Original Article

Progression of Blood Pressure and Cardiovascular Outcomes in Hypertensive Patients in a Reference Center

Gilberto Campos Guimarães Filho, Ana Luiza Lima Sousa, Thiago de Souza Veiga Jardim, Weimar Sebba Barroso Souza, Paulo César Brandão Veiga Jardim

Liga de Hipertensão da Faculdade de Medicina da Universidade Federal de Goiânia, Goiás, GO - Brazil

Abstract

Background: Hypertension is a public health problem, considering its high prevalence, low control rate and cardiovascular complications.

Objective: Evaluate the control of blood pressure (BP) and cardiovascular outcomes in patients enrolled at the Reference Center for Hypertension and Diabetes, located in a medium-sized city in the Midwest Region of Brazil.

Methods: Population-based study comparing patients enrolled in the service at the time of their admission and after an average follow-up of five years. Participants were aged ≥ 18 years and were regularly monitored at the Center up to 6 months before data collection. We assessed demographic variables, BP, body mass index, risk factors, and cardiovascular outcomes.

Results: We studied 1,298 individuals, predominantly women (60.9%), and with mean age of 56.7 ± 13.1 years. Over time, there was a significant increase in physical inactivity, alcohol consumption, diabetes, dyslipidemia, and excessive weight. As for cardiovascular outcomes, we observed an increase in stroke and myocardial revascularization, and a lower frequency of chronic renal failure. During follow-up, there was significant improvement in the rate of BP control (from 29.6% to 39.6%; p = 0.001) and 72 deaths, 91.7% of which were due to cardiovascular diseases.

Conclusion: Despite considerable improvements in the rate of BP control during follow-up, risk factors worsened and cardiovascular outcomes increased. (Arq Bras Cardiol. 2015; 104(4):292-298)

Keywords: Hypertension / complications; Arterial Pressure / physiopathology; Cardiovascular Diseases; Risk Factors; Indicators of Morbidity and Mortality.

Introduction

High blood pressure (BP) is one of the most important modifiable causes of cardiovascular (CV) morbidity and mortality in the adult population worldwide, and an independent risk factor for CV diseases [1,2].

The increased prevalence of high BP, associated with the large number of undiagnosed and inadequately treated hypertensive individuals, promotes hypertension to a serious public health problem [3].

The fact that hypertension is also the most frequent CV disease has contributed significantly to make it the third most important cause of disability worldwide and the leading risk factor for CV complications such as stroke, acute myocardial infarction (AMI), and terminal renal chronic disease [1,4].

This fact explains 54% of the deaths from stroke and 47% of those due to ischemic heart disease, with little variation between genders [5,6]. This reality shows that effective, safe and focused treatment goals are essential, leading to a better prognosis of hypertensive individuals by reducing CV events [7].

The efficacy of the services responsible for care of hypertensive patients, with identification of the strengths of their operations, may represent an important tool for management and planning.

Considering this background, the present study aimed at evaluating the rate of BP control, and frequency of risk factors and CV outcomes in hypertensive patients undergoing treatment at the Reference Center for Hypertension and Diabetes (*Centro de Referência em Hipertensão e Diabetes*, CRHD), located in a medium-sized city in the Midwest Region of Brazil.

Methods

The research project number 128/11 was evaluated and approved by the Ethics Committee of the *Hospital das Clínicas*, *Universidade Federal de Goiás* (UFG) and all participants signed an informed consent form.

This was a quasi-experimental study including a representative sample of the population of hypertensive patients undergoing follow-up at the CRHD.

Original Article

The CRHD was created with the primary purpose of building a system to reorganize the services offered to carriers of these diseases. In its structure, the Center seeks to monitor continually, by a multidisciplinary team, the care through consultations, use of medication, control of risk factors and CV outcomes.

The sample size was calculated assuming a significance level of 5%, at a confidence interval of 95%, with an absolute accuracy of 2.5% and an estimated frequency of concurrence of other risk factors associated with hypertension of 73.4[7]% (Lessa et al., 2004) with an estimated frequency of 25% of the patients with controlled BP, according to Burt et al., 1995. Based on these parameters, we obtained 1,298 individuals.

From an initial database of 14,000 patients enrolled in the CRHD, we randomly selected the participants for the study.

We included individuals of both genders (18 to 95 years), diagnosed with hypertension and undergoing regular treatment, registered at the CRHD between 2003 and 2012 until six months before starting data collection. Exclusion criteria included inability or refusal to sign the consent form, participation in other research protocols, presence of type 1 diabetes mellitus (DM), inability to locate the subject in two home visits, and incomplete initial consultation form.

We analyzed data from medical records pertaining the admission to the Center, and then followed up the individuals with new data collection during home visits. The instruments used on the admission to the CRHD and during home visit contained information related to anthropometric parameters, personal data, BP measurements, sedentary lifestyle, smoking, alcohol consumption, DM, dyslipidemia, stroke, AMI, chronic renal failure (CRF), and coronary artery bypass grafting (CABG).

We considered individuals as smokers if they consumed at least one cigarette a day[8]. Alcohol intake was reported by the patient as present or not, without amount quantification. We defined as physically active those individuals who reported engaging in any physical activity at least 3 times a week for at least 30 minutes each time.

The investigation of the diet was simplified and the individuals were asked if they were in a low-sodium, low-calorie, low-carbohydrate or low-fat diet. The use of medication was assessed during home visits through medical prescription and/or visual confirmation of the medications.

The presence of DM and dyslipidemia was determined by evaluating existing biochemical tests which confirmed the disorder, or use of specific medications. In the absence of both, we performed a rapid test of blood glucose with a glucometer (ACTIVE®, model Accu-Chek), and a lipid profile with biochemical analysis performed in a laboratory of the public health system (SUS).

Cardiovascular outcomes considered in the study were AMI, CABG, stroke, CRF and death. The investigation of these outcomes was performed based on report by the participant, a family member or a companion, by complementary tests, medical records or death certificate.

We calculated the body mass index (BMI) using the Quetelet index[9]. The weight was measured with the participant without shoes, using a calibrated electronic scale (Toledo®), with an accuracy of 100 g. The height was measured with an inextensible tape measure 150 inches long, set 50 inches above the ground.

The BP measurement on admission was performed with a calibrated aneroid sphygmomanometer (Preminum®). During home visits, the BP was measured with a digital, calibrated and validated automated sphygmomanometer (OMRON 710 CP). We performed two measurements with 1 minute interval between each and considered for analysis the average between them. Both measurements were performed according to the VI Brazilian Guidelines on Hypertension (2010).

Statistical Analysis

The statistical analysis was performed with the software SPSS v.20.0®. To verify the normality of the data distribution we used the Kolmogorov-Smirnov test. For correlation between variables, we calculated the correlation coefficient of Pearson or Spearman. To compare means between related groups, we used the Wilcoxon test, Student's t test or ANOVA and the McNemar's test to compare categorical variables at different moments. To compare proportions, we used the chi-square test (χ^2). For all tests, we considered a significance level of 5% and a confidence interval of 95%.

Results

The initial sample (admission phase) consisted of 1,299 participants. Of these, 123 were not found for the 2nd phase in two contact attempts and/or refused to participate in the study and were replaced by other participants of the initial database. The final sample (home visit) consisted of 1,227 individuals, with 72 deaths recorded.

The mean age was 56.7±13.1 years (minimum of 18 years and maximum of 95 years), 60.9% were females and 45.3% were in the age range above 60 years.

The frequency of elderly individuals at the admission to the CRHD was 45.3% (n = 588), of which 63.0% (n = 320) were males.

Regarding risk factors for CV disease, besides hypertension, we observed at the beginning of the study that 59.4% (n = 772) were sedentary, 21.2% (n = 275) were smokers, 1.3% (n = 17) consumed alcohol, 25.3% (n = 329) were diabetics, 1.5% (n = 20) reported dyslipidemia and 66.8% (n = 858) were overweight.

In the beginning of the study, 9.9% (n = 128) of the cohort reported a history of stroke, the same number of participants reported AMI, 12.7% (n = 165) reported CRF and 1.1% (n = 14) reported CABG.

The risk factors for CV diseases were also observed equally between men and women, except for excess weight, which was significantly higher among women. As for initial CV outcomes, we observed among men significantly higher frequencies of stroke and CRF.

Analysis of the risk factors and CV outcomes relative to the age range (< 60 years and > 60 years) showed no significant differences.

Upon admission, 914 patients (70.4%) had a BP outside the control targets. Among diabetics, it was also elevated the

Original Article

number of individuals (n = 295) without adequate BP control, corresponding to 89.7% of those.

Of 1,299 participants initially analyzed, 1,227 were reevaluated at home visits. The mean follow-up was 4.5 ± 2.2 years (median 5 years), with a maximum of 9 years and a minimum of 1 year.

Over time, there was a significant increase in the presence of CV risk factors among the participants, with the exception of smoking for which there were no changes (Table 1).

As for CV outcomes, we observed during the home visit a significantly higher frequency of stroke and CABG, and a lower frequency of CRF (Table 2).

In both phases of the study, there was a predominance of hypertensive and overweight individuals from both genders, which showed significant increase during follow-up (Table 3).

From admission to home visits, there was a significantly greater percentage of patients with controlled BP (Table 4).

Of the deaths that occurred during follow-up, 87.5% (n = 63) were due to CV diseases. There was no statistically significant difference in the frequency of deaths according to the age range (< 60 years and > 60 years).

Discussion

In the study cohort, there was a predominance of women (p < 0.01), which was probably related, among other reasons, to an inability of men to attend appointments during the available hours of operation of the health services. Similar results were also shown by Nascente et al, 2010[10] and during the last phase of the National Health and Nutrition Examination Survey (NHANES VI)[11].

The present study showed a large number of overweight participants, which were most frequently women. Similar results were also observed in Goiânia[7], Cuiabá[12], Nobres[13], and São Luiz[14]. This fact shows the importance of excessive weight as a risk factor and additional obstacle for improved hypertension control.

The investigation showed an increased rate of sedentary lifestyle (p < 0.01) during follow-up, which affected 76.3% of the participants. This result is similar to that reported by Duncan et al.[15] who found only 30% of the subjects practicing regular physical activity. This is another factor which prevents a more effective implementation, since evidence indicates that a regular routine of exercise lowers BP and reduces CV mortality by 30%[16].

The possibility of association between hypertension and DM is 50%, which not infrequently requires management of both diseases in the same individual. This is compounded by the fact that this association enhances microvascular and macrovascular damages arising from both diseases, causing high cardiovascular and cerebrovascular morbidity[1]. Effective treatment for these patients with high CV risk is crucial[17]. This study also showed

Table 1 – Presence of cardiovascular (CV) risk factors at baseline and at follow-up (Rio Verde - GO, 2012)

Variables	Admission (n = 1,299)		Follow-up (n = 1,227)		
	n	%	n	%	p*
Sedentarism					
Yes	772	59.4	936	76.3	0.00
No	527	40.6	291	23.7	
Smoking					
Yes	275	21.2	268	21.8	0.73
No	1,024	78.8	959	78.2	
Alcoholism					
Yes	17	1.3	157	12.8	0.00
No	1,282	98.7	1,070	87.2	
Diabetes mellitus					
Yes	329	25.3	415	31.9	0.00
No	970	74.7	812	66.2	
Dyslipidemias					
Yes	20	1.5	367	29.9	0.00
No	1,279	98.5	860	70.1	
Excessive weight					
Yes	858	66.1	875	71.3	0.00
No	427	32.9	352	28.7	

(*) McNemar's test.

Guimarães Filho et al.
Progression Of Pressure And Outcomes In Hypertensive Individuals

Original Article

Table 2 – Distribution of cardiovascular (CV) outcomes at admission and at follow-up (Rio Verde - GO, 2012)

Variables	Admission (n = 1,299)		Follow-up (n = 1,227)		
	n	%	n	%	p*
Stroke					
Yes	128	9.9	152	12.4	0.003
No	1,171	90.1	1,075	87.6	
AMI					
Yes	128	9.9	129	10.5	0.372
No	1,171	90.1	1,098	89.5	
CRF					
Yes	165	12.7	129	10.5	0.00
No	1,134	87.3	1,098	89.5	
CABG					
Yes	14	1.1	79	6.4	0.00
No	1,285	98.9	1,148	93.6	

(*) McNemar test.
AMI: Acute myocardial infarction; CRF: Chronic renal failure; CABG: Coronary artery bypass grafting.

Table 3 – Changes in body mass index (BMI) at admission and at follow-up according to gender (Rio Verde - GO, 2012)

BMI	Admission	Follow-up	
	(n = 1,299)	(n = 1,227)	
	Mean ± SD	Mean ± SD	p*
Male	27.2 ± 5.1	27.6 ± 5.2	0.00
Female	28.9 ± 6.6	29.3 ± 6.6	0.00

(*) Wilcoxon sign test.
SD: Standard deviation.

Table 4 – Progression of the rate of blood pressure (BP) control at baseline and at follow-up (Rio Verde - GO, 2012)

	Admission		Follow-up				
	n	%	n	%	p*	RR	CI
Uncontrolled BP	914	70.4	741	60.4	0.00	1.2	1.1-1.4
Controlled BP	385	29.6	486	39.6			
Total	1,299	100.0	1,227	100.0			

(*) McNemar's test.
CI: confidence interval; RR: Risk ratio.

higher presence of DM during follow-up (p < 0.01) which can also be a limiting factor for better control of hypertension and CV outcomes.

The complications associated with higher frequency of hypertension and/or DM were stroke and AMI. Similar results were observed by Moreira and Santos in Fortaleza in 2012[18].

Regarding stroke, which is closely related to BP values, it has been occurring at an increasingly earlier age in Brazil[19]. A study in a northeastern region of the country in 2012 also demonstrated that this complication was the most frequent in 6.2% of the hypertensive patients registered in the records analyzed[18]. Brescacin et al.[20], in a study published in 2010, showed that long-standing hypertension is

Original Article

one of the main reasons for a reduction in life expectancy in subjects with stroke. The present study showed that such complication was more frequent among hypertensive individuals, both at admission and during follow-up, even in those with better BP control. The explanation may be the low effectiveness of BP control achieved by the program, and eventually by a greater association with other comorbidities, such as the increased presence of excessive weight and even, age progression.

Coronary heart disease, including AMI, is one of the most common CV outcomes of hypertension[21,22]. In this study, AMI was the second most frequent complication (10.5%) , similar to that observed in another study, but with an incidence of 4.4%. Among these, half were hypertensive, whereas the other half had hypertension and DM, confirming the significant association with such complication[6].

The INTERHEART study, which was a multicentric international study planned to systematically assess the importance of risk factors for coronary heart disease in the world, has confirmed that the traditional risk factors explained more than 90% of the risk attributable to AMI[23]. The study AFIRMAR[24], performed in 104 hospitals in 51 Brazilian cities, presented virtually identical findings.

Hypertension is closely related to CRF, and may be the cause or the consequence of the renal disease[25]. A study conducted in the northeast area of Brazil showed 4.4% of CRF, in which half of these subjects were hypertensive and the other half had association of hypertension and DM[18]. In the present study, surprisingly, we observed a significant decrease in the percentage of individuals with CRF, from 12.7% to 10.5%. The fact that the collection of this variable has been recounted by the patient at the stage of admission in detriment of biomedical criteria for diagnosis of the disease was a major limitation of the study and may explain this result.

A significant increase in risk factors and CV complications evidenced in this investigation over five years may be explained by the aging of the population itself, since age is a major risk factor for hypertension and consequently, for their CV outcomes. However, one must consider that the collection of retrospective data (on the admission to the Center) may have represented a bias, which led to some of the results found[26,27].

The results obtained are far from ideal , since only 39.6% of the patients obtained BP control in the final evaluation and, as incredible as it may seem, this percentage is among the best reported in the literature[26,28-30].

Similar results were observed in the American study NHANES (2003 -2004), which showed BP controlled in 36.8%[11].

Similarly in Brazil, among hypertensive patients registered in the program HIPERDIA in the city of Novo Hamburgo, Rio Grande do Sul, the control of hypertension reached 33.7%[31].

Also in the State of Rio Grande do Sul, a recent investigation[32] found that only 10.4% of the individuals undergoing antihypertensive treatment had adequately controlled BP levels, whereas the CARMELA study[33] showed a rate of BP control of 24%.

If we take into account the philosophy and the objectives for which the CRHD medical unit was created, an alert message should be recorded with the results found. Clearly, there have been significant advances in the structure and form of care, but the results are still not ideal.

There is a clear need for a critical reassessment of these projects, but it is fundamental to reorganize all primary care. This should be based on a better working relationship with valorization of health professionals (creation of a formal career in health care), in the restructuring of multidisciplinary teams with defined responsibilities, and reorganization of the service itself, with decentralized installations, operation on alternative schedules, valorization of health promotion, and home visits.

Within this line of reasoning, special attention should be paid to care regarding medication adherence to changes in lifestyle habits, with the implementation of continuing education in real hopes of lowering cardiovascular outcomes[26,28].

This study has the limitations of studies that use in part retrospectively collected data. An important example is the possibility of an underestimation of metabolic changes that were mentioned in the first assessment and which were information effectively obtained from measurements at follow-up visits, which can simulate falsely higher values in the second stage. Despite these limitations, the sample size, and the fact that the final data collection was conducted during home visits, this study offers security for those who consider the provided information sufficiently consistent, to indicate paths in search of an improvement in the primary care population in one of the areas of greatest need and importance.

Conclusions

The results of this study show that, despite the improvement in the rates of BP control, there was a significant increase in risk factors and CV outcomes in the participants undergoing intervention by the CRHD compared with their stage of admission to the unit. It is noteworthy, therefore, the importance of evaluating mechanisms from the earliest stages, so that over time there is an adequate assessment of the developments of the quality of care.

Author contributions

Guimarães Filho et al.
Progression Of Pressure And Outcomes In Hypertensive Individuals

Original Article

References

1. Sociedade Brasileira de Cardiologia, Sociedade Brasileira de Hipertensão, Sociedade Brasileira de Nefrologia. VI Diretrizes brasileiras de hipertensão arterial. Rev Bras Hipertens. 2010;95 (1suppl 1):1-51.

2. Fields LE, Burt VL, Cutler JA, Hughes J, Roccella E, Sorlie P. The burden of adult hypertension in the United States 1999 to 2000: a rising tide. Hypertension. 2004;44(4):398-404.

3. Passos VM, Assis TD, Barreto SM. Hipertensão arterial no Brasil: estimativa de prevalência a partir de estudos de base populacional. Epidemiol Serv Saúde. 2006;15(1):35-45.

4. Kearney PM, Whelton M, Reynolds K, Muntner P, Whelton PK, He J. Global burden of hypertension: analysis of worldwide data. Lancet. 2005;365(9455):217-23.

5. Williams BD. The year in hypertension. J Am Coll Cardiol. 2010;55(1):65-73.

6. Ibrahim MM, Danaei AD, Finucane MM, Lin JK; Global Burden of Metabolic Risk Factors of Chronic Diseases Collaborating Group (Blood Pressure). National, regional, and global trends in systolic blood pressure since 1980: systematic analysis of health examination surveys and epidemiological studies with 786 country-years and 5.4 million participants. Lancet. 2011;377(9765):568-77.

7. Jardim PC, Gondim MR, Monego ET, Moreira HG, Vitorino PV, Souza WK, et al. Hipertensão arterial e alguns fatores de risco em uma capital brasileira. Arq Bras Cardiol. 2007;88(4):452-7.

8. Ministério da Saúde. Fundação Nacional de Saúde. Inquérito domiciliar sobre comportamentos de risco e morbidade referida de doenças e agravos não transmissíveis. Brasília (DF); 2011.

9. World Health Organization. (WHO). The World Health Report 2002: reducing risks, promoting healthy life. Geneva; 2002.

10. Nascente FM, Jardim PC, Peixoto MR, Monego ET, Moreira HG, Virotino PV, et al. Hipertensão arterial e sua correlação com alguns fatores de risco em cidade brasileira de pequeno porte. Arq Bras Cardiol. 2010;95(4):502-9.

11. Ong KL, Cheung BM, Man YB, Lau CP, Lam KS. Prevalence, awareness, treatment, and control of hypertension among United States adults 1999-2004. Hypertension. 2007;49(1):69-75.

12. Franco GP, Scala LC, Alves JC, França GV, Cassanelli T, Jardim PC. Síndrome metabólica em hipertensos de Cuiabá-MT: prevalência e fatores associados. Arq Bras Cardiol. 2009;92(6):472-8.

13. Rosário TM, Scala LC, Araújo GV, França GV, Jardim PC. Prevalência, controle e tratamento da hipertensão arterial sistêmica em Nobres-MT. Arq Bras Cardiol. 2009;93(6):622-8, 672-8.

14. França AK, Santos AM, Calado IL, Santos EM, Cabral PC, Salgado JV, et al. Filtração glomerular e fatores associados em hipertensos atendidos na Atenção Básica. Arq Bras Cardiol. 2010;94(6):779-87.

15. Duncan BB, Stevens A, Schmidt MI. Mortalidade por doenças crônicas no Brasil: situação em 2010 e tendências de 1991 a 2010. In: Ministério da Saúde, Brasil 2011. Brasília, DF. 2012. p. 95-103.

16. Guedes NG, Lopes MV, Moreira RP, Cavalcante TF, Araújo TL. Prevalence of sedentary lifestyle in individuals with high blood pressure. Int J Nurs Terminol Classif. 2010;21(2):50-6.

17. Danaei G, Finucane MM, Lu Y, Singh GM, Cowan MJ, Farzadfar F, et al; Global Burden of Metabolic Risk Factors of Chronic Diseases Collaborating Group (Blood Glucose). National, regional, and global trends in fasting plasma glucose and diabetes prevalence since 1980: systematic analysis of health examination surveys and epidemiological studies with 370 country-years and 2.7 million participants. Lancet. 2011;378(9785):31-40.

18. Santos JC, Moreira TM. Fatores de risco e complicações em hipertensos/diabéticos de uma regional sanitária do nordeste brasileiro. Rev esc enferm USP. 2012;46(5):1125-32.

19. Malta DC, Moura L, Souza FM, Rocha FM, Fernandes FM. Doenças crônicas não transmissíveis: mortalidade e fatores de risco no Brasil, 1990 a 2006. In: Ministério da Saúde. Saúde Brasil 2008: 20 anos de Sistema Único de Saúde (SUS). Brasília; 2009.

20. Brescacin L, Alonzo C, Zurru MC, Brienza S, Ortega F, Romano M, et al. Secondary stroke prevention in the very erdely in real life. J Hypertens. 2010;28(Suppl A):139-42.

21. Kannel WB. Blood pressure as a cardiovascular risk factor: prevention and treatment. JAMA. 1996;275(20):1571-6.

22. National High Blood Pressure Education Program Working Group report on primary prevention of hypertension. Arch Intern Med. 1993;153(2):186-208.

23. Yusuf S, Hawken S, Ounpuu S, Dans T, Avezum A, Lanas F, et al. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study. Lancet.2004;364(9438):937-52.

24. Piegas LS, Avezum A, Pereira JC, Rossi Neto JM, Hoepfner C, Farran JA, et al; AFIRMAR Study Investigators. Risk factors for myocardial infarction in Brazil. Am Heart J. 2003;146(2):331-8.

25. Moreira HG, Sette JB, Keiralla LC, Alves SG, Pimenta E, Sousa M, et al. Diabetes mellitus, hipertensão arterial e doença renal crônica: estratégias terapêuticas e suas limitações. Rev Bras Hipertens. 2008;15(2):111-6.

26. Pereira MR, Coutinho MS, Freitas PF, D'Orsi E, Bernardi A, Hass R. Prevalência, conhecimento, tratamento e controle de hipertensão arterial sistêmica na população adulta urbana de Tubarão, Santa Catarina, Brasil, em 2003. Cad Saúde Pública. 2007;23(10):2363-74.

27. Longo GZ, Neves J, Luciano VM, Peres MA. Prevalence of high blood pressure levels and associated factors among adults in Southern Brazil. Arq Bras Cardiol. 2009;93(4):387-94, 380-6.

28. Zattar LC, Boing AF, Giehl MWC, D'Orsi E. Prevalência e fatores associados à pressão arterial elevada, seu conhecimento e tratamento em idosos no sul do Brasil. Cad Saúde Pública. 2013;29(3):507-21.

29. Cipullo JP, Martin JF, Ciorlia LA, Godoy MR, Cação JC, Loureiro AA, et al. Hypertension Prevalence and Risk Factors in a Brazilian Urban Population. Arq Bras Cardiol. 2010;94(4):519-26.

30. Basu S, Millett C. Social epidemiology of hypertension in middle-income countries: determinants of prevalence, diagnosis, treatment, and control in the WHO SAGE Study. Hypertension. 2013;62(1):18-26.

31. de Souza CS, Stein AT, Bastos GA, Pellanda LC. Controle da pressão arterial em hipertensos do Programa Hiperdia: estudo de base territorial. Arq Bras Cardiol. 2014;102(6):571-8.

32. Gus I, Harzheim E, Zalavsky C, Medina C, Gus M. Prevalência, reconhecimento e controle da hipertensão arterial sistêmica no estado do Rio Grande do Sul. Arq Bras Cardiol. 2004;83(5):429-33, 424-8.

33. Hernández-Hernández R, Silva H, Velasco M, Pellegrini F, Macchia A, Escobedo J, et al. CARMELA Study Investigators. Hypertension in seven Latin American cities: the Cardiovascular Risk Factor Multiple Evaluation in Latin America (CARMELA) study. J Hypertens. 2010;28(1):24-34.