

Blood Pressure Measurement Essentials

The required elements for accurate BP measurement include:

1. Proper patient preparation
2. Individualized cuff selection
3. Mastery of BP measurement

When any/all of these elements is not followed, the obtained BP may be as much as 50 mmHg from the patient's actual BP (table).

Factor	Increase in Blood Pressure
Talking	7-10 mmHg
Listening	5 mmHg
Crossed Legs	2-8 mmHg
No back support	6-10 mmHg
Arm unsupported	Systolic: 1-7 mmHg; Diastolic: 5-11 mmHg
Arm positioned with center of bladder at heart level	Each inch above this level decreases BP by ≥ 2 mm Hg, and vice versa*
Oscillometric Device	Systolic: 10 mmHg; Diastolic: 5 mmHg
Distended urinary bladder	10-15 mmHg
Recent caffeine intake	Systolic: 10 mmHg; Diastolic: 5 mmHg
Recent smoking	Systolic: 6 mmHg; Diastolic: 5 mmHg
Cuff over clothing	Systolic: 5-50 mmHg
Cuff too small	Systolic: 10 mmHg; Diastolic: 2-8 mmHg

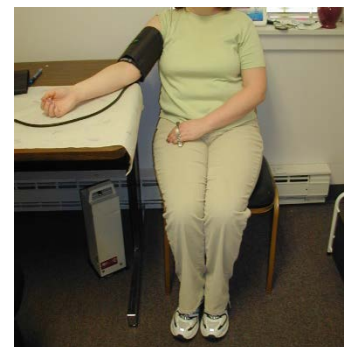
Patient Preparation

Prior to the measurement, each patient should:

- Refrain from caffeine, smoking, exercise for at least 30 minutes.
- Empty their bladder.
- Rest for 2-5 minutes.

During the measurement, they should:

- Be seated with their arm, back and feet supported.
- Keep their legs uncrossed.
- Refrain from talking, reading or using an electronic device such as a smart phone.



Providers should:

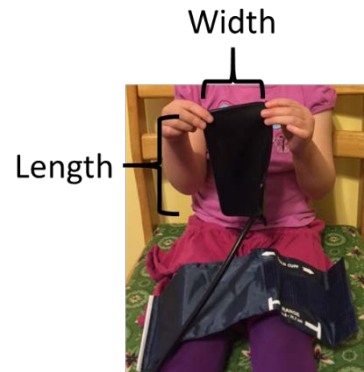
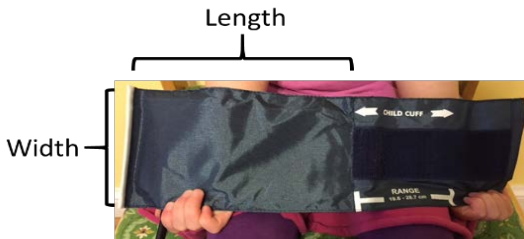
- Keep the room quiet and refrain from talking.
- Apply the BP cuff to a bare arm, ensuring that nothing is constraining the arm above the cuff

Choosing the Right Cuff

The correct cuff has:

- **bladder** length of 75 % to 100 % of the upper mid-arm circumference
- **bladder** width of 37 % to 50 % of the upper mid-arm circumference

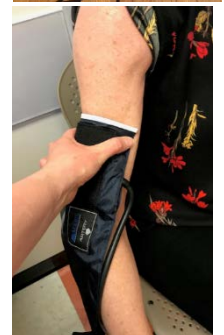
The bladder is the inflatable portion of the BP cuff



Ideal: Measure the distance between the acromion (bony part of the shoulder) and olecranon (elbow) with measuring tape while the arm is bent at 90 degrees. Note the midpoint, then measure the mid-arm circumference at that point when the arm is resting at the patient's side. Use this measurement to choose the correct cuff for your patient.



Acceptable: Choose a cuff, rotate the cuff 90 degrees so that the short end of the cuff *bladder* (the "width") is between both of your hands. Then place this on your patient's upper arm at the mid-point between the shoulder and elbow. If the width encircles at least 40% of the mid-arm, place the cuff on your patient. If the cuff *bladder* length encircles at least 80% of the mid-arm you have chosen the correct cuff. If these criteria are not met, then choose a smaller or larger cuff as appropriate and repeat the steps above. When in doubt, err on the side of choosing a larger cuff.



Preparing for the measurement

Once you have identified the correct size cuff, fold it in half to identify the mid-point of the bladder. This mid-point of the bladder of the cuff will need to be positioned centrally above the brachial artery. Note that the packaging may mark a location (often labeled "artery") that is different than the actual midpoint of the bladder. Use the point you identify when folding the BP cuff in half.

Then locate your patient's brachial pulse, which can be achieved by placing your index and third finger in the crease of his/her elbow. Once the brachial pulse is identified, place the blood pressure cuff 2 cm (or 1-2 finger breadths) above this location, taking care to ensure that the mid-point of the bladder is placed directly above the brachial pulse. When putting the cuff on the person's arm, it can be helpful to lift the participant's arm slightly before placing the midpoint of the cuff bladder directly over the brachial artery. The cuff should fit snugly on the arm, allowing for up to 2 fingers to fit underneath the cuff when secured.



Once the cuff is placed, make sure the patient's arm is supported and that the midpoint of the cuff is at heart level.

Taking a Blood Pressure Measurement by Manual Auscultation

Have the participant rest for 5 minutes before taking any blood pressure measurements. Make sure the sphygmomanometer dial is close and at eye level.

During auscultatory blood pressure measurement, you are listening for Korotkoff sounds. K1, which is the onset of at least 2 consecutive taps, is the systolic measurement and K5, which is the point when tapping ceases, is the diastolic measurement. When tapping can be heard to 0 mmHg, or to a nonphysiologic level, K4, which is the point at which the Korotkoff sounds start to muffle, is then used for the diastolic measurement.

Korotkoff sounds are best heard using the bell of your stethoscope. The bell should be placed lightly over the brachial pulse. There should be no overlap between the bell and the cuff. If unable to use the bell, the diaphragm is acceptable.



Determine the Pulse Obliteration Pressure:

Once your patient is rested, palpate the radial pulse. Then pump the sphygmomanometer quickly to 60 mmHg and then in increments of 10 mmHg until you no longer feel the pulse. This is your *pulse obliteration pressure*. Deflate the cuff.

Determine the Peak Inflation Level:

Add 20-30 mmHg to the pulse obliteration pressure. This is your peak inflation level. After 15-30 seconds rest from when the cuff was inflated to determine the pulse obliteration pressure, reinflate the cuff to the peak inflation level, then deflate the cuff slowly at 2-3 mmHg per second. You want to deflate it to at least 10 mmHg below the K5 measurement (disappearance of tapping) to ensure you have the proper K5 measurement.

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Both the systolic and diastolic BP measurement should be measured to the nearest 2 mmHg. When needed, the value should be rounded up to achieve this.

In between measurements, ensure the cuff is completely deflated and patient remains at rest. Raise patient's arm passively for 15 seconds, then lower arm for 15 seconds prior to subsequent measurements.

References/Resources

Clinical Practice Guideline: Flynn JT, Kaelber DC, Baker-Smith CM, et al. Clinical Practice Guideline for Screening and Management of High Blood Pressure in Children and Adolescents. Pediatrics. 2017;140(3):e20171904

BP Measurement in Children Instructional Video: <http://youtu.be/JLzkNBpqwi0>

Hander, J. The Importance of Accurate Blood Pressure Measurement. The Permanente Journal. 2009 Summer;13(3):51-4. PMID: 20740091.

Rakotz MK, Townsend RR, Yang JN, et al. Medical students and measuring blood pressure: Results from the American Medical Association Blood Pressure Check Challenge. J Clin Hypertens 2017;19:614-9.