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IMPLEMENTATION TO INCREASE BLOOD PRESSURE CONTROL: WHAT WORKS? (JEFFREY BRETTLER AND KRISTI REYNOLDS, SECTION EDITORS)

Automated Office-Based Blood Pressure Measurement: an Overview and Guidance for Implementation in Primary Care

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Abstract

Purpose of Review The purposes of this study are to review evidence supporting the use of automated office blood pressure (AOBP) measurement and to provide practical guidance for implementing it in clinical settings.

Recent Findings Mean AOBP readings correlate with awake ambulatory blood pressure monitor (ABPM) values and predict cardiovascular outcomes better than conventional techniques. However, heterogeneity among readings suggests that AOBP does not replace ABPM. Blood pressure (BP) measurement protocols differ among commonly described AOBP devices, but all produce valid BP estimates. Rest periods should not precede AOBP with BpTRU devices but should occur before use with Omron HEM-907 and Microlife WatchBP Office devices. Attended and unattended AOBP appear to produce similar results. This review also describes a framework to aid AOBP's implementation in clinical practice.

Summary Evidence supports AOBP as the preferred method for measuring BP in office settings, but this approach should be a complement to out-of-office measurements, such as self-measured BP monitoring or 24-h ABPM, not a substitute for it.

Keywords Blood pressure measurement · Automated office blood pressure · AOBP · Hypertension · Implementation science · Primary care

Introduction

Accurate blood pressure (BP) measurement provides a foundation for appropriately managing hypertension. Conventional BP measurement (typically single measurements obtained during a medical office visit with either an auscultatory or oscillometric device) often produces inaccurate readings that can lead to disease misclassification and inappropriate treatment decisions [1•]. Studies demonstrate that out-of-office approaches for measuring BP, such as with 24-h ambulatory BP monitors (ABPM) or self-measured BP (SMBP) devices, predict hypertension-related physiologic changes and cardiovascular events better than conventional BP measurement [2••, 3•, 4•, 5]. Thus, American College of Cardiology/American Heart Association (ACC/AHA) guidelines for BP measurement recommend that clinicians perform out-of-office testing before diagnosing hypertension diagnosis in patients with high office BP [6••].

Nevertheless, office-based BP measurements still have a central role in managing this condition since BP readings serve functions beyond establishing a hypertension diagnosis, including screening patients, monitoring patients' response to therapy, and reporting quality of care metrics to regulatory agencies and payers. To minimize the risk for inaccurate BP measurements in medical offices, some international guidelines recommend automated office BP (AOBP) measurement as the preferred approach for measuring BP in medical office settings [7•, 8•]. This article describes AOBP and provides guidance for integrating this approach into clinical practice.

This article is part of the Topical Collection on *Implementation to Increase Blood Pressure Control: What Works?*

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What Is AOBP?

AOBP is an approach for estimating BP, using a validated, fully automated, BP measurement device [9]. In contrast to semi-automated devices, which only obtain a single BP reading when activated, fully automated devices are capable of obtaining multiple BP readings without a healthcare worker present. In addition to displaying each individual BP reading, AOBP devices also display the average of all readings obtained in a sitting, thus relieving medical personnel of the need to perform the calculations. Some devices also incorporate a timer that counts down a "rest period" between device activation and first BP measurement. AOBP may be performed "unattended" (i.e., with the patient alone in a room) or "attended" (i.e., with medical personnel in the room but not engaging with the patient) [10].

AOBP 2001–Present

AOBP is best understood in terms of BP measurement guidelines that codify research techniques for using mercury sphygmomanometers or semi-automated oscillometric devices in cohort studies and clinical trials. ACC/AHA guidelines recommend that medical personnel seat patients in a quiet room with back supported, arm supported at heart level, legs uncrossed, and feet supported on the ground or a step stool; place an appropriate size cuff on the patient's bare upper arm; ask them to sit quietly for at least 5 min; and then to obtain at least two BP measurements, being careful to avoid rapid cuff deflation or misidentifying Korotkoff sounds [6••, 11].

These techniques require a great deal of skill to perform well, and it has been estimated that performing them as recommended requires approximately 14 min [12]. Thus, it is widely acknowledged that medical personnel in real-world settings rarely adhere to BP measurement guidelines [1•]. Conventional BP measurement techniques are also vulnerable to the white coat effect (WCE): a pattern whereby office BP readings are elevated at multiple visits but are at non-hypertensive levels when measured with out-of-office methods, which is thought to result from an alert response to the presence of a healthcare worker during BP measurement [13].

AOBP was developed to address these concerns by leveraging technological innovations that standardize BP measurement technique and allow patients to undergo multiple BP measurements without a healthcare worker in the room. Although the technology needed for this approach had existed previously, the BpTRU Vital Signs Monitor (BpTRU Medical Devices, Coquitlam, BC, Canada), introduced in 2001, is credited as being the first widely adopted professional device for performing AOBP [14]. Once a BP cuff is placed on a patient and the device is activated, the BpTRU monitor performs an initial test measurement with the healthcare worker present to verify that it functions appropriately. Then, with the patient left alone in a quiet room, the device automatically performs a series of five BP measurements at pre-specified intervals before displaying the average of all five readings.

Early studies involving the BpTRU device showed that this approach obtained lower BP readings than conventional BP measurement, with much of the difference coming from elimination of WCE [15]. Subsequent studies have shown that mean AOBP readings closely correlate with awake ABPM readings, leading some to ask if AOBP could substitute for ABPM. A recent meta-analysis of 18 of the high-quality studies reported that pooled mean systolic AOBP readings obtained with BpTRU devices differed from awake ABPM by −1.5 mmHg (95% CI −3.29 to 0.25 mmHg, $P = 0.09$). This review also found significant heterogeneity among measurements, suggesting that while AOBP is a superior to conventional technique, it should not be viewed as a substitute for ABPM [16••]. Studies have also reported that mean AOBP readings obtained with BpTRU predict target organ damage and cardiovascular events better than conventional measurements [17–19].

Since BpTRU's introduction, other devices capable of performing AOBP have entered the market, including the Omron HEM-907 (Omron Healthcare Inc., Lake Forest, IL, USA) [20] and the Microlife WatchBP Office (Microlife AG, Widnau, Switzerland) [21], which is also sold in the USA as the Welch Allyn ProBP 2400 (Welch Allyn Inc., Skaneateles Falls, NY, USA).

Clinical uptake of AOBP has grown over the past two decades, particularly in Canada, where 54% of 769 family physicians in a recent survey reported using this approach to guide hypertension treatment [22]. National biometric surveillance programs have also adopted this approach, making it a primary method for obtaining BP benchmarks in North American populations. The Canadian Health Measures Survey began using BpTRU to collect national BP data in the 2007–2009 cycle [23]. Similarly, the US National Health and Nutrition Examination Survey (NHANES) began using the Omron HEM-907 in adults starting in the 2009–2010 survey administration and recently proposed protocols for using AOBP in children as young as 8 years of age [24]. AOBP's use in recent hypertension outcome trials—notably the Systolic Blood Pressure Intervention Trial (SPRINT)—has also generated recent interest in this approach.

SPRINT reported that high-risk patients randomized to treatment targeting systolic BP < 120 mmHg experienced 25% less cardiovascular morbidity and 27% less all-cause mortality than those randomized to a less-intensive BP target [25••]. Although the findings were influential, critics questioned whether the results apply to clinical practice since study outcomes were obtained with AOBP instead of conventional techniques more commonly used in practice [26]. However, others noted that

SPRINT's BP measurement protocol is a scalable approach that adhered to traditional research methods more closely than techniques used in real-world settings [27]. Thus, there is interest in AOBP as a practical approach for standardizing BP measurement in office settings in a way that aligns the BP measurement techniques performed in clinical practice with those used in outcomes trials [28•, 29•].

BP Measurement Devices for AOBP

Medical offices interested in implementing AOBP should start by selecting a device that has been independently validated for use in medical offices and that is capable of obtaining multiple upper arm BP measurements without a healthcare worker present (Table 1). AOBP-capable devices typically cost between US$550 and US$1200 per unit. Lists of validated devices are available from the DABL Educational Trust Fund (http://www.dableducational.org/) and the British and Irish Hypertension Society (www.bhsoc.org/bp-monitors/bp-monitors). Although BpTRU monitors may still be found in primary care practices, BpTRU Medical Devices, LLC stopped manufacturing devices, parts, and accessories in 2017 [30]. Currently, experts recommend Omron HEM-907 and Microlife WatchBP Office/Welch Allyn ProBP 2400 devices as alternatives [9].

Some validated SMBP devices also allow patients to undergo multiple BP measurements without direct supervision from a healthcare worker [31–33]. As SMBP devices typically cost less than US$100 per unit, medical offices in low-resource settings have used them for AOBP. However, it is important to recognize that SMBP devices fit a narrower range of arm sizes and are less durable than devices specifically designed for professional office use. An informal environmental scan conducted by the authors also identified the Welch Allyn Connex and the Omron HEM-9000 as capable of obtaining multiple unattended BP measurements [34, 35]. However, the HEM-9000 is not currently sold in North America, and to our knowledge, studies have not formally evaluated the Connex as an AOBP device.

Comparing BpTRU, HEM-907, and WatchBP devices is challenging, due to the heterogeneity with which each performs AOBP. For example, the HEM-907 inserts a 0-, 3-, 5-, or 10–min interval between device activation and first BP reading, and then obtains either two or three upper arm BP measurements before displaying the average of all readings. In contrast, the WatchBP has two upper arm cuffs, allowing users to measure BP in one arm or both arms simultaneously, and when activated, it delays BP measurement for 1 min before obtaining the average of three BP readings. Neither of these devices discards the first BP reading, as the BpTRU device does. This heterogeneity notwithstanding, it is notable that most studies report that BP readings from all of these devices correlate with awake ABPM values and predict cardiovascular events better than conventional technique.

Several studies involving the Omron HEM-907 have validated the device for use in most adult populations [36–39], although concerns have been raised over its validity in patients with kidney disease [40, 41]. Two studies directly compared BpTRU and Omron HEM-907 devices. Myers et al. performed AOBP using both devices on the same patients while controlling for order effect and found both produced similar mean BP values [42]. In contrast, Rinfret et al. found that mean systolic BP was 4.3 mmHg higher using the HEM-907, but the analysis did not control for order effect [43]. Five studies reported that mean BP values obtained with the HEM-907 correlate with awake ABPM readings better than conventional techniques [44–48], although a sub-study of SPRINT found that HEM-907 readings underestimated ABPM values [49]. One study reported that HEM-907 AOBP readings predict left ventricular hypertrophy similar to awake ABPM [44], and two outcome trials using the HEM-907 showed that its AOBP values predicted cardiovascular events [25••, 50].

Table 1 Fully automated BP measurement devices capable of performing AOBP

Device	Cuff sizes (range)	Programmable features: Timer delay	Number of measurements	Interval between measurements	Discard first BP	Validation protocol
BpTRU BPM-200	S, M, L, XL (18–52 cm)	N/A	Single mode 1 AOPB mode 6	1, 2, 3, 4, or 5 min	Yes	AAMI
Omron HEM-907XL	S, M, L, XL (17–50 cm)	0 sec, 3 min, 5 min, or 10 min	Single mode 1 AOBP mode 2 or 3	5 sec, 30 sec, 1 min, or 2 min	N/A	AAMI ESH 2002
Microlife WatchBP Office	M, L, XL (22–52 cm)	1 min	First mode 3 Follow-up mode 3	1 min	N/A	AAMI ESH 2002
Welch Allyn Connex	Sizes 6–13 (7–55 cm)	0–120 min	1–6	0–240 min	Possible	AAMI

AOBP automated office blood pressure monitoring, *min* minutes, *sec* seconds, *N/A* feature not available, *AAMI* Association for Advancement of Medical Instrumentation, *ESH* European Society for Hypertension

Besides validation studies [51, 52], evaluations of the Microlife WatchBP AOBP device include one study demonstrating that mean AOBP values correlate well with SMBP readings [53] and two studies reporting that mean AOBP readings closely matched those obtained with awake ABPM [54, 55]. Recent studies also demonstrate that AOBP values obtained with the WatchBP predict left ventricular hypertrophy, proteinuria, and cardiovascular events similar to out-of-office techniques and better than conventional BP measurements [53, 55, 56]. One exploratory analysis compared the WatchBP and BpTRU devices on severely obese patients and found approximately 9 mmHg discrepancies in their mean systolic AOBP readings, highlighting a need for future studies to individually validate BP measurement devices in this patient population [57].

Using an AOBP Device

Once a medical practice has selected an AOBP device, it should determine how clinical personnel will use it, taking into consideration pragmatic issues, such as the number of devices available to the practice, time needed to perform the procedure, and competing tasks that medical personnel must perform. Additionally, primary care teams should determine what device settings to use. AOBP protocols described in the published literature have varied in terms of timed rest periods before cuff inflation, the number of BP measurements obtained, and the interval between readings (Table 2). Although a universally accepted AOBP protocol does not exist, a growing body of evidence offers guidance.

Selecting Patients for AOBP

If practices cannot perform AOBP on all patients because of cost or time constraints, it may be reasonable to reserve this approach for patients at higher risk for misclassification with conventional BP measurement [14, 29•]. A retrospective analysis of NHANES data found that obtaining multiple BP measurements is unlikely to change a patient's hypertension classification if their first BP reading is < 140/90 mmHg, but in approximately one third of patients whose initial BP is ≥ 140/90 mmHg, additional BP measurements would change treatment recommendations [58]. Another recent study similarly showed that obtaining two or three BP measurements increased the likelihood of correctly classifying patients' hypertension status when the first systolic BP was near treatment threshold (approximately 130–155 mmHg), but more than one BP measurement was unlikely to re-classify patients with very low or very high first BP readings [59•]. Thus, some authors have proposed that when medical practices cannot perform AOBP on all patients, they use a staged "screen and confirm" approach, whereby only patients with initial BP outside a predetermined range receive AOBP [60, 61].

It also is important to recognize that the oscillometric method used by AOBP devices does not accurately estimate BP in patients with an irregular pulse, such as those with atrial fibrillation. Although no ideal technique exists for estimating BP in patients with atrial fibrillation, experts recommend averaging the results of multiple auscultatory measurements [62•].

Location for Performing AOBP

Multiple studies involving BpTRU and Omron HEM-907 devices suggest that location does not affect AOBP results, as long as it occurs in an area that is quiet and free from distractions. Specific areas that have been studied include exam rooms, "open" clinical areas, clinic waiting rooms, and community pharmacies [43, 63–65].

Attended vs Unattended AOBP

A theoretical justification for AOBP is that this approach allows patients to undergo BP measurement alone, thereby avoiding WCE [66]. However, recent studies suggest it may be acceptable for medical personnel to remain in the room during AOBP, as long as they do not interact with the patient [67]. For example, only 47% of patients enrolled in SPRINT were left unattended throughout the AOBP process, yet a retrospective analysis of trial data found no difference in between mean BP values regardless of whether patients were attended or unattended [68]. A recent systematic review of 10 high-quality studies directly comparing attended and unattended AOBP in the same patient reported a statistically non-significant difference in pooled systolic BP of − 1.3 mmHg (95% CI − 4.3, 1.7 mmHg) [69], suggesting that medical offices may allow personnel the flexibility to perform other tasks in or outside the BP measurement area during AOBP, as long as they do not interact with the patient.

Timed Rest Periods Before Measurements

Whether to provide a timed rest period before AOBP warrants further investigation, given its implications for clinical workflow. BpTRU devices do not incorporate a delay timer to enforce a rest period, and AOBP measurement guidelines written with this device in mind explicitly recommend against resting patients [8•], as doing so can produce falsely low readings [16••]. However, it is unclear if patients should rest before performing AOBP with other devices. The algorithm used by WatchBP devices includes a 1-min delay, and HEM-907 devices can be set to provide a 3–10-min rest period. Two studies directly examined whether patients should rest before AOBP with non-BpTRU devices. A small study comparing the HEM-

Table 2 AOBP protocols used in recent clinical outcome trials and national biometric surveys

Study (year)	Device	Unattended?	Rest period (min)	Measurements (no.)	Interval between measurements (min)	Discarded first BP?
SPRINT (2016)	Omron HEM-907XL	Some	5	3	1	No
ACCORD (2014)	Omron HEM-907XL	Not specified	5	3	Not specified	No
NHANES	Omron HEM-907XL	No	5	3	0.5	Yes
Canadian Health Measures Survey	BpTRU BPM-300	Yes	0	6	1	Yes

AOBP automated office blood pressure monitoring, *SPRINT* Systolic Blood Pressure Intervention Trial, *ACCORD* Action to Control Cardiovascular Risk in Diabetes, *NHANES* US National Health and Nutrition Examination Survey

907 without a rest period with a BpTRU device set to 1-min intervals found that both protocols produced similar BP estimates [42]. A second study compared two HEM-907 protocols—with and without a 5-min delay—and found that mean BP was significantly higher (+ 4.0 mmHg, $P < 0.001$) when obtained without a rest period [70]. Superseding these studies, it should be noted that the studies linking HEM-907 and WatchBP readings with ABPM values and cardiovascular outcomes performed AOBP with a rest period [44, 46, 47, 53, 55, 56]. Furthermore, the HEM-907 protocols used hypertension outcome trials also specify resting patients 5 min before BP measurement [50, 71]. Thus, experts recommend rest periods before AOBP with HEM-907 and WatchBP devices [72].

Number of Measurements

The number of BP measurements to accurately perform AOBP has received relatively little attention despite differences among the protocols used by different AOBP devices. Whereas BpTRU devices average the results of five back-to-back BP measurements after discarding an initial test measurement, WatchBP devices average the results of three BP readings, and HEM-907 devices allow users to average the results of two or three BP readings. Furthermore, ACC/AHA guidelines recommend obtaining at least two BP readings [6••], but hypertension outcome trials often report the average of three BP measurements [50, 71]. To address this question, Kronish et al. examined the incremental value of averaging the results of obtaining one to five BpTRU measurements. They determined that averaging two readings increased the precision of BP estimates over that of one reading and that averaging three BP measurements further increased the probability of correctly classifying patients' hypertension status but with diminishing returns for the additional effort [59•]. Averaging more than three readings did not improve the precision of BP estimates in this study. Similarly, Moore et al. compared AOBP against 24-h ABPM and found that averaging the results of two to three BP readings yielded optimal results [73].

Intervals Between Measurements

There also is relatively little evidence for what the optimal interval BP readings should be. Early AOBP protocols involving BpTRU devices included a 2-min delay between BP measurements, but Myers et al. found that BpTRU devices produced equivalent BP readings regardless of whether 1- or 2-min intervals elapsed between readings [74]. Another study comparing Omron HEM-907 and BpTRU devices obtained similar readings in patients regardless of whether AOBP was performed with 1-min intervals between readings; however, mean diastolic BP obtained with the HEM-907 was significantly lower than those obtained with BpTRU when HEM-907 measurements were performed with 2-min intervals [42]. When interpreting these studies, it is important to recognize BpTRU device time intervals from the start of one measurement to the start of the next measurement, whereas HEM-907 and WatchBP device time intervals between readings from the end of one measurement to the start of the next. Thus, the time that elapses between readings on a BpTRU devices programmed for 1-min intervals may be closer to 30-s intervals when using HEM-907 or WatchBP devices.

Our Approach

Primary care practices in the Johns Hopkins Health System apply a screen and confirm approach in which medical assistants are trained to obtain a single oscillometric BP reading when rooming patients, and then if the initial BP is 140/90 mmHg or higher, perform an AOBP measurement. When performing AOBP, we have programmed our devices (Omron HEM-907XL) to provide a 5-min rest period before obtaining three BP measurements at 30-s intervals. Medical assistants may be present during AOBP, but many choose to leave patients unattended to perform other tasks such as preparing vaccines or rooming another patient. We selected this approach in collaboration with frontline clinicians because it balances the imperative to facilitate clinical workflow with their desire to use BP measurements that can be directly compared to treatment thresholds established in clinical outcome trials.

Interpreting AOBP Readings

Studies conducted with BpTRU have shown that AOBP, SMBP, and awake ABPM correspond to cardiovascular risk at similar thresholds: 135/85 mmHg when the treatment cutoff for conventional BP would otherwise be 140/90 mmHg [18, 19, 75]. However, differences among AOBP, out-of-office BP, and conventional BP converge at lower BP values; thus, ACC/AHA guidelines suggest that for treatment thresholds near 130/80 mmHg, AOBP, conventional BP, SMBP, and awake ABPM should be viewed equivalent [6••].

Integrating AOBP into Clinical Workflow

Although some have questioned the feasibility of implementing AOBP in real-world settings, successful efforts have been reported [76, 77]. Primary care groups may find a conceptual framework by Cabana et al. helpful for anticipating and preemptively addressing barriers to implementing this approach [78•]. It classifies reasons for not adhering to best practice guidelines in terms of healthcare workers' *knowledge* (e.g., awareness and familiarity with the activity) and *attitudes* (e.g., agreement with guidelines that recommend the activity, belief in the activity's effectiveness, motivation, and belief in their ability to engage in the activity), as well as *external factors* to that activity.

Addressing Knowledge Barriers

To overcome lack of knowledge, implementation efforts should orient medical personnel to the AOBP device and describe how to perform this technique. Training programs should give special attention to the importance of positioning patients in seated position with appropriate-size cuff on their bare arm, arm at heart level, back supported, legs uncrossed, and feet not dangling because obtaining accurate AOBP measurements still depends on medical personnel correctly preparing and positioning patients. Ideally, educational efforts will be delivered in a way that provides personnel with opportunities to ask questions, express concerns, and demonstrate AOBP technique in a supervised setting before performing it in practice [79•]. Demonstrating BP measurement skills to supervisors or peers can help learners consolidate what they have learned [80], and engaging clinical personnel in discussions that address their concerns about a new practice can enhance the likelihood that they will perform it as intended.

Addressing Attitudinal Barriers

In particular, clinicians' attitudes towards AOBP can hinder its implementation by refusing to use this approach, and also through their indirect influence on medical assistants' and nurses' attitudes. Many clinicians have used the auscultatory technique throughout their professional career, but few are even aware of AOBP as a distinct concept. Further, given the high degree of skill needed to measure BP manually, some may even view auscultatory BP measurement as a means for demonstrating expertise and establishing rapport with patients. We recommend beginning by summarizing scientific literature that describes the validity of AOBP devices [81•], describes the potential for improved operational efficiency [82], and highlights potential to reduce patient harm due to misclassifying hypertension [67]. But implementation efforts should also ensure sufficient time to solicit clinicians' perspectives and engage them in co-developing the AOBP process in a way that addresses their concerns.

Addressing External Barriers

Physical constraints in the office environment are a common barrier to adhering to BP measurement guidelines. For example, medical personnel may fail to correctly position patients if BP measurement devices are installed far from chairs or if rooms lack surfaces on which patients may rest their arms. Similarly, they may use incorrect cuff sizes, if all cuff sizes are not readily accessible. Medical practices can minimize risks for position-related measurement errors by ensuring patients undergo BP measurement in rooms equipped with a full range of BP cuffs and arranged in a manner that ergonomically supports correct patient positioning.

Addressing clinical workflow is also important. Although AOBP is still more efficient than correctly performing manual measurements (requiring 5–8 min, depending on which device and protocol are used, vs 14 min), clinicians infrequently adhere to BP measurement guidelines and thus may perceive AOBP as less efficient than their usual process. To address this concern, groups implementing AOBP might highlight how fully automated devices allows medical personnel to perform other tasks during the AOBP process, such as rooming other patients, requesting medical records, preparing vaccines, or documenting in the chart. They might also propose team-oriented workflows. For example, a medical assistant might room a patient and start the AOBP process before leaving to perform other tasks, but a clinician would record the BP reading in the chart when they begin to examine the patient. Indeed, a standardized, team-based BP measurement approach can lay the foundation for other team-based hypertension management, such as providing patients with early follow-up with nurses empowered to perform BP checks and make protocol-based medication adjustments, similar to protocol-based anticoagulation management.

Lastly, it is important to recognize that patients play an important role in successfully performing AOBP, especially when left unattended. Patients accustomed to conventional BP measurements may be confused by a new BP measurement process, leading to impatience with the time needed to measure BP or even unwanted movement during the AOBP process. In many instances, medical offices can reduce address patient-related barriers by providing patients with posters or handouts that describe the benefits of improved BP measurement, and provide anticipatory guidance about the new process, such as describing the rest period and number of measurements they will experience [76].

Conclusions

AOBP is a more accurate approach for assessing cardiovascular risk than conventional office-based BP measurement, with predictive characteristics similar to awake ABPM. Consensus for a specific AOBP protocol does not exist currently, but protocols used in clinical trials and national population health initiatives typically include a timed rest period, obtaining three back-to-back BP measurements separated by 30–60 s each. Although feasible to implement in medical office settings, this approach should not be viewed as a substitute for out-of-office measurements, such as SMBP or 24-h ABPM.

Compliance with Ethical Standards

Conflict of Interest The authors declare no conflicts of interest relevant to this manuscript.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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