESCRIPTORS: Diabetes Mellitus, epidemiology. Hypertension, epidemiology. Chronic Disease, prevention & control. Health Surveys. Brazil. Telephone interview.

INTRODUCTION

Hypertension is the most frequent of non-communicable chronic diseases (NCCD) and the main risk factor for cardiovascular complications such as cerebrovascular accident and acute myocardial infarction, in addition to end-stage chronic renal disease.[2] Simplicity of diagnosis facilitates conduction of studies on population prevalence. Since the 1970s, various local studies performed in different areas of Brazil, employing diverse sampling processes and diagnostic criteria, showed frequencies of hypertension in adults varying from 11.6% to 44.4%.[7,10] In a study performed in 14 Brazilian state capitals and the Federal District, between 2002 and 2005, with individuals who reported

[I] Departamento de Medicina Social. Faculdade de Medicina. Universidade Federal do Rio Grande do Sul (UFGRS). Porto Alegre, RS, Brasil

[II] Programa de Pós-Graduação em Epidemiologia. UFRGS. Porto Alegre, RS, Brasil

[III] Coordenação Geral de Doenças e Agravos Não Transmissíveis. Secretaria de Vigilância em Saúde. Ministério da Saúde. Brasília, DF, Brasil

[IV] Departamento de Enfermagem Materno-Infantil e Saúde Pública. Escola de Enfermagem. Universidade Federal de Minas Gerais. Belo Horizonte, MG, Brasil

[V] Departamento de Atenção Básica. Secretaria de Atenção à Saúde. Ministério da Saúde

Correspondence:
Maria Ines Schmidt
R. Ramiro Barcelos, 2600/414
90035-003 Porto Alegre, RS Brasil
E-mail: maria.schmidt@ufrgs.br

Received: 11/28/2008
Revised: 7/18/2009
Approved: 8/19/2009

having their pressure measured in the last two years, the frequency of self-reported hypertension varied from 18% to 29%.[a]

Prevalence of diabetes has increased worldwide and has currently become an epidemic, mostly resulting from population aging. However, physical inactivity, an inadequate diet and the increase in obesity are also responsible for the global expansion of diabetes. Hospitalizations due to diabetes mellitus represent 9% of the *Sistema Único da Saúde* (SUS – National Health System) hospital spending.[11]

The diagnosis of diabetes requires blood tests such as fasting glycemia or, preferably, the glucose tolerance test, thus hindering this diagnosis in surveys. As a result, data on the prevalence of diabetes in Brazil are less frequent than those on hypertension.[4,8,9,13] A Brazilian study based on the glucose tolerance test was conducted with individuals aged between 30 and 69 years, in eight Brazilian capitals and the Federal District, from 1986 to 1988.[7] The prevalence of diagnosed diabetes was 7.6% versus 4.1% for self-reported diabetes. These results began to be used to describe the prevalence of diabetes in Brazil,[4,8] and based on such, the World Health Organization (WHO) estimated that the country would have 4.6 million diabetics in 2000 and 11.3 million in 2030.[15]

Recently, studies with a broader scope nationwide were performed, based on reports of previous medical diagnosis. A study performed in 2002-2005 showed prevalences of self-reported diabetes between 3% and 7% in the 16 Brazilian capitals studied and Federal District.[a] In a probability sample of the Brazilian population in 2003, the World Health Survey (WHS) found a prevalence of 6.2% for self-reported diabetes in individuals aged ≥18 years.[12] Moreover, in 2003, in another representative survey of the Brazilian population, the *Pesquisa Nacional por Amostra de Domicílios* (PNAD – National Household Sample Survey), self-reported morbidity was assessed by self-report or by someone associated with the selected individual, and the prevalence found was lower – 2% in men and 2.6% in women aged ≥18 years.[1]

The high morbimortality associated with diabetes and hypertension requires health promotion strategies and the detection of risk groups for preventive interventions. In Brazil, policies and strategies for their control have enabled the integration of preventive actions in primary health care.[b,c,d] These strategies require an estimate of the number of people with diabetes and/or hypertension, obtained with difficulty due to the lack of uniformity between studies and their usually local scope.

The present study aimed to estimate the prevalence of self-reported diabetes and hypertension in Brazil and their absolute numbers for this country.

METHODS

This was a cross-sectional study with data collected by the *Sistema de 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), implemented in 2006. This system continually monitors the frequency and distribution of such factors in Brazilian capitals and the Federal District by telephone interviews and electronic questionnaire.[e] VIGITEL is based on probability samples of the adult population living in households with fixed telephone lines. VIGITEL methodology has been described in previous publications.[6,f] The present study assessed individuals who answered the following questions, "Has any doctor ever said you have high blood pressure?" and "And diabetes?"

The total number of individuals studied was 54,369, all aged 18 years or older, interviewed in 2006.

No direct compensation method for the fraction of households not served by fixed telephone lines or in each population stratum is employed by the VIGITEL system. However, to reduce bias resulting from the lack of universal telephone system coverage, post-stratification weights were attributed to individuals interviewed by this system.

For the 27 cities monitored by VIGITEL, prevalence estimates were directly standardized using weighting applied to the sample's 36 age, sex and level of

[a] Ministério da Saúde. Inquérito domiciliar sobre comportamentos de risco e morbidade referida de doenças e agravos não transmissíveis. Brasília; 2003 [cited 2008 dec 01] Available from: http://www.se.gov.br/userfiles/arquivos/216/anexo_15_tabagismo_e_fatores_de_risco_publicacao_inquerit.pdf

[b] Ministério da Saúde. Secretaria de Atenção a Saúde. Departamento de Atenção Básica. Diabetes Mellitus. Brasília; 2006. (Cadernos de Atenção Básica, 16. Série A. Normas e Manuais Técnicos).

[c] Ministério da Saúde. Secretaria de Atenção a Saúde. Departamento de Atenção Básica. Hipertensão Arterial Sistêmica. Brasília; 2006. (Cadernos de Atenção Básica, 15. Série A. Normas e Manuais Técnicos).

[d] Ministério da Saúde. Organização Pan-Americana da Saúde. Avaliação do Plano de Reorganização da Atenção à Hipertensão e ao Diabetes Mellitus no Brasil. Brasília; 2004. (Série C - Projetos, Programas e Relatórios).

[e] Ministério da Saúde.VIGITEL Brasil 2006. Vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico: estimativas sobre freqüência 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; 2006 [cited 2008 jan] Modelo do Questionário Eletrônico 2006. Available from: http://hygeia.fsp.usp.br/nupens/questionario2006.pdf

[f] Ministério da Saúde. VIGITEL Brasil 2006. Vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico: estimativas sobre freqüência 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.

education strata. The following were considered for this weighting: the number of fixed telephone lines in the interviewee's household; the number of adults in the household; and the ratio between the fraction of the total number of interviewees in the VIGITEL per stratum and the fraction of the city's total population in the corresponding stratum, according to the demographic census.[a] The first factor corrects the greater chance of individuals, living in households with more than one fixe telephone line, being randomly selected. The second factor corrects the greater chance of individuals, living in households where other people live, being randomly selected. Finally, the third factor aims to make the sociodemographic composition of the sample of adults studied equal to the sociodemographic composition of the city's total adult population.

For the estimates of the total adult population of the 27 cities, the final weight was multiplied by a fourth factor, which considered the differences between the population contingent of several cities and the number of individuals (about 2,000) studied by the system, in each city.

To estimate the prevalence of diabetes and hypertension in Brazil, based on self-reported morbidity, a fifth factor was applied, standardizing these prevalences in each age and sex category to the distribution of the Brazilian population's nutritional status by a direct method. To achieve this, Brazilian population estimates[b] and the *Pesquisa de Orçamentos Familiares* (POF – Family Budget Survey) were used.[c] The POF includes rural and urban areas, provides the frequency of low weight, normal weight, overweight and obesity in adults aged 20 years or older, according to sex and age groups. VIGITEL's 18-to-24-year age group was standardized according to the POF's 20-to-24-year group.

The absolute number of cases in the country was calculated by multiplying the number of individuals in the reference population by the frequency of self-reported diabetes, standardized by nutritional status, age and sex.

The frequencies and respective 95% confidence intervals were obtained using SPSS 13.0. Standardizations and estimates of absolute numbers came from electronic spreadsheets.

As telephone interviews were involved, informed consent form was replaced by verbal consent, obtained when interviewees were contacted by telephone. VIGITEL was approved by the *Comissão de Ética em Pesquisa em Seres Humanos do Ministério da Saúde* (Ministry of Health Human Research Ethics Committee).

RESULTS

Prevalence of self-reported diabetes was 5.3% for the group of cities studied (95% CI: 5.1;5.5%), 4.4% (95% CI: 4.2;4.7) in men and 6.0% (95% CI: 5.7;6.2) in women. Prevalence among cities varied from 2.7% in Palmas (TO) to 6.2% in São Paulo (SP) (Table 1) .

Prevalence of self-reported hypertension was 21.6% (95% CI: 21.3;22.0) for the group of cities, 18.4% (95% CI: 17.9;18.8) in men and 24.4% (95% CI: 23.9;24.9) in women. Prevalences among cities varied from 15.1% in Palmas to 24.9% in Recife (PE) (Table 2) .

Prevalences and their respective 95% confidence intervals, shown in the Figure, reveal a gradual increase in diabetes and hypertension with age, this increase being steeper for diabetes in individuals aged between 45 and 54 years. In addition, it shows higher prevalences of diabetes and hypertension in overweight and obese individuals.

Standardized prevalence of diabetes for the Brazilian population was 5.2% versus 5.3% for the group of capitals (Table 3); and 21.2% versus 21.6% for hypertension, respectively (Table 4).

In Brazil, it was estimated that there were 6,317,621 cases diagnosed with diabetes, 2,573,413 in men and 3,744,208 in women. It was also estimated that there were 25,690,145 of cases diagnosed with hypertension, 10,528,959 in men and 15,161,186 in women.

DISCUSSION

Diabetes and hypertension are clinical conditions that can be asymptomatic, which can result in an underestimation of the total number of cases in the population.

As such, the use of self-reported morbidity in health surveys can underestimate the prevalence of diseases involved. A study performed in a national sample in the United States, the National Health and Nutrition Examination Survey III, 1988-1991, showed that self-reporting of hypertension has good sensitivity (71%) and specificity (92%), suggesting that hypertension can be measured by this instrument in the population.[14] Similar result was found in a Brazilian population-

[a] Ministério da Saúde. VIGITEL Brasil 2006. Vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico: estimativas sobre freqüência 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.

[b] Ministério da Saúde. DATASUS. Informações de Saúde. Brasília; 2008 [cited 2008 jan 01]. Available from: http://tabnet.datasus.gov.br/cgi/deftohtm.exe?ibge/cnv/popbr.def

[c] Instituto Brasileiro de Geografia e Estatística. Pesquisa de Orçamentos Familiares 2002-2003. Rio de Janeiro; 2004.

Table 1. Prevalence[a] of self-reported diabetes, according to sex. Brazil, 2006. (N=54,369)

Capitals/FD	Diabetes					
	Men		Women		Total	
	%	(95% CI)	%	(95% CI)	%	(95% CI)
Aracaju	3.3	(2.0;4.6)	4.6	(3.5;5.8)	4.0	(3.2;4.9)
Belém	5.1	(3.5;6.6)	5.1	(3.8;6.3)	5.1	(4.1;6.0)
Belo Horizonte	3.3	(2.1;4.6)	4.4	(3.3;5.6)	3.9	(3.1;4.8)
Boa Vista	2.9	(1.7;4.1)	4.6	(3.4;5.8)	3.8	(2.9;4.6)
Campo Grande	3.8	(2.4;5.1)	4.5	(3.4;5.7)	4.2	(3.3;5.0)
Cuiabá	3.9	(2.6;5.2)	3.8	(2.7;4.9)	3.8	(3.0;4.7)
Curitiba	4.8	(3.3;6.4)	5.0	(3.8;6.2)	4.9	(4.0;5.9)
Florianópolis	2.9	(1.8;4.1)	5.9	(4.6;7.3)	4.5	(3.6;5.4)
Fortaleza	4.4	(3.0;5.8)	4.4	(3.2;5.6)	4.4	(3.5;5.3)
Goiânia	4.6	(3.1;6.1)	5.0	(3.7;6.2)	4.8	(3.9;5.7)
João Pessoa	4.1	(2.7;5.5)	6.2	(4.9;7.6)	5.3	(4.3;6.2)
Macapá	3.2	(2.0;4.4)	3.8	(2.7;4.9)	3.5	(2.7;4.3)
Maceió	4.8	(3.3;6.3)	5.2	(4.0;6.4)	5.0	(4.1;6.0)
Manaus	3.7	(2.4;5.0)	5.2	(3.9;6.5)	4.5	(3.6;5.4)
Natal	2.9	(1.7;4.1)	5.9	(4.6;7.2)	4.5	(3.6;5.4)
Palmas	2.5	(1.5;3.5)	3.0	(2.0;3.9)	2.7	(2.0;3.4)
Porto Alegre	3.9	(2.5;5.3)	6.3	(5.0;7.6)	5.2	(4.3;6.2)
Porto Velho	4.8	(3.4;6.3)	4.8	(3.6;6.0)	4.8	(3.9;5.8)
Recife	5.0	(3.4;6.6)	5.7	(4.4;6.9)	5.4	(4.4;6.4)
Rio Branco	3.2	(2.0;4.4)	3.7	(2.6;4.8)	3.5	(2.7;4.3)
Rio de Janeiro	4.7	(3.1;6.7)	6.9	(5.5;8.3)	5.9	(4.9;6.9)
Salvador	3.7	(2.4;4.0)	5.5	(4.2;6.7)	4.7	(3.7;5.6)
São Luís	5.5	(3.9;7.1)	5.2	(3.9;6.4)	5.3	(4.3;6.3)
São Paulo	5.0	(3.4;6.5)	7.3	(5.8;8.7)	6.2	(5.1;7.3)
Teresina	4.5	(3.1;6.0)	3.9	(2.8;5.0)	4.2	(3.3;5.1)
Vitória	5.6	(4.0;7.2)	4.4	(3.3;5.5)	5.0	(4.0;5.9)
Federal District	3.8	(2.5;5.2)	6.3	(4.9;7.6)	5.1	(4.2;6.1)
Total[b]	4.4	(4.2;4.7)	6.0	(5.7;6.2)	5.3	(5.1;5.5)

[a] Weighted to adjust the sociodemographic distribution of the VIGITEL sample to the adult population distribution of each city in the 2000 Demographic Census.
[b] Weighted according to the population weight of each city.

based study in Bambuí (Southeastern Brazil) (72% of sensitivity and 86% of specificity), suggesting self-reporting to be a suitable indicator to estimate the prevalence of arterial hypertension, even outside great urban centers.[3]

Sensitivity is lower for self-reported diabetes, as the investigation of this disease is more complex and less widespread than that of hypertension, thus leaving a higher number of people in the population without diagnosis. A study on the elderly in Bambuí showed a sensitivity of 57.1% (95% CI: 50.3;63.8) for self-reported diabetes mellitus, compared to the medical diagnosis combined with fasting glycemia.[9]

As prevalences shown in the present study are based on reports of previous medical diagnosis, they are subject to reporting bias, including false positives, which would mistakenly increase the prevalence based on self-reported morbidity. However, a telephone-survey validation study performed in the United States showed a positive predictive value of 88.2% (95% CI: 77.4;99.1), indicating that the majority of individuals who reported having diabetes had a previous diagnosis of this disease (73.2% of sensitivity, 99.3% of specificity).[5] Ongoing studies to validate questions about self-reported morbidity in the VIGITEL will enable the quantification of the percentage of false positives and, if necessary, the correction of prevalence estimates.

Table 2. Prevalence[a] of self-reported hypertension, according to sex. Brazil, 2006. (N=54,369)

Capitals/FD	Hypertension					
	Men		Women		Total	
	%	(95% CI)	%	(95% CI)	%	(95% CI)
Aracaju	18.8	(16.0;21.6)	23.5	(21.2;25.8)	21.4	(19.6;23.2)
Belém	16.1	(13.6;18.7)	21.2	(18.9;23.5)	18.9	(17.2;20.6)
Belo Horizonte	22.7	(19.8;25.6)	24.5	(22.1;26.9)	23.7	(21.8;25.5)
Boa Vista	16	(13.5;18.5)	21.8	(19.5;24.1)	18.9	(17.2;20.6)
Campo Grande	21.2	(18.3;24.1)	23.3	(21.0;25.7)	22.3	(20.5;24.1)
Cuiabá	19.8	(17.1;22.5)	21.6	(19.3;24.0)	20.7	(19.0;22.5)
Curitiba	18.6	(15.9;21.4)	23.3	(20.9;25.7)	21.1	(19.3;22.9)
Florianópolis	14.9	(12.5;17.3)	20.2	(17.9;22.4)	17.7	(16.0;19.3)
Fortaleza	15.7	(13.1;18.2)	20.8	(18.5;23.0)	18.5	(16.8;20.2)
Goiânia	17	(14.4;19.7)	20.6	(18.3;22.8)	18.9	(17.2;20.6)
João Pessoa	22.4	(19.5;25.4)	25.2	(22.7;27.6)	23.9	(22.1;25.8)
Macapá	15.6	(13.1;18.0)	22.1	(19.7;24.4)	18.9	(17.2;20.6)
Maceió	18.4	(15.6;21.1)	23.5	(21.1;25.9)	21.2	(19.4;23.0)
Manaus	18	(15.4;20.6)	19.2	(17.0;21.5)	18.6	(16.9;20.3)
Natal	19.1	(16.3;21.9)	25.4	(23.0;27.8)	22.6	(20.7;24.4)
Palmas	14.9	(12.5;17.2)	15.3	(13.2;17.4)	15.1	(13.5;16.6)
Porto Alegre	19	(16.2;21.9)	23.4	(21.1;25.7)	21.4	(19.6;23.2)
Porto Velho	16.6	(14.1;19.9)	22.9	(20.4;25.3)	19.8	(18.0;21.5)
Recife	22.5	(19.5;25.6)	26.8	(24.4;29.2)	24.9	(23.0;26.8)
Rio Branco	18.4	(15.8;21.1)	24.8	(22.4;27.3)	21.8	(20.0;23.6)
Rio de Janeiro	21	(18.0;23.9)	28	(25.5;30.6)	24.8	(22.9;26.7)
Salvador	18.6	(15.9;21.4)	27.3	(24.8;29.8)	23.4	(21.5;25.2)
São Luís	15.9	(13.3;18.5)	19.3	(17.1;21.5)	17.8	(16.1;19.4)
São Paulo	16.7	(14.1;19.3)	25.5	(23.0;27.9)	21.4	(19.6;23.2)
Teresina	16.4	(13.8;19.0)	18.4	(16.2;20.5)	17.5	(15.8;19.1)
Vitória	23.1	(20.1;26.1)	22.6	(20.3;25.0)	22.9	(21.0;24.7)
Federal District	15.5	(13.0;18.0)	21	(18.7;23.2)	18.4	(16.7;20.1)
Total[b]	18.4	(17.9;18.8)	24.4	(23.9;24.9)	21.6	(21.3;22.0)

[a] Weighted to adjust the sociodemographic distribution of the VIGITEL sample to the adult population distribution of each city in the 2000 Demographic Census.
[b] Weighted according to the population weight of each city.

In Brazil, in a household survey on risk behavior and self-reported morbidity of non-communicable diseases and health problems,[a] it was estimated that the prevalence of self-reported diabetes for the group of capitals was 5.2% (95% CI: 4.9;5.5) between 2002 and 2005, varying from 3.3% in Palmas to 9.4% in São Paulo. In the present study, this prevalence was 5.3% (95% CI: 5.1;5.5), varying from 2.7% in Palmas to 6.2% in São Paulo. As regards hypertension, the same household survey showed a prevalence of 25.8% (95% CI: 25.2;26.4), varying from 16.9% in Palmas to 31.0% in Rio de Janeiro;[a] while, in the presence study, prevalence was 21.6% (95% CI: 21.3;22.0), varying from 15.1% in Palmas to 24.9% in Recife.

According to the World Health Survey (WHS), prevalence of self-reported diabetes in Brazilian adults was 6.2%.[12] The 2003 PNAD showed lower prevalences of self-reported diabetes (2.0% and 2.7% in men and women, respectively) and self-reported hypertension (8.8% and 14.4% in men and women, respectively).[1] These two studies were based on probability samples in the Brazilian population. The low prevalence obtained in the PNAD could have been underestimated due to

[a] Ministério da Saúde. Inquérito domiciliar sobre comportamentos de risco e morbidade referida de doenças e agravos não transmissíveis. Brasília; 2003 [cited 2008 Dec 01] Available from: http://www.se.gov.br/userfiles/arquivos/216/anexo_15_tabagismo_e_fatores_de_risco_publicacao_inquerit.pdf

Table 3. Estimates of absolute and relative prevalences of self-reported diabetes by age and sex, standardized by nutritional status.[a] Brazil, 2006. (N=54,369)

Age (years)	Absolute and relative prevalences					
	Men		Women		Total[b]	
	Absolute	%	Absolute	%	Absolute	%
18 to 24	109,139	0.8	179,275	1.4	288,414	1.1
25 to 29	59,884	0.8	125,337	1.6	185,221	1.2
30 to 34	131,880	1.9	52,379	0.7	184,259	1.3
35 to 44	300,778	2.4	393,248	3.0	694,026	2.7
45 to 54	540,293	6.4	734,539	8.1	1,274,832	7.3
55 to 64	651,412	12.5	1,064,169	18.2	1,715,581	15.5
65 to 74	509,269	16.2	770,118	20.3	1,279,387	18.4
≥75	270,757	16.4	425,143	18.5	695,901	17.6
Total[b]	2,573,413	4.4	3,744,208	6.0	6,317,621	5.2

[a] According to the 2002-2003 POF,[4] according to BMI categories.
[b] Standardized to the Brazilian adult population distribution in 2007, according to the IBGE (Brazilian Institute of Geography and Statistics) estimate, by sex and age.

proxy reporting of morbidity by individuals close to those selected.

The main limitation to the present study refers to the use of self-reported morbidity, instead of biomedical criteria for disease diagnosis. In this way, data shown here concern only already diagnosed cases. However, as regards hypertension, the literature shows that self-reporting is a satisfactory indicator for prevalence estimates, offering the advantages of speed to obtain information and low cost.[5,14] Nonetheless, the differences are greater for diabetes, requiring inference of these results only to already diagnosed cases.

Although the use of expansion factors reduced bias due to the non-inclusion of residents without a fixed telephone line in these cities, another limitation refers to the sample representativeness, given that telephone service coverage is lower in the Northern and Northeastern regions.

Yet another limitation was the projection of data on Brazilian capitals to Brazil. Even considering differences in age distribution, sex and nutritional status, it is possible that the prevalences found in the present study are still overestimated for the Brazilian population. This is because greater access to health services and diagnosis in the metropolitan area was not considered in the adjustment.

Differences in prevalence among cities can result in bias of access to service, due to lower availability of tests in Northern and Northeastern Brazil. In addition, there

Table 4, Estimates of absolute and relative prevalences of self-reported hypertension by age and sex, standardized by nutritional status[a] Brazil, 2006, (N=54,369)

Age (years)	Absolute and relative prevalences					
	Men		Women		Total[b]	
	Absolute	%	Absolute	%	Absolute	%
18 to 24	521,043	4.0	873,627	6.7	1,394,670	5.3
25 to 29	491,520	6.4	734,995	9.3	1,226,515	7.9
30 to 34	785,750	11.0	1,000,821	13.4	1,786,571	12.2
35 to 44	1,888,619	15.3	2,664,843	20.4	4,553,462	17.9
45 to 54	2,438,590	28.7	2,999,581	33.2	5,438,171	31.0
55 to 64	1,972,904	37.7	3,256,542	55.7	5,229,446	47.2
65 to 74	1,663,468	52.8	2,343,788	61.8	4,007,256	57.7
≥75	767,065	46.5	1,286,989	56.0	2,054,054	52.0
Total[b]	10,528,959	17.9	15,161,186	24.3	25,690,145	21.2

[a] According to the 2002-2003 POF,[4] according to BMI categories,
[b] Standardized to the Brazilian adult population distribution in 2007, according to the IBGE (Brazilian Institute of Geography and Statistics) estimate, by sex and age.

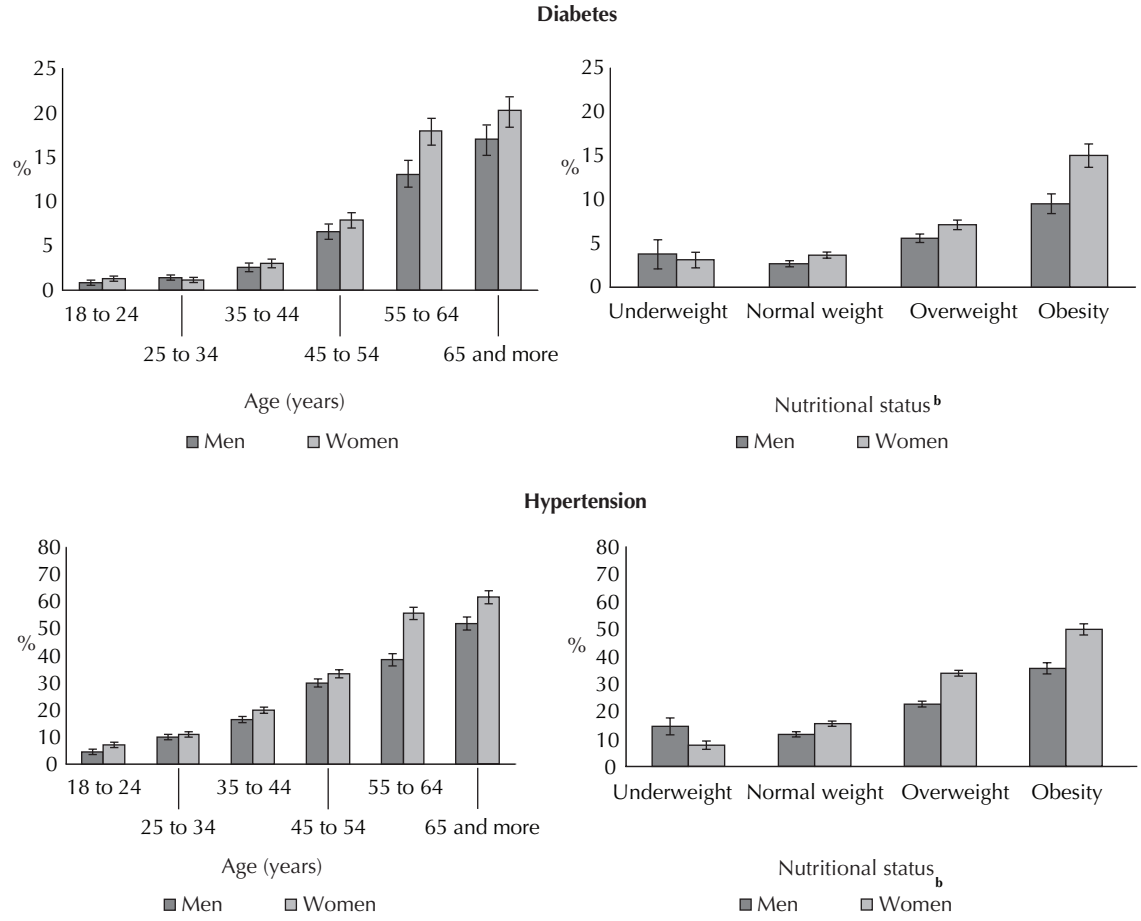

Figure. Estimated prevalence of self-reported diabetes and hypertension in adults ≥18 years in the group of capitals by sex and according to age (years) and nutritional status.[b] Brazil, 2006. (N=54,369)
[a] Weighted to adjust the sociodemographic distribution of the VIGITEL sample to the adult population distribution of each city in the 2000 Demographic Census and considering each city's population weight.
[b] According to body mass index classification (Underweight: <18.5kg/m^2; Normal weight: 18.5 – 24.99kg/m^2; Overweight: 25 – 29.99kg/m^2; Obesity: ≥30kg/m^2)

are differences in the population's age distribution, as exemplified by Palmas, whose population is younger,[a] apart from other factors.

There remains a fraction of undiagnosed cases of diabetes and hypertension, which tends to decrease with the increase in access to health services and with the organization of primary health care. Knowing this fraction becomes more important when assessing programs and strategies that involve actively searching for and tracking these diseases in the population, something already well-established and functional for hypertension, but not for diabetes.

The total number of cases of diabetes has been estimated based on some known fraction of diagnosed cases in relation to the total number of cases. As an example, the 50% fraction[4] has been frequently used, doubling the self-reporting prevalence to estimate the prevalence of the total number of cases. However, these fractions need to be updated, considering the changes that have occurred in access to and organization of services.

Taking into consideration the potential of VIGITEL to survey non-communicable diseases in Brazil, validation studies against a gold standard for diagnosing diabetes and hypertension would enable the necessary corrections of false negatives and false positives to be made. In addition, it would be desirable to improve the questions formulated, aiming to reduce the percentage of false reports of these diseases.

[a] Ministério da Saúde. VIGITEL Brasil 2006. Vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico: estimativas sobre freqüência 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.

In conclusion, diagnosed hypertension and diabetes are prevalent conditions that can be monitored by strategies such as VIGITEL, especially if accompanied by validation studies. Considering the high cost and difficult functioning of regular household surveys with objective measurements of glycemia and arterial pressure, information resulting from VIGITEL can contribute to planning, monitoring and assessing national actions to control these diseases.

REFERENCES

1. Barros MBA, Cesar CLG, Carandina L, Torre G. Desigualdades sociais na prevalência de doenças crônicas no Brasil, PNAD-2003. *Cienc Saude Coletiva*. 2006;11(4):911-26. DOI:10.1590/S1413-81232006000400014
2. Lessa I. O Adulto brasileiro e as doenças da modernidade: epidemiologia das doenças crônicas não-transmissíveis. São Paulo: Hucitec / Rio de Janeiro: Abrasco; 1998.
3. Lima-Costa MF, Peixoto SV, Firmo JO. Validade da hipertensão arterial auto-referida e seus determinantes (projeto Bambuí). *Rev Saude Publica*. 2004;38(5):637-42. DOI:10.1590/S0034-89102004000500004
4. Malerbi DA, Franco LJ. Multicenter study of the prevalence of diabetes mellitus and impaired glucose tolerance in the urban Brazilian population aged 30-69 yr. The Brazilian Cooperative Group on the Study of Diabetes Prevalence. *Diabetes Care*. 1992;15(11):1509-16. DOI:10.2337/diacare.15.11.1509
5. Martin LM, Leff M, Calonge N, Garrett C, Nelson DE. Validation of self-reported chronic conditions and health services in a managed care population. *Am J Prev Med*. 2000;18(3):215-8. DOI:10.1016/S0749-3797(99)00158-0
6. Moura EC, Neto OLM, Malta DC, Moura L, Silva NN, Bernal R. Vigilância de Fatores de Risco para Doenças Crônicas por Inquérito Telefônico nas capitais dos 26 estados brasileiros e no Distrito Federal (2006). *Rev Bras Epidemiol*. 2008;11(Supl 1):20-37. DOI:10.1590/S1415-790X2008000500003
7. Neder MM, Borges AAN. Hipertensão arterial sistêmica no Brasil: o que avançamos no conhecimento de sua epidemiologia? *Rev Bras Hipertens*. 2006;13(2):126-33.
8. Oliveira JE, Milech A, Franco LJ. The prevalence of diabetes in Rio de Janeiro, Brazil. The Cooperative Group for the Study of Diabetes Prevalence in Rio De Janeiro. *Diabetes Care*. 1996;19(6):663-6. DOI:10.2337/diacare.19.6.663
9. Passos VM, Barreto SM, Diniz LM, Lima-Costa MF. Type 2 diabetes: prevalence and associated factors in a Brazilian community-the Bambui health and aging study. *Sao Paulo Med J*. 2005;123(2):66-71. DOI:10.1590/S1516-31802005000200007
10. Passos VM, Assis TD, Barreto SM. Hipertensão arterial no Brasil: estimativa de prevalência a partir de estudos de base populacional. *Epidemiol Serv Saude*. 2006;15(1):35-45.
11. Rosa RS, Schmidt MI. Diabetes Mellitus: magnitude das hospitalizações na rede pública do Brasil, 1999-2001. *Epidemiol Serv Saude*. 2008;17(2):131-4.
12. Theme-Filha MM, Szwarcwald CL, Souza-Júnior, PRB. Características sócio-demográficas, cobertura de tratamento e auto-avaliação da saúde dos indivíduos que referiram seis doenças crônicas no Brasil, 2003. *Cad Saude Publica*. 2005;21(Supl 1):43-53. DOI:10.1590/S0102-311X2005000700006
13. Torquato MT, Montenegro Jr RM, Viana LA, Souza RA, Lanna CM, Lucas JC, et al. Prevalence of diabetes mellitus and impaired glucose tolerance in the urban population aged 30-69 years in Ribeirão Preto (Sao Paulo), Brazil. *Sao Paulo Med J*. 2003;121(6):224-30. DOI:10.1590/S1516-31802003000600002.
14. Vargas CM, Burt VL, Gillum RF, Pamuk ER. Validity of self-reported hypertension in the National Health and Nutrition Examination Survey III, 1988-1991. *Prev Med*. 1997;26(5 Pt 1):678-85. DOI:10.1006/pmed.1997.0190
15. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. *Diabetes Care*. 2004;27(5):1047-53. DOI:10.2337/diacare.27.5.1047

This article underwent the peer review process adopted for any other manuscript submitted to this journal, with anonymity guaranteed for both authors and reviewers. Editors and reviewers declare that there are no conflicts of interest that could affect their judgment with respect to this article.
The authors declare that there are no conflicts of interest.