

Korotkoff sound (muffling) is used to estimate diastolic BP. Oscillometric devices estimate diastole using an algorithm that imputes from mean arterial pressure.³⁷

Inter-arm difference: systolic BP difference of >10 mmHg when BP is measured sequentially in each arm.³⁸

Postural/orthostatic hypotension: decrement of ≥ 20 mmHg in systolic BP and/or ≥ 10 mmHg in diastolic BP when BP is measured in the standing position at 1 and/or 3 min after standing following a 5-min period in the sitting or lying position.

White-coat hypertension: BP that is above the threshold for diagnosing hypertension in the office but below the threshold in home/ambulatory settings, e.g. $\geq 140/90$ mmHg in office but $<135/85$ mmHg at home/ambulatory daytime (or 24-h BP $<130/80$ mmHg).

Masked hypertension: BP that is below the hypertension diagnostic threshold in the office but above the hypertension diagnostic threshold in home/ambulatory settings, e.g. $<140/90$ mmHg in clinic but $\geq 135/85$ mmHg at home/ambulatory daytime (or 24-h BP $\geq 130/80$ mmHg).

Office BP: also known as clinic BP. The two terms are interchangeable. This guidelines document uses 'office BP' preferentially. Of note, office BP can be measured manually or using an automated device. In addition, automated office BP (AOBP) can be conducted in a setting attended by a healthcare professional or in an unattended fashion. Finally, not all office BP measurements are equal, with some facilities using a standardized method (which is recommended and outlined below) and others unfortunately using suboptimal approaches to office BP measurement.

Home BP measurement (HBPM): an out-of-office approach to measuring BP when the patient measures their own BP at home using a validated monitor (usually an upper-arm oscillometric cuff device).

Ambulatory BP measurement (ABPM): an out-of-office BP measurement that uses a fully automated oscillometric device, usually for a 24-h period, and measures BP at set intervals.

5.2. Practical recommendations for measuring blood pressure

5.2.1. Clinical validation of equipment for measuring blood pressure

A prerequisite of BP measurement is that it must be undertaken using a device that has been clinically validated and confirmed to be accurate. Of the commercially available oscillometric BP measurement devices, as few as 6% have been adequately tested.^{39–41} National and international organizations provide lists of validated monitors (e.g. www.stridebp.org, www.validatebp.org).

Since the 2018 ESC/ESH Guidelines on the management of arterial hypertension, three arbiters of device accuracy (the Association for the Advancement of Medical Instrumentation, the ESH, and the International Organization for Standardization) have published a universal standard for validating devices for measuring BP.⁴² This standard will likely become widely adopted. Validation standards and methodology need to be developed and implemented for novel BP measurement devices that are non-occlusive and 'cuffless'.^{43,44}

5.2.2. Office blood pressure measurement

All BP measurements can be influenced by circumstances of measurement, including position, ambient temperature, the technique of measurement, accuracy of equipment, and physical condition of the

patient.⁴⁵ For BP measurements in the office, we recommend following a standardized method (Figure 3).

Patient preparation: BP should be measured with the patient seated comfortably after 5 min of rest. Patients should avoid exercising and stimulants (caffeine, tobacco) for at least 30 min before measurement. The patient's bladder should be emptied if needed.⁴⁶ Patients should be seated with their legs unfolded and their back supported at the time of measurement. The arm should be supported (to avoid isometric exercise-induced increases in BP). Clothing at the location of the cuff placement should be removed; rolling up of shirt sleeves should be avoided as this can result in a tourniquet effect.

BP measurement technique: auscultatory or oscillometric techniques can be used to measure BP non-invasively. The manual auscultatory approach is the traditional method of measuring systolic and diastolic BP at the brachial artery site using a stethoscope. In contrast, oscillometric devices compute mean arterial BP using the oscillation amplitude with cuff deflation (or inflation) and then estimate systolic and diastolic BP. Oscillometric devices can be semi-automated (taking one reading per activation) or fully automated (obtaining multiple readings before averaging them). Oscillometric devices are not typically validated for use in AF, and the manual auscultatory method is preferred in these circumstances when feasible.^{47–49}

BP cuff selection and positioning: an appropriately sized cuff should be used, as an under-sized or over-sized cuff will artificially elevate or reduce BP, respectively.⁵⁰ The bladder length should be 75%–100% and the width 35%–50% of the arm circumference. The arm circumference can be measured at the mid-point of the olecranon and the acromion but many cuffs include sizing indicators. The cuff should be positioned on the patient's upper arm at the level of the heart with the lower edge of the cuff a few centimetres above the antecubital fossa. The stethoscope should not be placed under the cuff. In those with significant obesity where a correctly fitting upper arm cuff is not available, measurement at the lower arm or wrist can be considered as an alternative.⁵¹

BP measurement by manual auscultation: three BP measurements should be taken, each 1–2 min apart, and additional measurements only if the readings differ by >10 mmHg (e.g. this may occur with arrhythmias or white-coat effects). The BP recorded should be the average of the last two BP readings.

BP measurement using AOBP measurement: as noted above, AOBP using oscillometric devices may be obtained with (attended) or without (unattended) clinicians or staff present. Clear evidence regarding superiority of unattended vs. attended AOBP in managing BP to reduce rates of CVD is lacking; however, because BP readings may differ for unattended vs. attended measurements,⁵² we advise that a consistent approach be used depending on local resource and preference. AOBP monitors typically make three or six readings at 1-min intervals and provide an average. AOBP correlates more closely with mean ABPM than with the manual auscultatory technique and may reduce measurement error and white-coat effects.⁵³

Inter-arm BP difference: at the initial visit, BP should be measured in both arms to detect an inter-arm difference. Though devices allowing simultaneous measurement in both arms exist, sequential arm measurement is considered sufficiently reliable.^{54,55} Measurement in the contralateral arm should be undertaken once the three measurements in the index arm have been taken, and if a difference is detected, further measurement in the original arm is indicated to ensure the difference is consistent. If systolic BP differs by >10 mmHg between arms, subsequent measurements are obtained using the arm with the higher BP value. Significant inter-arm BP differences may reflect arterial stenosis or