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ORIGINAL ARTICLE / *ARTIGO ORIGINAL*

Adequacy of sphygmomanometer cuff to brachial circumference of people attended in Primary Health Care Centers

Adequação do manguito do esfigmomanômetro às medidas de circunferência braquial em pessoas atendidas na Atenção Primária

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ABSTRACT: ***Objective:*** To evaluate the adequacy of sphygmomanometer cuff to brachial circumference (BC) of individuals treated at Primary Health Care Centers. ***Methods:*** Epidemiological, observational, and quantitative cross-sectional study. A total of 381 blood pressure (BP) readings conducted by nursing professionals were observed at 18 service units selected by drawing, considering two modalities of care centers. The correct use of the cuff was the main outcome variable. The BC was measured using inelastic measuring tape. The tests used for statistical analysis were Student's t-test, χ^2, or Fisher's exact test. ***Results:*** The measurement of BC ranged from 19.5 to 45.0 cm (mean = 30.4; standard deviation – SD = 4.3). Among the BP measurements, 218 (57.2%) of them were conducted with the appropriately sized cuff, being more frequent in the units with Family Health Teams (59.6 versus 40.4; $p < 0.001$). Ninety-three (24.2%) BC measurements were < 27 cm and 63 (16.5%) were > 34 cm. The adult cuff was used correctly 209 (59.4%) times and the large adult cuff was used correctly 9 (31.0%) times. ***Conclusion:*** The study found an inadequacy in the use of the cuff in 42.8% of blood pressure readings in the Primary Health Care Centers. Similar studies should be performed in other cities and areas to estimate the effect of this problem in the diagnosis and monitoring of systemic arterial hypertension (SAH).

Keywords: Hypertension. Blood pressure determination. Primary Health Care. Epidemiology. Family health. Health evaluation.

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RESUMO: ***Objetivo:*** Avaliar a adequação do manguito às medidas de circunferência braquial (CB) em pessoas atendidas na Atenção Primária. ***Métodos:*** Estudo epidemiológico do tipo transversal observacional e quantitativo. Foram observadas 381 medidas de pressão arterial (PA), realizadas por profissionais de enfermagem, em 18 serviços de Atenção Primária selecionados por sorteio, considerando 2 modalidades de atenção. O uso correto do manguito foi a principal variável de desfecho. A CB foi medida com fita métrica inelástica. Para análise estatística das variáveis foram utilizados os testes *t* de Student, χ^2 ou exato de Fisher. ***Resultados:*** A medida de CB variou de 19,5 a 45,0 cm (média = 30,4; desvio padrão – DP = 4,3). Observou-se que 218 (57,2%) das medidas foram executadas com o manguito adequado, com maior frequência nas unidades com Equipes de Saúde da Família (59,6 *versus* 40,4; $p < 0,001$). Constatou-se 93 (24,2%) medidas de CB < 27 cm e 63 (16,5%) medidas de CB > 34 cm. O manguito adulto foi usado corretamente 209 (59,4%) vezes e o manguito adulto grande, 9 (31,0%) vezes. ***Conclusão:*** O estudo constatou uma inadequação no uso do manguito em 42,8% das medidas de PA na Atenção Primária à Saúde (APS). Estudos semelhantes em serviços de outras cidades e regiões devem ser realizados para estimar a magnitude do problema para o diagnóstico e monitoramento de hipertensão arterial sistêmica (HAS).

Palavras-chave: Hipertensão. Determinação da pressão arterial. Atenção Primária à Saúde. Epidemiologia. Saúde da Família. Avaliação em Saúde.

INTRODUCTION

Arterial hypertension (AH) is a multifactorial disease and can be defined as a condition in which systolic blood pressure (SBP) is above or equal to 140 mmHg, or diastolic blood pressure (DBP) is above or equal to 90 mmHg[1]. When an individual is found to be normotensive while using antihypertensive drugs, he or she should also be considered equally hypertensive[2].

Nowadays, AH is considered the most frequent of the chronic cardiovascular diseases. According to the VI Brazilian Guidelines for Hypertension (BGH)[3], overall prevalence in Brazilian cities is higher than 30%, varying from 22.3 to 43.9% depending on the city analyzed. However, for the population between 60 and 69 years of age, this rate increases to 50% and for those above 70 years of age, the rate increases to 75%[4]. Thus, it has become the main risk factor for cerebrovascular accidents, acute myocardial infarction, and chronic kidney disease, in addition to being responsible for 40% of the cases of early retirement and absenteeism in the workplace,[5] and for approximately 12.8% of total deaths worldwide[6], constituting, therefore, in a public health issue.

AH diagnosis directly depends on the environment, on the training of the professional, the technique and the equipment utilized to obtain the blood pressure readings, and the observer[3]. Despite being considered a simple and ordinary activity, errors still occur in the execution of blood pressure (BP) readings, which compromises the accuracy of the results[7,8].

It is known that the length of the cuff, the inflatable chamber of the sphygmomanometer cuff, should cover at least 80% of the brachial circumference (BC). In addition, the width should represent 40% of the arm width[1,4]. The American Heart Association (AHA), the Brazilian Ministry of Health[1,4], as well as the VI BGH[3] advocate the use of the cuff

known as "newborn," with a 4 x 8 rubber bag, for BC ≤ 10 cm and "children" (6x12), which includes BC from 11 to 15 cm; "small adult" (10x17), 20 to 26 cm; "adult" (12x23), 27 to 34 cm; "large adult" (16x32), 35 to 45 cm; and "thigh" (20x42), 46 to 52 cm.

The appropriate choice of cuff in relation to the size of BC is one of the determining factors for the accuracy of the BP reading (class of recommendation I – level of evidence B)[4,9]. This has been a concern since the first years of the 20th century, when H. Von Recklinghausen demonstrated that a large cuff of 4.5 cm was too narrow for adult men and caused mistakenly high readings. In 1926, Korns equally corroborated the influence of the size of the cuff in Korotkoff sounds[8,10-12].

The use of the inadequate cuff can lead to a false high or false low BP reading, leading to a misdiagnosis[3]. However, none of the 179 professionals assessed in the study carried out by Rabello et al[7] measured the BC before choosing a cuff. This inadequate action can have negative repercussions on the health and the quality of life of the patient, as truly hypertensive people may remain without the benefit of drug therapy, and normotensive individuals may mistakenly suffer the side effects of unnecessary medicines[7].

The adult cuff utilized in the majority of cases is 12 x 23 cm on average[4]. For Veiga et al.[13], many individuals included in the AH studies have a metabolic syndrome and the vast majority of them have a brachial circumference above 33 cm; therefore, they need a larger cuff. However, other people, such as young adults, women, thin individuals, or even those of a normal weight, have a BC lower than 27 cm, which demands the use of a smaller cuff. Ostchega et al.[2] affirm that, among men, 44.8% of the population would need a cuff that is two sizes above the adult-sized cuff. For women, 13.5% would need a smaller cuff and 28.1% need a cuff that is larger than the standard size; therefore, 86.4% of the population would have an inadequate BP reading, when only cuff size is taken into consideration.

The Primary Health Care Centers (PHCs) are responsible for the prevention, diagnosis, treatment, and longitudinal monitoring of hypertensive patients. Therefore, each member of the Primary Health Care staff has an imperative role in the adequate control of the BP readings on an individual and collective scope and in the reduction of the morbidity and mortality resulting from this disease. This includes all the way from applying the appropriate measurement technique to the training of professionals and the infrastructure of the workplace[4].

In Blumenau, in the state of Santa Catarina, PHC services are organized in two care modalities. In one of them there are seven general clinics (GCs), which count on general practitioners, pediatricians, obstetrician gynecologists, in addition to nursing, social services, psychology, pharmacy, and dentistry professionals, without a registered population, and treat patients on demand. This modality cares for approximately 40% of the city's population. The other modality is represented by 60 Family Health Strategy (FHS) teams, which are made up by general practitioners, nurses, nursing technicians, and community health agents.

Arcuri[12] affirms that studies which assess or verify procedure or technique patterns are rare, AHA assessed its own recommendations within the medical community. Some studies have observed the effect of the size of the cuff in BP readings, but it is uncommon to find studies that analyze the correct execution of these norms. Considering how important

is the determination and appropriate choice of cuff according to BC to obtain the correct BP measurement, an assessment of the compliance with the guidelines proposed decades ago by international societies is mandatory. This is due to the fact that 90% of adult population is assisted in Primary Care at least once a year[14] and due to the scarce and outdated data on the subject.

In this context, this study aimed at assessing the adequacy of the cuff to the BC in people treated at the Primary Care Centers.

METHODS

This is an epidemiological, observational, and quantitative cross-sectional study.

The study is a part of the project named "Assessment of the Quality of Blood Pressure Readings in the Primary Care Modalities in the Blumenau Regional Unified Health Care System", approved by the Research Ethics Committee from the *Universidade Regional de Blumenau* (protocol CAEE number 38637014.3.0000.5370).

To estimate the errors in the utilization of the cuffs, a sample was calculated considering a frequency of 40% of error in the BP reading procedures, 80% statistical power, 95% confidence interval (95%CI), and precision of 5%, considering 10% loss and refusal, which totaled 406 readings. These readings were observed in people treated at PHC units from the Unified Health System (SUS) in Blumenau, Santa Catarina. In Blumenau, SUS offers 100% coverage in PHC, with 60% of coverage in the FHS modality (with 57 units) and 40% with GCs (7 units). Eighteen units were selected using simple random sampling, with 15 being FHS units and 3 GCs. The quantity of measurements to be conducted in each unit was proportional to the average of clinical production of these units.

In order to be included in the study, participants should be aged 18 years or older and have a routine BP reading performed by the nursing staff (technician or nurse). Those who were undergoing emergency treatments were excluded from the study.

The data were collected in the second semester of 2014 – during the period that services were being provided in each unit, on weekdays and during varying hours – by two trained preventive medicine students. These researchers were instructed, theoretically and practically, as to the correct procedures for BP gauging, especially regarding how to measure the BC.

In the units, students observed the BP reading procedure conducted by the nursing professionals, then measured the BC of the patients with the measuring tape made from inextensible material with a graduation in mm – available at all units – and determined which cuff size was used during the readings.

The outcome variable was "correct use of the cuff." The study variables were PHC modalities (GC or FHS); category of health professional (nurse or nursing technician); time since the last training session for the professionals; participant's characteristics, such as sex, age (in years completed), weight (in kg); BC (in cm); cuff size, "small adult" (10x17), 20 to 26 cm; "adult" (12x23), 27 to 34 cm; "larger adult" (16x32), 35 to 45 cm.

After the data were inputted into electronic databases using double entry, they were submitted to quality control to identify possible inconsistencies. The categorical variables were examined regarding the distribution of frequency and were described using tables. For the continuous variables, the measurements for central tendency (average and median) and variability (amplitude and standard deviation – DP) were calculated. The following tests were applied: Student's t-test to compare the averages and χ^2 or Fisher's exact (when indicated) to compare the categorical variables. A significance level of $p<0.05$ was accepted.

RESULTS

A total of 381 participants and 48 health care professionals were observed – 4 (8.3%) nurses and 44 (91.7%) nursing technicians – in the two Primary Care Center modalities at Blumenau. Among the participants, 174 (45.7%) were treated in GCs and 207 (54.3%) at FHS units, with a predominance of female individuals, represented by 255 (66.9%) women.

The age ranged from 18 to 88 years, with a mean of 44.5 years (SD = 17.1) and a median of 43.7 years. There was no significant age difference between men and women (45.2 versus 44.2; t = 0.5099; p = 0.61). The average weight was 75.2 kg, with men having a higher mean weight compared to women (81.8 versus 71.9; SP = 15.9; t = -0.9635; p < 0.001). The BC measurement varied from 19.5 to 45.0 cm, with the most frequent measurement being 30 cm, for a total of 29 people (7.6%). There was no statistically significant difference between men and women for BC (30.9 versus 30.11; SD = 4.2; t = 1.7678; p = 0.0779). Table 1 characterizes the population observed according to the Primary Care modality where they were treated.

Table 1. Participants' characteristics (n=381).

Variables	Total (%)	Primary Health Care Center Modality	
		General Clinic (%)	Family Health Strategy (%)
Sex*			
Male	126 (33.1)	56 (44.4)	70 (55.6)
Female	255 (66.9)	118 (46.3)	137 (53.7)
Variables	**Average (DP)**	**Average (DP)**	**Average (DP)**
Average age (years)**	44.5 (17.1)	40.4 (15.9)	48.2 (17.3)
Average weight (kg)***	75.2 (15.9)	74.3 (16.5)	75.9 (15.4)
Average brachial circumference (cm)****	30.4 (4.3)	29.9 (4.6)	30.8 (3.9)

*χ^2 test = 0.11; p = 0.736; **Student's t-test = -4.466; p < 0.0001; ***Student's t-test = -0.964; p = 0.336; ****Student's t-test = -2.036; p = 0.043; SD: standard deviation.

The health care professionals only measured the BC in two observations, both at the FHS ($\chi^2 = 1.69$; $p = 0.194$) and the choice of cuff was inadequate in both the cases. Only 11 (22.9%) nursing professionals reported they had received some training to execute this procedure. They reported an average of 103.6 months (SD =39.2) since their last training session.

In relation to the size of the cuff utilized, the small adult (10x17) was not utilized in any situation. The BCs were categorized according to the range of cuffs sizes available (Table 2).

The correct use of the cuff occurred in 218 (57.2%) measurements, with the adult size being correctly used in 209 (59.4%) of them and the large adult in 9 (31.0%) of them. Table 3 shows the BC and the size of the cuff utilized in the BP readings. The adequate choice by PHC modality is shown in Table 4.

Table 2. Brachial circumference and cuff size, by type of health unit.

Variables	Total (%)	Primary Health Care Center Modality	
		General Clinic (%)	Family Health Strategy (%)
Brachial circumference*			
< 27	93 (24.4)	53 (57.0)	40 (43.0)
27 to 34	225 (59.1)	90 (40.0)	135 (60.0)
> 34	63 (16.5)	31 (49.2)	32 (50.8)
Cuff size**			
Adult (12 x 23)	352 (92.4)	152 (87.4)	200 (96.6)
Large adult (16 x 32)	29 (7.6)	22 (12.6)	7 (3.4)
Total	381 (100)	174 (45.7)	207 (54.3)

*χ^2 test = 8.04; p = 0.018; **χ^2 test = 11.53; p = 0.001.

Table 3. Association of brachial circumference with cuff size.

Brachial circumference (cm)	Total (%)	Cuff size	
		Adult (%) (12 x 23)	Large adult (%) (16 x 32)
< 27	93 (24.4)	89 (95.7)	4 (4.3)
27 to 34	225 (59.1)	209 (92.9)**	16 (7.1)
> 34	63 (16.5)	54 (85.7)	9 (14.3)**
Total	381 (100.0)	352 (92.4)	29 (7.6)

*χ^2 test = 5.52; p = 0.063; **correct use.

No statistically significant association was found between the correct type of cuff and the type of professional studied (nursing technician or nurse). Similarly, there was no association with the time of training.

DISCUSSION

This study found that approximately 40% of BP readings conducted at the PHC at Blumenau are conducted with inadequate cuffs in relation to the BC, which can lead to errors in AH diagnoses and monitoring AH treatments. This proportion was worse at the GC modality than at the FHS units and measuring BC was an uncommon practice among the nursing professionals studied.

In 93 of the observations whose patient's BC was smaller than 27 cm, the cuff sizes used by the professionals were adult or large adult, even tough they needed smaller cuff sizes. Therefore, in this situation, the SBP is known to be probably underestimated by 5 to 11 mmHg and the DBP by 3 to 7 mmHg (the minimum alteration occurs when the BC is closer to 27 cm, and the maximum when the BC is lower), which may hinder the diagnosis of arterial hypertension, or may result in insufficient treatment for the disease, increasing the risk of cardiac, cerebral, and renal-vascular repercussions, among others[3,4,6,13].

Another error that was observed in this study was the use of adult cuff unsuitable for the BC, a practice described in various national and international studies which show inaccurate results in blood pressure readings[15-18] for people with a BC from 27 to 34 cm. This attitude may result in underestimation of the SBP by 2 to 5 mmHg and DBP by 1 to 4 mmHg[19], exposing these individuals to the consequences mentioned earlier.

Among 63 participants whose arms were wider than 34 cm, 54 of them had their BP measured with the adult cuff. In these cases, the overestimation of SBP may vary from 4 to 11 mmHg and the DBP from 3 to 11 mmHg (the maximum alteration occurs when the BC is larger and the minimum alteration occurs when the BC is closer to 34 cm)[19]. This may lead to a misdiagnosis of systemic hypertensive disease or to overtreatment of AH, exposing the person to the side effects of unnecessary medication, such as dizziness and falls[3,13,20].

Table 4. Relationship between the correct cuff choice and the health unit type.

Use of adequate cuff	Total (%)	Primary Health Care Center Modality	
		General Clinic (%)	Family Health Strategy (%)
Yes	218 (57.2)	88 (40.4)	130 (59.6)
No	163 (42.8)	86 (52.8)	77 (47.2)
Total	381 (100.0)	174 (45.7)	207 (54.3)

*χ^2 test = 5.77; p = 0.016.

The fact that BC was measured only twice by health professionals stands out. In one of those occasions, the choice of the cuff was inappropriate. This is in line with the results presented by Rabello et al.[7], who found that none of the professionals observed in his study measured the BC. This can be partially explained by structural factors or the work processes. In the first case, the absence of adequate cuffs and/or measuring tapes in the health units prevented the measurements. With respect to the work processes, the unsatisfactory level of knowledge of the technician due to insufficient training, the negligent professional behavior in following the recommendations on BP reading due to lack of supervision, or shortage of professionals who conduct multiple activities could explain the omission of this procedure[21,22]. Silva et al.[23] identified the lack of adequate cuffs in 85% of units and lack of training in approximately 75% of nursing professionals from the PHC at the SUS in Maringá, Paraná.

No study was found comparing the BC measurements with the use of cuffs among the different modalities of Primary Care Centers from SUS. However, similar to other studies on Primary Care Centers[2,7,11,15-18], a predominance of female patients was found. The mean age of 44.5 years found in the present study is quite similar to the study by Bakx et al.[18], but inferior to the mean age showed by Veiga et al.[13].

It is important to highlight that this study found a larger portion of people with a BC from 27 to 34 cm in the FHS units. Another fact that stood out is that the number of adequate choices of cuffs sizes in the GCs is lower than the adequate choices in the FHS units; of the 218 correct choices, 59.6% occurred at FHS units (this finding did not seem to be associated to the type of nursing professional or the length of their training). From this total, 209 were for people who needed the adult-sized cuff. Thus, the choice of cuff without previously measuring the BC could be due to the fact that most participants had a BC from 27 to 34 cm at the FHS units and not necessarily due to a higher mastery of the technique by the professionals from these units.

Chaves et al.[11], in their study on children, affirm that the standard-sized cuff is used indiscriminately, without a distinction concerning physical structure. In our study, 92.4% of the BP readings were conducted with the 12x23 cuff, similar to that found in the study by Freitas et al.[15], in which all readings were conducted with the adult cuff. At the PHCs analyzed in Blumenau, 42.8% of participants would have needed a different cuff than the one employed, similarly to what was highlighted by the author mentioned earlier (50%). It is important to highlight that all units studied had at least two sizes of cuffs available.

The Brazilian Institute of Geography and Statistics (IBGE)[24] estimates that in 2014, the Brazilian population was equivalent to 202 million people, with approximately 67% adults[25]. Considering that 90% of the population could be treated at Primary Care Centers at least once a year[1], it is estimated that at least 121.8 million BP measurements could be performed during a year. Applying the results found in our study, we could assume that 52.1 million Brazilians would have an incorrect BP reading. If the statistics were representative of the national population, 34.8 million would have an underestimated BP reading and 17.3 million an overestimated reading, which could negatively impact public health.

It is estimated that over 40.6 million Brazilians will be hypertensive in 2014, considering the estimates of the 30% of adults with AH[1,3]. Among them, only 406 thousand to 6.1 million (1 to 15%) will be controlled[1]. This low estimate of effectiveness in controlling AH could be partially due to the inadequacy in the cuffs utilized in monitoring the BP of individuals, which can generate anxiety for doctors and patients as well as public health costs.

This study presents some limitations. As it is a cross-sectional study, it does not allow for casual inferences based on the results found. A convenience sample was used in this study, which could hinder the internal validity of the results. However, given the sample size and its distribution among various health units in various days and times, it is possible to assume that this problem is minimized. Finally, it is worth remembering that the BP values can be affected by various factors linked to the person, equipment, and work process utilized by the professional conducting the measurement, with the adequacy of the cuff being only a part of the procedure.

CONCLUSIONS

Our study show an inadequacy in the use of cuffs in 42% of the BP measurements conducted in the PHC. Similar studies in services provided in other cities and areas should be conducted to estimate the magnitude of this issue within the SUS context and their possible consequences for public health and the individual treatment for people with AH.

REFERENCES

1. Brasil. Ministério da Saúde. Estratégias para o cuidado da pessoa com doença crônica: hipertensão arterial sistêmica. Cadernos de Atenção Básica nº 37. Brasília: Ministério da Saúde; 2013. 128 p. Disponível em: <http://189.28.128.100/dab/docs/portaldab/publicacoes/caderno_37.pdf> (Acessado em 12 de novembro de 2014).
2. Ostchega Y, Hughes JP, Zhang G, Nwankwo T, Chiappa MM. Mean mid-arm circumference and blood pressure cuff sizes for U.S. adults: National Health and Nutrition Examination Survey, 1999-2010. Blood Press Monit 2013; 18(3): 138-43.
3. Sociedade Brasileira de Cardiologia/Sociedade Brasileira de Hipertensão/Sociedade Brasileira de Nefrologia. VI Diretrizes Brasileiras de Hipertensão. Arq Bras Cardiol 2010; 95(Suppl. 1): 1-51.
4. Brasil. Ministério da Saúde. Hipertensão arterial sistêmica para o Sistema Único de Saúde. Cadernos de Atenção Básica nº 15. Série A. Normas e Manuais Técnicos. Brasília: Ministério da Saúde; 2006.
5. Veiga EV. Esfigmomanometria indireta e a prática clínica: reflexões e perspectivas [tese de doutorado]. Ribeirão Preto: Universidade de São Paulo; 2003.
6. World Health Organization (WHO). Global status report to non-communicable diseases. Geneva: WHO; 2010.
7. Rabello CCP, Pierin AMG, Mion Junior D. O conhecimento de profissionais da área da saúde sobre a medida da pressão arterial. Rev Esc Enferm USP 2004; 38(2): 127-34.
8. Araujo TL, Arcuri EAM, Martins E. Instrumentação na medida da pressão arterial: aspectos históricos, conceituais e fontes de erro. Rev Esc Enferm USP 1998; 32(1): 33-41.
9. Sociedade Brasileira de Hipertensão (SBH). Introdução e conceitos básicos. Revista Hipertensão 2011; 14(1): 6-11.
10. Introcaso L. História da medida da pressão arterial: 100 anos do esfigmomanômetro. Arq Bras Cardiol 1996; 67(5): 305-11.

11. Chaves ES, Guedes NG, Moreira RP, Cavalcante TF, Lima REF, Araújo TL. Manguitos de largura correta: levantamento em um grupo específico de crianças e adolescentes. Rev RENE 2004; 5(2): 35-40.
12. Arcuri EAM. Fatores de erro na medida da pressão arterial: a influência do manguito. Rev Hipertens 2011; 14(2): 21-32.
13. Veiga EV, Arcuri EAM, Cloutier L, Santos JLF. Medida da pressão arterial: circunferência braquial e disponibilidade de manguitos. Rev Latino-Am Enfermagem 2009; 17(4): 455-61.
14. Sharma AM, Wittchen HU, Kirch W, Pittrow D, Ritz E, Göke B, Lehnert H, Tschöpe D, Krause P, Höfler M, Pfister H, Bramlage P, Unger T; HYDRA Study Group. High prevalence and poor control of hypertension in primary care: cross-sectional study. J Hypertension 2004; 22(3): 479-86.
15. Freitas CCQ, Pantarotto RFR, Costa LRLG. Relação circunferência braquial e tamanho de manguitos utilizados nas Unidades Básicas de Saúde de uma cidade do interior paulista. J Health Sci Inst 2013; 13(3): 48-52.
16. Arcuri EAM, Rosa SCD, Scanavini RM, Denzin GSC. Medida da pressão arterial no braço e antebraço em função do manguito. Acta Paul Enferm 2009; 22(1): 37-42.
17. Couto MT, Pinheiro TF, Valença O, Machin R, Silva GSN, Gomes R, et al. O homem na atenção primária à saúde: discutindo (in)visibilidade a partir da perspectiva de gênero. Interface (Botucatu) 2010; 14(33): 257-70.
18. Bakx C, Oerlemans G, van den Hoogen H, van Weel C, Thien T. The influence of cuff size on blood pressure measurement. J Hum Hypertens 1997; 11(7): 439-45.
19. Maxwell MH, Waks AU, Schroth PC, Karam M, Dornfeld LP. Error in blood-pressure measurement due to incorrect cuff size in obese patients. Lancet 1982; 2(8288): 33-6.
20. Mourad JJ, Lopez-Sublet M, Aoun-Bahous S, Villeneuve F, Jaboureck O, Dourmap-Collas C, et al. Impact of miscuffing during home blood pressure measurement on the prevalence of masked hypertension. Am J Hypertens 2013; 26(10): 1205-9.
21. Veiga EV, Nogueira MS, Cárnio EC, Marques S, Lavrador MAS, Moraes AS, et al. Avaliação de técnicas da medida da pressão arterial pelos profissionais de saúde. Arq Bras Cardiol 2003; 80(1): 83-9.
22. .Arcuri EAM, Araújo TL, Veiga EV, Oliveira SMJV, Lamas JLT, Santos JLF. Medida da pressão arterial e a produção científica de enfermeiros brasileiros. Rev Esc Enferm USP 2007; 41(2): 292-8
23. Silva RLDT, Barreto MS, Arruda GO, Marcon SS. Avaliação da implantação do programa de assistência às pessoas com hipertensão arterial. Rev Bras Enferm 2016; 69(1): 79-87.
24. United Nations. Department of Economic and Social Affairs. Population Division. World Urbanization Prospects: the 2014 Revision. New York: United Nations; 2014.
25. Instituto Brasileiro de Geografia e Estatística (IBGE). Censo demográfico 2010. Rio de Janeiro: IBGE; 2010. Disponível em: <http://www.censo2010.ibge.gov.br> (Acessado em 20 de novembro de 2014).

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