

# Home blood pressure monitoring and control in a group of hypertensive patients\*

A MONITORIZAÇÃO RESIDENCIAL DA PRESSÃO ARTERIAL E O CONTROLE DE UM GRUPO DE HIPERTENSOS

MONITOREO RESIDENCIAL DE LA PRESIÓN ARTERIAL Y CONTROL DE UN GRUPO DE HIPERTENSOS

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## ABSTRACT

This qualitative study was performed with 71 hypertensive patients, with the objectives to compare outpatient and home blood pressure monitoring (HBPM), to assess blood pressure control, and characterize white-coat hypertension. A nurse performed the outpatient blood pressure measurement. The home blood pressure monitoring was carried out over seven days. White-coat hypertension was quantified as a difference between the outpatient measurement and home blood pressure monitoring in the ranges from 1 to 5, 6 to 10 and > 10 mmHg. The outpatient blood pressure measurement was significantly higher ( $p < 0.05$ ) than the home blood pressure measurement. Pressure control corresponded to 9.9% in the outpatient measurement and 23.9% in the home blood pressure measurement. The white-coat effect > 10 mmHg was 57.7% for systolic and 32.4% for diastolic pressure, in the range from 6 to 10 mmHg. Home blood pressure measurement provided a better assessment of hypertensive patients' control.

## DESCRIPTORS

Hypertension  
Measures  
Monitoring  
White coat hypertension  
Control

## RESUMO

Comparar a medida de consultório com a monitorização residencial da pressão arterial (MRPA), avaliar o controle da pressão e caracterizar o efeito do avental branco. Pesquisa de campo, quantitativa com 71 hipertensos. A medida da pressão em consultório foi feita pela enfermeira. A monitorização residencial da pressão arterial foi realizada durante 7 dias. O efeito do avental branco foi quantificado para diferenças entre a medida de consultório e a monitorização residencial da pressão arterial nas faixas 1 a 5, 6 a 10 e > 10 mmHg. A medida da pressão de consultório foi significativamente maior ( $p < 0,05$ ) do que a monitorização residencial da pressão arterial. O controle da pressão foi 9,9% na medida de consultório e 23,9% na MRPA. O efeito do avental branco > 10 mmHg para a sistólica foi 57,7% e para a diastólica, 32,4%, na faixa de 6 a 10 mmHg. A medida da pressão em casa avaliou melhor o controle dos hipertensos.

## DESCRITORES

Hipertensão  
Medida  
Monitoramento  
Hipertensão do jaleco branco  
Controle

## RESUMEN

Comparación de la medición en consultorio con el monitoreo residencial de la presión arterial (MRPA), evaluación del control de presión y caracterización del efecto del delantal blanco. Investigación de campo, cuantitativa, con 71 hipertensos. La medición de presión en consultorio fue realizada por la enfermera. El MRPA se efectuó durante siete días. El efecto del delantal blanco se cuantificó para diferencias entre la medición de consultorio y el MRPA en las fajas 1-5, 6-10 y >10mmHg. La medición de presión en consultorio fue significativamente mayor ( $p < 0,05$ ) que el monitoreo residencial de presión arterial. La presión se mantuvo bajo control en el 9,9% de la medición de consultorio y 23,9% de la MRPA. El efecto del delantal blanco >10 mmHg para la sistólica fue de 57,7% y para la diastólica, 32,4%, en la faja 6-10 mmHg. La medición de presión domiciliar evaluó mejor el control de los hipertensos.

## DESCRIPTORES

Hipertensión  
Medidas  
Monitoreo  
Hipertensión de la bata blanca  
Control

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## INTRODUCTION

Systemic arterial hypertension is a multifactorial clinical condition that is basically characterized by high blood pressure levels<sup>(1)</sup>. As it is defined by the rise in blood pressure levels, its measurement is fundamental to distinguish between normotension and hypertension. The high prevalence of arterial hypertension and the low control rates grant blood pressure measurement an important role in hypertension detection and management.

As for hypertension prevalence in Brazil, no national study exists, but isolated and regional data. In general, it is estimated that 30% of the adult population is hypertensive. Hypertension is the most frequent chronic condition in higher age ranges and is closely related with cerebrovascular and ischemic heart disease, which are the most prevalent circulatory diseases and the main cause of death among Brazilian elderly people. In 2006, cerebrovascular and ischemic diseases and arterial hypertension were responsible for 9.4%, 8.8% and 3.6% of deaths by diseases of the circulatory apparatus, respectively, corresponding to 223,800 deaths, 74% of deaths by cardiovascular disease<sup>(2)</sup>.

The blood pressure measure is a crucial element to establish the arterial hypertension diagnosis and assess treatment effectiveness. Adequately trained professionals should measure blood pressure levels in all health assessments<sup>(1)</sup>.

Although the procedure is simple and easy to accomplish, blood pressure measurement is subject to errors that can be equipment, technique, environment, patient or observer-related. Concerning the patient, possible errors can be related with measurement after physical exercise, eating, smoking, alcohol or caffeine intake before the measure, incorrect position or arm position. Brazilian studies<sup>(3-4)</sup> have revealed weaknesses in the nursing team's knowledge involved in hypertensive patient care. Observer-related errors are mainly linked to incorrect eye position, rounding off of measures to digits ending in zero or five, excessive stethoscope pressure deforming the artery, excessive cuff inflation that provokes pain or rapid deflation, cold hands and equipment, incorrect identification of systolic and diastolic sounds and incorrect interaction with the patient. For reliable verification, the equipment should be calibrated and the relation between the cuff size and the patient's arm should be adequate. On the opposite, the use of an inadequate cuff can lead to underestimated or overestimated pressure levels. The width of the inflatable cuff should correspond to 40% of the arm circumference and its length should involve 80% of the arm, maintaining a relation of 1:2.

In blood pressure measurement, the interactions among patient, observer and environment are factors that interfere in the obtained levels. According to the IV Guideline for the use of outpatient monitoring and the II Guideline for the use of home blood pressure monitoring,

pressure measurement outside the consultation room can distance the white-coat effect in blood pressure measurement<sup>(5)</sup>. A study at Primary Health Care Units that compared the mean home pressure measurement during four days with the measure by a nurse showed no difference for systolic pressure, but a significantly lower diastolic pressure than nursing records, characterizing the white-coat effect<sup>(6)</sup>. Also in Brazil, another study showed that home measurement not only shows lower values than measurements in the consultation room, but also reveals a better prognosis to identify target organ lesions like left ventricular hypertrophy<sup>(7)</sup>.

According to the VI Brazilian Hypertension Guidelines<sup>(5)</sup>, blood pressure measurements in the consultation room remains the usual hypertension and diagnosis treatment method, but measures outside the consultation room are indicated as a possibility to clarify the diagnosis, as a possibility to clarify the diagnosis, since it distances the possibility of white-coat hypertension.

After the development of automatic devices, measures outside the medical consultation room started to be studied more properly. These devices not only provide and store

a large number of measures in situations outside the consultation room, but also do not depend on the patients' skills to measure their own blood pressure. Home blood pressure monitoring (HBPM) is the recording of blood pressure through the indirect method, performed by the patient or another trained person, during the watch period, at home or at work. The identification of white-coat hypertension, the presence of the white-coat effect, masked hypertension and assessment of anti-hypertensive treatment figure among its main indications<sup>(1)</sup>. Home blood pressure monitoring differs from self-measurements, which refers to isolated and non-systematic measures patients perform at home.

Studies appoint home blood pressure monitoring as a more appropriate method than measuring at the consultation room and as good as outpatient blood pressure monitoring, as it provides diagnostic precision and better hypertension monitoring in the course of treatment<sup>(8-9)</sup>. A research at an outpatient clinic of a teaching hospital in São Paulo city evidenced the beneficial effect of home blood pressure monitoring in the assessment of hypertensive patients' control, even exceeding the assessment of outpatient blood pressure monitoring (OBPM). The levels obtained through outpatient blood pressure monitoring and home blood pressure monitoring were lower than those obtained at the consultation room, which confirms literature findings that blood pressure levels at the consultation room are higher than measurements using the methods mentioned<sup>(10)</sup>.

Thus, the goals of this research were: 1- Compare measures at the consultation room with home blood pressure monitoring. 2- Assess blood pressure control according to outpatient measurement and HBPM. 3- Characterize the white-coat effect.

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## METHOD

A descriptive study with a quantitative approach was carried out. Seventy-one adults with essential arterial hypertension were studied, who attended a Hypertension and Diabetes Referral Center in Peruibe, a city on the coast of São Paulo State. The inclusion criteria for the hypertensive patients were: a) patient's agreement to participate in the study through the signing of the informed consent term; b) being an essential stage I or II hypertensive patient, under treatment at the unit for more than six months; c) age 18 years or older; and d) belonging to the community covered in the city of Peruibe. The exclusion criteria were: a) pregnant hypertensive women; b) hypertensive patients with a history of drug abuse or mental disorders that can invalidate the informed consent; c) secondary arterial hypertension; and d) Type I Diabetes. Approval for the study was obtained from the Ethics Committee at the University of São Paulo School of Nursing.

The nurse measured blood pressure in the consultation room with the help of a validated automatic device (OMROM HEM 705 CP), at the health unit, in a calm and quiet environment; sitting down, after 5-10 minutes of rest; with the left arm resting at the height of the heart; for three consecutive times, at 1-2 minute intervals between one measure and the other; using an adequate cuff size for the patient's arm; without having practiced physical exercise for 60-90 minutes; on an empty bladder; and without meals, alcohol or caffeine intake for at least 30 minutes. Measures above 140/90 mmHg<sup>(1)</sup>, used to characterize hypertension control, were considered abnormal.

For home blood pressure monitoring (HBPM), the nurse researcher advised patients at the health unit about the correct use of the blood pressure measurement device, impression and recording of pressure levels on a specific form. HBPM took place during seven consecutive days, three times in the morning and three times in the evening, in the period between 06h00-10h00 and 18h00-22h00, respectively. Patients were oriented as follows about HBPM: performing the measurement in a calm environment, at a pleasant temperature, not on a full bladder, without having exercise for at least 60 minutes, without having consumed alcoholic beverages, coffee, food, or without having smoked 30 minutes earlier, and without talking during the measures; measure the blood pressure in the sitting position, after 5 minutes of rest, with the back supported, legs uncrossed and feet on the floor, at a one-minute interval between measures; always using the left arm supported at the height of the heart, with the hand palm turned upwards and without moving during the measures; placing the cuff on the bare arm without any squeezing from tight clothes.

HBPM levels above 135/85 mmHg were considered altered<sup>(5)</sup> in the control assessment. As for the quality of the procedure, measures were considered valid on all days and excluding deviant values like diastolic pressure

above 140 mmHg and below 40mmHg, systolic pressure below 70mmHg and above 250 mmHg and pulse pressure below 20 mmHg or above 100 mmHg, provided that no clinical justification existed. In both verification modes, three measures were taken and the average of the second and third measure was used as the average. For data collection, an identification form was used with the participants' sociodemographic variables.

The white-coat effect was characterized by the difference between the blood pressure measured in the consultation room and HBPM, stratified in the following ranges: <0, 1-5, 6-10 and >10 mmHg. In data analysis, classification variables are presented descriptively with absolute frequencies (n) and percentages (%). Quantitative variables with normal distribution are presented descriptively with means and standard deviations. Continuous variables were analyzed through profile analysis. P-values <0.05 were considered statistically significant.

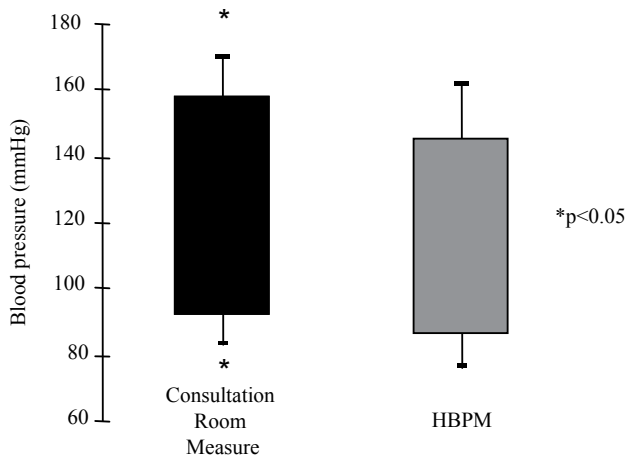
## RESULTS

The characterization of the study sample evidenced the predominance of hypertensive people in the age range over 60 years, male (53.5%), white (77.5%), with partner (76.1%), finished primary education (51.4%), retired (53.5%) and treatment time at the unit around 5 years (Table 1).

**Table 1** – Biosocial characteristics of hypertensive patients studied – Peruibe, SP, 2010

Variables	N	%
<b>Gender</b>		
Female	33	46.5
Male	38	53.5
<b>Ethnic origin</b>		
White	55	77.5
Black	5	7.0
Mulatto	9	12.7
Yellow	2	2.8
<b>Marital status</b>		
Single	3	4.2
Married	44	62.0
Separated	5	7.0
Fixed partner	10	14.1
Widowed	9	12.7
<b>Education</b>		
Illiterate/ Reads and writes	7	9.9
Primary	36	50.7
Secondary	18	25.3
Higher	9	14.1
<b>Occupation</b>		
Retired	38	53.5
Non-specialized manual	21	29.6
Specialized manual	20	14.1
Non-manual	2	2.8
<b>Age (mean ± Standard Deviation, years)</b>		63.3±11.0
<b>Treatment time (mean ± Standard Deviation, years)</b>		5.11±3.53

The assessment of blood pressure measures showed that the levels obtained at the hypertensive care unit were significantly higher ( $p<0.05$ ) than those obtained through home blood pressure monitoring ( $157.7\pm 12.3/91.4\pm 8.2$  vs.  $145.1\pm 16.2/85.0\pm 9.4$  mmHg) (Figure 1).



**Figure 1** – Consultation room and home blood pressure monitoring (HBPM) measures of hypertensive patients under study – Peruibe, SP, 2010

HBPM evidenced significantly higher levels ( $p<0.05$ ) for systolic and diastolic pressure in the morning and in the evening when comparing the first weekday with other days. No distinction was found in values for days 2, 3 and 4. On day 5, a statistically significant drop was found ( $p<0.05$ ), except for diastolic pressure in the evening. Although systolic pressure levels increased on day 6 and 7, they were still lower than measures at the start of the week (Table 2).

**Table 2** – Home blood pressure monitoring (HBPM) of hypertensive patients studied, in the morning and at night, comparison of seven weekdays – Peruibe, SP, 2010

Days	Systolic HBPM (Mean ± Standard Deviation, mmHg)		Diastolic HBPM (Mean ± Standard Deviation, mmHg)	
	Morning	Evening	Morning	Evening
1	150.8±17.2*	151.4±21.2*	90.2±10.9*	87.5±11.6*
2	144.2±14.8	146.6±20.4	87.0±10.2	84.6±11.4
3	144.7±18.5	146.2±20.8	86.3±10.5	84.4±12.3
4	145.4±18.1	144.1±19.8	86.4±11.0	83.7±11.1
5	140.7±17.3†	142.3±20.5§	84.3±10.6§	83.0±11.6
6	144.0±18.3	144.2±21.9	85.5±10.9	83.9±11.0
7	144.6±19.0	143.3±20.2	85.9±10.3	83.6±10.5
Mean	145.1±16.2		85.0±9.4	

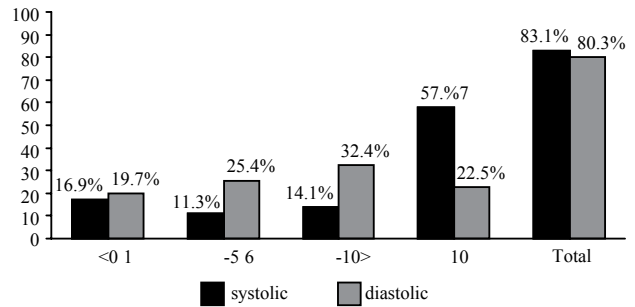
\* $p<0.05$ : day 1 vs. 2 vs. 3 vs. 4 vs. 5 vs. 6 vs. 7

† $p<0.05$ : day 5 vs. 3 vs. 4 vs. 7

§ $p<0.05$ : day 5 vs. 2 vs. 3 vs. 4

The white-coat effect, assessed through the difference between the consultation room blood pressure measure and HBPM, showed that the magnitude of the effect ex-

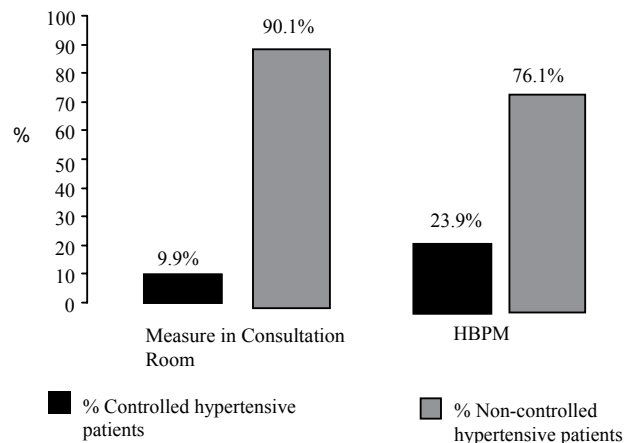
ceeded 10 mmHg for systolic pressure in more than half (57.7%) of the hypertensive patients, and varied between 6 and 10 mmHg (32.4%). About 80% of the patients revealed the white-coat effect. Also, the opposite effect was found in 16.9% and 19.7% of the hypertensive patients, for systolic and diastolic pressure, respectively.



Differences between consultation room measures and HBPM (mmHg)

**Figure 2** – Percentage of hypertensive patients according to the white-coat effect for systolic and diastolic pressure – Peruibe, SP, 2010

The assessment of blood pressure control showed that, according to the consultation room measure, only 9.9% of the patients studied had their pressure levels under control ( $<140/90$  mmHg). On the other hand, when considering HBPM, this control percentage ( $<135/85$  mmHg) more than doubled (23.9%) (Figure 3).



**Figure 3** – Percentage of controlled and non-controlled hypertensive patients according to consultation room measure and home blood pressure measurement (HBPM) - Peruibe, SP, 2010

## DISCUSSION

The main finding in this study showed blood pressure measures outside the outpatient context were significantly lower, once again revealing the importance of home measurement. The observer's influence in blood pressure measurement has been widely studied in the literature. A pioneering study in the area, accomplished more than two decades ago, showed that the presence of the physician and nurse provoked an increase in pressure levels

assessed through the direct method, but the increase the nurse's presence provoked was less enhanced than what the physician's presence provoked. The authors conclude that repeated doctor's visits in short time periods did not avoid the overestimation of blood pressure levels, but can be reduced if the nurse performs the measure<sup>(11)</sup>. A more recent study also showed that nurses' measures were significantly lower than physicians'<sup>(12)</sup>. A meta-analysis<sup>(13)</sup> on the theme evidenced increases of 30 mmHg or more when the physician checked BP levels. In the same sense, a Brazilian study analyzed blood pressure levels measured by patients, nurses, physicians, outpatient monitoring and home blood pressure monitoring, and the results showed that the physician obtained the highest levels<sup>(14)</sup>. Reinforcing the importance of the observer's role in blood pressure measurement, another study<sup>(15)</sup> compared nurses' and patients' measures, evidencing that nurses obtained lower values and that, even when repeated after five minutes, although pressure levels dropped, nurses' measures were lower. Another Brazilian study compared pressure levels among different observers and ascertained that patients' and nurses' measures were close<sup>(16)</sup>.

The differences between the pressure levels measured in the consultation room and at home or through outpatient monitoring (OBPM) characterize the white-coat phenomenon, which comprises different situations. White-coat hypertension is when the blood pressure measured in the consultation room shows hypertension and outpatient or home measures show normotension. Masked hypertension is the opposite of white-coat hypertension. Another possibility is the white-coat effect, characterized by the increase in blood pressure levels when the physician measures BP in the consultation room in comparison with outpatient blood pressure monitoring (OBPM) or home measures, independently of normotension or hypertension diagnoses. Thus, in the white-coat effect, the patient's diagnosis does not change. In our midst, research on this subject is still scarce. A study in a hypertension league at a teaching hospital compared records of 670 outpatient pressure monitoring tests with consultation room measures. The results showed that 46% were hypertensive, 12% suffered from masked hypertension, 20% were white-coat hypertensive patients and 27% showed the white-coat effect<sup>(17)</sup>.

In this study, it was observed that, although nurses measured BP in the consultation room, levels were significantly higher when compared with the patient's measures at home through home blood pressure measurement (HBPM). Thus, although the observer's influence was mitigated, environmental influence continued. This fact influenced the control of blood pressure levels, as only 10% of patients whose consultation room measures were analyzed revealed controlled blood pressure.

Concern with measuring blood pressure outside the consultation room is not recent. A literature report from 1940<sup>(18)</sup> compared BP records of hypertensive patients at

home and in the consultation room and reported, for the first time, the white-coat hypertension phenomenon, evidencing lower measures at home than in the consultation room.

Diagnosing white-coat hypertension and the white-coat effect represents a great challenge for health professionals, as blood pressure measurement in the consultation room remains the most used blood pressure diagnosis method. Although nurses measured BP levels in the consultation room in this study, home blood pressure monitoring (HBPM) showed a drop in blood pressure levels, once again underlining the importance of this BP assessment strategy, not only to confirm the hypertension diagnosis, but also in anti-hypertensive treatment management. Great distinctions in BP control when comparison both BP assessment forms evidence this fact. More than half of the patients studied showed a white-coat effect of more than 10 mmHg in systolic pressure, which may imply that these patients are excessively treated, including the increased use of anti-hypertensive drugs.

Although hypertension control levels are higher according to HBPM, these are still very low. In Brazil, it has been verified that only about 30% of patients are under control. Thus, studying alternatives that can change this panorama becomes very important and BP measurement at home is a possibility. Studies have evidenced that BP measurement at home can enhance treatment adherence and, consequently, greater control of BP levels<sup>(19-20)</sup>.

In this study, no differences were found between BP levels measured in the morning and in the evening, neither for systolic nor for diastolic pressure. These data are similar to another Brazilian study that involved HBPM for seven days, in which mean systolic and diastolic BP levels were measured in the morning, afternoon and evening<sup>(7)</sup>. A Brazilian review highlighted the importance of HBPM in hypertension management. The authors highlighted that this method permits assessing how blood pressure behaves in the medium and long-term. Also, it is effective to assess anti-hypertensive treatment and promotes conditions that favor treatment adherence and, consequently, increase disease control levels<sup>(21)</sup>.

## CONCLUSION

Data in this study once again reinforce that the place where BP measurements take place influence pressure levels and that home measurement contributed not only to identify the white-coat effect, observed in most hypertensive patients, but also assessed actual blood pressure control. Effective blood pressure control is extremely important for hypertensive patients' treatment management. Continued high pressure levels can entail complications, including damage to target organs, with severe repercussions for patients. Another fact was the low BP control level among the patients analyzed. Even when as-



essed through HBPM, this remains far below desirable levels. This is a task all stakeholders involved in hypertension care should pay attention to and patients' blood pressure assessment at home can be one resource, due to the

possibility of further involvement in their health problem. In view of the incipient nature of data on the research problem, this research provides important information for future comparisons.

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