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Automatic Office Blood Pressure Measured without Doctors or Nurses Present

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Abstract

Backgrounds—We evaluated the agreement between office blood pressure (OBP) measured by mercury sphygmomanometer (Sphyg) and automatic (Auto) device without any observers, and compared Auto and Sphyg OBP to ambulatory (ABP) and home blood pressure (HBP).

Methods—OBP was measured in 75 hypertensive patients at 2 sites using an automatic monitor without a doctor or nurse present and by Sphyg during 3 clinic visits. Between visits, ABP and HBP monitoring were also performed.

Results—Mean Auto OBP was similar to Sphyg OBP and they were closely correlated (ICC=0.84 for systolic and 0.91 for diastolic OBPs); however, the difference between Auto and Sphyg systolic OBP (1.6 ± 8.2 mmHg) varied by the first office visit, gender, and the site. Auto systolic OBP was lower than both systolic awake ABP (137.1 ± 14.7 mmHg) and HBP (139.2 ± 15.6 mmHg). Auto systolic OBP and Sphyg OBP were similarly correlated with systolic awake ABP (both $r=0.59$, $P<0.001$). Mean Auto diastolic OBP was similar to Sphyg OBP (81.1 ± 11.3 vs.

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80.3±13.3 mmHg, $P=0.20$, $ICC=0.91$), diastolic awake ABP and HBP. Auto diastolic OBP and Sphyg OBP were related to diastolic awake ABP (both $r>0.68$, $P<0.001$). In multivariable analyses, neither OBP measure was a significantly stronger predictor of out-of-office BP than the other.

Conclusion—Auto systolic OBP measured without a doctor or nurse present was lower than systolic awake ABP and HBP. Auto and rigorously assessed Sphyg OBP had similar means and were similarly related to awake ABP. Auto OBP might be an advantageous alternative to Sphyg measurements in the usual clinic setting.

Keywords

Ambulatory blood pressure monitoring; home blood pressure; self-measured blood pressure; office blood pressure

Introduction

It is becoming increasingly accepted that blood pressure (BP) measured in the conventional manner in a doctor's office gives a relatively poor estimate of a patient's "true" BP, compared with either ambulatory BP (ABP) or home BP (HBP). In order to improve the accuracy of office BP (OBP) measurement, automated BP devices are being used in some clinics. These automated BP devices can eliminate errors, such as digit preference, that are common in manual measurements. Moreover, automated BP monitors can assess BP without a doctor or nurse being present, can automatically take multiple readings, and, therefore, may reduce the white coat effect¹⁻³, which is believed to be a conditioned anxiety response⁴⁻⁶. It has been reported previously that automated BP readings using the BpTRU device tend to be lower than readings taken by a doctor using a mercury sphygmomanometer (Sphyg) in the usual clinic settings^{1, 2, 7}; however, the automated BP was compared with OBP taken by family physicians in a busy clinical practice or with OBP measured by technicians at the time of ABP monitoring. There are no data comparing the agreement between automated BP, measured without a doctor or nurse present, using the Microlife WatchBP Office device, and research quality OBP measured using Sphyg according to the guidelines for OBP measurements.

Additionally, there is little data comparing automated OBP, which can reduce/eliminate the white coat effect, with sphyg OBP in terms of their ability to predict mean awake ABP performed during normal activity (the gold standard for out-of-office BP) or HBP (out-of-office BP taken in the same seated position as OBP)^{8,9}.

This study had two main objectives: (1) to compare BP readings taken in the office using a professional automatic (Auto) device (Microlife WatchBP Office) in the absence of a doctor or nurse with guideline-compliant conventional Sphyg office measurements taken by a physician and (2) to compare their respective relationships with home and ambulatory BP.

Methods

Sample

We enrolled 87 hypertensive participants to compare two types of in-office measures (Sphyg vs. automatic oscillometric device) with each other and to two types of out-of-office measures (home and ambulatory). Patients untreated or treated on stable antihypertensive therapy at least for 4 weeks, were recruited from out-patient hypertension clinics at Columbia University Medical Center (NY, USA; N=58) and at Hypertension Center, 3rd University Department, Sotiria Hospital (Athens, Greece; N=29). After excluding subjects who never attended an office visit or withdrew their informed consent (N=8), dropped out

midway through the protocol (N=2), or performed shift work (N=1), and one who was unable to measure BP using oscillometric devices (N=1), there were 75 subjects with data available for analysis.

Design

The study protocol is illustrated in Figure 1.

Office Blood Pressure by mercury sphygmomanometer

Conventional OBP readings were taken by physicians following the American Heart Association Guidelines⁸, using a Sphyg to take 3 readings. The first measurement was taken after 5 minutes rest and the second and third measurements were taken at 1-minute intervals thereafter. The appropriate cuff size for manual OBP measurements was determined by the participant's arm circumference.

Office Blood Pressure by automatic device

The Auto OBP readings were taken using the WatchBP® Office device (Microlife Medical Home Solutions, Inc., Golden, CO), which was programmed to take 3 readings at 1-minute intervals with neither a physician nor a nurse present. At Athens University Hypertension Centre (N=25), the physician pressed the button to initiate (after a 1 min delay) the automated OBP measurements and immediately left the room leaving the patient alone. The BP values were automatically recorded in the device, and the physician reviewed the data after the 3 readings were taken. At Columbia University Medical Center, the Auto OBP measurements were triggered by a wireless remote control system and the data were sent to the physician's computer. Both Sphyg and Auto OBP measurements were measured at all three office visits (at 2-week intervals) in an isolated exam room used only for BP measurements.

To avoid order effects, the sequence of Sphyg and Auto OBP readings was randomly assigned at each visit by either a coin toss (at Columbia University Medical Center) or by a PC-generated randomization scheme (Athens University Hypertension Centre). The number of subjects who had the Sphyg OBP readings taken before the Auto OBP readings was 51% at visit 1, 52% at visit 2 and 55% at visit 3. The appropriate cuff size, based on the participant's arm circumference, was used for all OBP measurements.

Out-of-Office Blood Pressure measurements

HBP readings were taken during the 2-week interval between either the 1st and 2nd clinic visit or between the 2nd and 3rd clinic visit. Two HBP readings were taken early in the morning (as soon as possible after getting up, between 5 a.m. and noon) and two were taken at night just before going to bed (between 6 p.m. and midnight), for 7 weekdays, using a validated upper-arm cuff oscillometric device, WatchBP® Home (Microlife Medical Home Solutions, Inc., Golden, CO)¹⁰. The device was programmed to automatically take the second reading 1 minute after the first. The readings were stored in the device's memory. The average of HBP during the last 6 days, excluding the first day's HBP readings, was used for the analysis, in accordance with the European Society of Hypertension Guidelines¹¹. The device-specific cuff, appropriate for each participant's arm circumference, was used.

A 24-hour ABP recording was obtained at the time of the second office visit, using the validated SpaceLabs® 90207 ABP monitor (SpaceLabs Inc., USA). The ABP device was programmed to take readings at 30-minute intervals and hooked up by a trained technician or physician. The readings were stored in the device's memory and downloaded when the subject returned the monitor. The mean awake and asleep ABP were calculated using

participants' diary reports of their sleep and wake times. The appropriate-sized device-specific cuff, given the participant's arm circumference, was used.

Statistical analyses

Data are shown as the mean $\pm$ standard deviation (SD) or as percentages. The difference in BP between Sphyg and the Auto device was analyzed using a paired t-test and potential predictors of this difference were investigated using multiple linear regression analysis. The intraclass correlation coefficient and Bland-Altman plots were used to assess the overall agreement between the two types of OBP. The relationships of both the Auto and Sphyg OBP to awake ABP and HBP were assessed using Pearson's correlation. The differences between Auto OBP and awake ABP or HBP were also analyzed using paired t-tests. The difference between correlation coefficients was tested using the conventional, dependent samples, test.¹² We used linear regression analysis, treating HBP and awake ABP as outcomes, to compare the predictive power of Auto and Sphyg OBP. All statistical analyses were performed using the SPSS statistical software package (version 18.0; SPSS Inc., Chicago, Illinois, USA). Values of $P < 0.05$ were considered statistically significant.

Results

The average age was 56.1 ± 13.8 years (male 41, female 34). The average body mass index was 27.1 ± 4.9 kg/m². The percentage of participants taking antihypertensive medication was 50.7%; 34.7% had hyperlipidemia; and 16.0% had diabetes mellitus. The 24-hr average (systolic/diastolic) ABP was $132 \pm 14 / 77 \pm 11$ mmHg, and asleep ABP was $120 \pm 16 / 68 \pm 11$ mmHg.

Auto vs. Sphyg Office Blood Pressure

The mean $\pm$ sd of Sphyg OBP and Auto OBP are shown in Table 1. The difference between systolic Auto OBP and Sphyg OBP (1.6 mmHg, $P = 0.10$) was not significant. The difference between diastolic Auto OBP and Sphyg OBP (0.8 mmHg, $P = 0.20$) was also not significant. Bland-Altman plots for systolic OBP and diastolic OBP are shown in Figure 2. They show that for both systolic and diastolic OBP, the Sphyg minus Auto OBP differences were not associated with the level of (average) OBP. The intraclass correlation coefficients for agreement between Auto OBP and Sphyg OBP were 0.84 ($P < 0.001$) for systolic, 0.91 ($P < 0.001$) for diastolic; both quite high.

When we repeated the analysis separately for each visit, the difference between Auto and Sphyg systolic OBP was significant only at visit 1 (Table 2). The differences in systolic OBP at visit 1 did not depend on the order in which the two types of measurements were taken, Sphyg-Auto versus Auto-Sphyg ($P = 0.79$). The difference in diastolic OBP was non-significant at each of the three visits. Additionally, the difference between the two types of OBP were not statistically significant between the sequence of Sphyg-Auto and Auto-Sphyg in either of visit; however, there was a tendency for the first type of OBP to be higher than the second type of OBP. (Table 3).

In the multiple linear regression analysis, female gender was a significant predictor of the difference in OBP (Sphyg - Auto) for both systolic ($P = 0.006$) and diastolic ($P = 0.01$) OBP. On average, Sphyg was higher than Auto systolic OBP in women (135.8 mmHg vs. 131.5 mmHg, $P = 0.001$), while they were similar in men (133.3 mmHg vs. 134.0 mmHg, $P = 0.53$), after adjustment for other covariates of age, sex, body mass index, smoking status, alcohol consumption, presence of hyperlipidemia, presence of diabetes and the average of Auto and Sphyg OBP. There was a negligible difference between Sphyg and Auto diastolic OBP in women (81.0 mmHg vs. 80.3 mmHg, $P = 0.35$), but Sphyg diastolic OBP was lower than

Auto diastolic OBP in men (79.7 mmHg vs. 81.7 mmHg, $P=0.004$), after adjustment for covariates ($P=0.01$ for gender difference). Site was also a significant predictor of the difference between Sphyg and Auto OBP ($P=0.02$ for systolic, $P=0.004$ for diastolic). Sphyg systolic OBP was higher than Auto systolic OBP at Columbia University Medical Center (134.5 mmHg vs. 131.3 mmHg, $P=0.01$), while Sphyg systolic OBP was marginally lower than Auto systolic OBP at Athens University (134.2 mmHg vs. 135.9 mmHg, $P=0.06$), after adjustment for other covariates. Sphyg diastolic OBP was similar to Auto diastolic OBP at Columbia University Medical Center (78.7 mmHg vs. 78.7 mmHg, $P=0.96$), but Sphyg diastolic OBP was lower than Auto diastolic OBP at Athens University (83.6 mmHg vs. 85.8 mmHg, $P<0.001$), after adjustment for the covariates. The difference between Sphyg and Auto diastolic OBP was *not* related to age, body mass index, smoking status, alcohol consumption, presence of hyperlipidemia, or presence of diabetes (all $p>0.10$).

Office vs. Ambulatory and Home Blood Pressure

The average awake ABP and HBP are shown in Table 1. Auto systolic OBP was significantly lower than both awake systolic ABP and systolic HBP while Sphyg systolic OBP was significantly lower than systolic HBP only. Auto diastolic OBP was similar to awake diastolic ABP and diastolic HBP, but Sphyg diastolic OBP was significantly lower than diastolic HBP. Bland-Altman plots showing the relationships of awake ABP to Auto and Sphyg OBP are provided in Figure 3. There was no systematic pattern to the differences between Auto OBP and awake ABP, or between Sphyg OBP and awake ABP.

Both Auto and Sphyg systolic OBP were moderately correlated with awake systolic ABP (both $r=0.59$, $p<0.001$), with the difference in the correlation coefficients being non-significant ($P=0.97$). Both Auto and Sphyg diastolic OBP were also significantly correlated with awake diastolic ABP ($r=0.73$ and $r=0.68$, both $p<0.001$), with the difference again being non-significant ($P=0.19$).

In a multiple regression analysis predicting awake systolic ABP from Auto systolic OBP and Sphyg systolic OBP, both were marginally related to awake systolic ABP (Auto systolic OBP, $B=0.33$, $P=0.08$; Sphyg systolic OBP, $B=0.31$, $P=0.07$). Auto diastolic OBP was significantly related to awake diastolic ABP even after controlling for Sphyg diastolic OBP ($B=0.68$, $P=0.003$); Sphyg diastolic OBP was not independently related to awake diastolic ABP ($B=0.09$, $P=0.65$).

Both Auto and Sphyg systolic OBP were moderately correlated with systolic HBP ($r=0.60$ and $r=0.67$, both $p<0.001$), with the difference between correlation coefficients being non-significant ($P=0.15$). Both Auto and Sphyg diastolic OBP were also significantly related to diastolic HBP ($r=0.77$ and $r=0.76$, both $p<0.001$), with the difference again being non-significant ($P=0.73$). In a multiple regression analysis predicting systolic HBP from Auto and Sphyg systolic OBP, Auto systolic OBP was not significantly related to systolic HBP ($B=0.16$, $P=0.39$), while Sphyg systolic OBP was ($B=0.56$, $P=0.001$). Auto diastolic OBP was significantly related to diastolic HBP ($B=0.43$, $P=0.02$) even after controlling for Sphyg OBP ($B=0.26$, $P=0.08$).

Discussion

The major findings of this study are as follows: 1) the mean levels of Auto systolic OBP were similar to Sphyg systolic OBP of research quality, although Auto systolic OBP was “slightly” lower than Sphyg systolic OBP at the first office visit, in women, and when Auto systolic OBP was measured using a wireless system. 2) The means of Auto systolic OBP were lower than awake systolic ABP and systolic HBP. 3) Auto systolic OBP and Sphyg systolic OBP were similarly related to awake systolic ABP. 4) The mean of Auto diastolic

OBP did not differ significantly from the means of Sphyg diastolic OBP, awake diastolic ABP, or diastolic HBP. 5) Auto diastolic OBP was related to awake diastolic ABP independently of Sphyg diastolic OBP. 6) Sphyg systolic OBP was related to systolic HBP independently of Auto systolic OBP, while Auto diastolic OBP was related to diastolic HBP independently of Sphyg diastolic OBP. These results suggested that OBP measured using the Microlife WatchBP Office (automatic cuff oscillometric) device, with neither a doctor nor nurse present, provided similar OBP levels to Sphyg measured in research condition. The Auto systolic OBP is predictive of awake systolic ABP similarly to Sphyg systolic OBP. Auto diastolic OBP was a significant independent predictor of awake diastolic ABP and diastolic HBP, while Sphyg diastolic OBP was not; we were not able to clearly demonstrate that Auto diastolic OBP is a stronger predictor than Sphyg diastolic OBP.

This is the study in which an Auto OBP device other than the BpTRU device was compared to a research quality manual BP, ABP and/or HBP. The results of this study extend the concept of Auto OBP beyond the use of a single device. The Microlife WatchBP Office device takes a different number of readings compared to the BpTRU with a period of rest before the first reading which is not done with the BpTRU. A previous validation study¹³ reported that the Microlife WatchBP Office device satisfied the European Society of Hypertension International Protocol, the mean observer-device differences in systolic and diastolic BP for that study were -1.4 mmHg and -0.8 mmHg, respectively. These differences were nearly identical to those found in the present study (-1.6 mmHg and -0.8 mmHg), respectively. Additionally, the discrepancy between Auto and Sphyg systolic OBP was similar to a previous report in which the Omron HEM-907CP device was used for the measurement of Auto OBP (-1.9 mmHg)¹⁴. Thus, we conclude that Auto OBP measured using the Microlife WatchBP Office device can be applied for clinical research.

On the other hand, even under optimal conditions for measuring Sphyg OBP, Auto systolic OBP was slightly lower than Sphyg systolic OBP at the first office visit, in women, and when Auto OBP was measured using the wireless system (at Columbia University Medical Center); this suggests that a small white coat effect, an anxiety induced OBP elevation^{5, 6}, existed in some subjects. Indeed, it is during the first office visit that we would most expect a white coat effect to occur. The tendency for women to exhibit a positive difference between Sphyg and Auto systolic OBP is consistent with a previous report¹⁵ examining predictors of the white coat effect. At Columbia University Medical Center, Auto OBP measurements were started using a wireless system after the participant was left alone for more than 5 minutes before the first reading was taken, while at Athens University, the physician pressed the device button and left the room leaving the participant alone: automated triplicate OBP measurements started one minute after the physician pressed the button. In contrast, for diastolic OBP, men tended to exhibit a slight masked hypertension effect (or negative white coat effect).

Sphyg and Auto systolic OBP were both lower, on average, than awake systolic ABP (a positive masked hypertension effect, or negative white coat effect), although systolic OBP by physicians has often been reported to be higher than awake systolic ABP^{1, 16}. There were many factors that likely contributed to OBP being lower than HBP and awake ABP in this study. The first pertains to the measurement conditions. At both investigation sites, OBP was taken in a quiet BP monitoring research setting. Second, the large number of OBP readings (total of 18; 9 Sphyg and 9 Auto) obtained over 3 visits resulted in a lower average OBP due to 2nd and 3rd visit readings being lower on average than the 1st visit readings. Third, we were careful to follow guidelines for measuring OBP, including waiting for at least 5 minutes, without talking, before initiation of Sphyg and Auto OBP measurements. For all of these reasons, the white coat effect (OBP minus awake ABP) was, on average, negative in this study. In the current study, the proposed diagnostic method is automated

OBP with patients being alone in the examination room.^{2, 7} Our results suggest that by using an automated electronic device without the need of an experienced nurse or physician, standardized OBP measurements free of (or at least a reduced) white coat effect can be achieved in clinical practice. In practical terms, what is needed is a small examination room dedicated to the assessment of automated measurements.

Both Sphyg and Auto OBP were correlated with awake ABP, with no significant difference. The correlation coefficients between Auto OBP by the Microlife WatchBP Office device and awake ABP in this study were similar to a previous report² comparing Auto OBP by the BpTRU device and awake ABP by the SpaceLabs 90207 device (i.e. 0.62 for systolic and 0.72 for diastolic). In contrast, the correlation between Auto OBP and awake ABP was much higher than that between family physicians' Sphyg OBP at a routine office visit and awake ABP in a previous report (0.32 for systolic and 0.48 for diastolic)². Under the rigorous research setting conditions for assessing Sphyg OBP in this study, Auto and Sphyg systolic OBP were similarly predictive of awake systolic ABP. This strongly suggests that even if Auto OBP is slightly biased (i.e., its mean is 1 to 2 mmHg different from guideline-compliant assessments of Sphyg OBP), Auto OBP is likely to consistently provide a more accurate estimate of an individual patient's BP than physician measurements taken during routine office visits. The high level of agreement between Sphyg and Auto OBP in this study (very close mean values, high intraclass correlation, and similar correlations with awake ABP and HBP) indicates that Auto OBP, using the Microlife WatchBP Office device, should be considered interchangeable with Sphyg OBP in research settings.

There were some differences in the relationships of Auto OBP to awake ABP and HBP and between systolic and diastolic BP. Although we expected Auto systolic OBP to be more strongly related to HBP than is Sphyg systolic OBP, because Auto OBP and HBP were both taken using oscillometric devices from the same manufacturer, no difference was detected. On the other hand, controlling for Sphyg diastolic OBP, Auto diastolic OBP is predictive of both home and awake ABP, while Sphyg diastolic OBP is not independently predictive. We speculate that it may sometimes be difficult to measure diastolic BP by Sphyg, when disappearance of the 5th Korotkoff sound is not clearly audible, whereas oscillometric BP devices calculate diastolic from systolic BP and MAP levels. Furthermore, the agreement between two oscillometric measurements might be greater than the agreement of oscillometric with Sphyg measurements.

Conclusions

OBP measured automatically, with neither a doctor nor nurse present, is similar to Sphyg OBP in research settings, but Auto was somewhat lower than Sphyg systolic OBP at the first office visit, in women, and when Auto OBP was taken using wireless system. Auto OBP tends to yield a lower systolic OBP than awake ABP and HBP; Auto systolic OBP's relationship to awake systolic ABP is similar to that of high quality Sphyg systolic OBP. Additionally, diastolic OBP measured automatically is similar to Sphyg diastolic OBP, awake diastolic ABP, and diastolic HBP, and is related to awake diastolic ABP and diastolic HBP independently of Sphyg measured diastolic OBP.

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Figure 1.
Study protocol

Figure 2.

Bland-Altman plots for office blood pressures (OBP) taken by a mercury sphygmomanometer (Sphyg) and using the automatic WatchBP Office device (Auto). OSBP indicates office systolic blood pressure; ODBP, office diastolic blood pressure. The horizontal lines show the average (black solid line), 95% confidence intervals (dashed lines) and ± 2 standard deviations (gray solid line) of the difference between Sphyg OBP and Auto OBP.

Figure 3.

Bland-Altman plots for awake ambulatory blood pressure (ABP) and office blood pressure (OBP) taken using either the automatic WatchBP Office device (Auto) or a mercury sphygmomanometer (Sphyg).

OSBP indicates office systolic blood pressure; ODBP, office diastolic blood pressure; ASBP, ambulatory systolic blood pressure; ADBP, ambulatory diastolic blood pressure. The horizontal lines show the average (black solid line) and 95% confidence intervals (dashed lines) and ± 2 standard deviations (gray solid line) of the difference between OBP and awake ABP.

Means and standard deviations of office BP by mercury sphygmomanometer, office BP by automatic device, home BP, and awake ambulatory BP (N=75)

Table 1

	Office BP by mercury Sphyg	Office BP by automatic device	Home BP	Awake ABP
Systolic BP, mmHg	134.4±15.2	132.9±13.7	139.2±15.6 ^{***†††}	137.1±14.7 ^{††}
Diastolic BP, mmHg	80.3±13.3	81.1±11.3	82.2±10.2 [*]	81.0±12.0

Data are shown as mean ± SD; BP, blood pressure; P values for differences in means are based on paired t-tests;

- *

p<0.05,
- **

p<0.01 vs. Office BP by mercury sphygmomanometer;
- ††

p<0.01,
- †††

p<0.001 vs. Office BP by automatic device.

Table 2

Means and standard deviations of office blood pressure (mmHg) taken by mercury sphygmomanometer (sphyg) and by automatic device (Watch BP Office), by visit (N=75)

Office BP (mmHg)	Mercury Sphyg (mean±SD)	Automatic device (mean±SD)	Difference (mean±SD)
Visit 1			
Systolic BP, mmHg	137.0±19.4	134.7±16.9	2.3±9.1*
Diastolic BP, mmHg	81.6±14.3	82.3±12.8	-0.6±6.3
Visit 2			
Systolic BP, mmHg	133.3±14.8	132.6±14.9	0.8±11.9
Diastolic BP, mmHg	79.6±12.2	81.0±10.5	-1.4±6.3
Visit 3			
Systolic BP, mmHg	132.7±16.6	130.8±15.5	1.9±10.8
Diastolic BP, mmHg	81.0±11.8	80.8±11.5	0.2±6.5

BP, blood pressure;

* p<0.05.

Table 3

Means and standard deviations of office blood pressure (mmHg) taken by mercury sphygmomanometer (sphyg) and by automatic device (Watch BP Office), by the sequence of office blood pressure measurements (N=75)

	Sequence of Sphyg-Auto	Mean±SD	Sequence of Auto-Sphyg	Mean±SD
Visit 1				
Sphyg OSBP, mmHg	136.7±19.7		137.3±19.3	
Sphyg ODBP, mmHg	83.7±13.4		79.5±15.0	
Auto OSBP, mmHg	133.9±18.4		135.5±15.4	
Auto ODBP, mmHg	83.4±13.5		80.8±12.0	
Visit 2				
Sphyg OSBP, mmHg	134.3±14.8		132.3±15.0	
Sphyg ODBP, mmHg	78.8±12.3		80.4±12.1	
Auto OSBP, mmHg	132.5±13.9		132.7±16.2	
Auto ODBP, mmHg	78.7±11.6		82.4±11.1	
Visit 3				
Sphyg OSBP, mmHg	134.3±17.9		131.2±13.3	
Sphyg ODBP, mmHg	81.8±11.5		80.4±12.7	
Auto OSBP, mmHg	129.2±15.4		132.4±15.1	
Auto ODBP, mmHg	80.3±10.9		80.3±14.1	

Sphyg indicates sphygmomanometer; Auto, automatic; OSBP, office systolic blood pressure; ODBP, office diastolic blood pressure