Measuring Blood Pressure Accurately
Disclosures

• None
Objectives

- List factors (patient, observer, system) that can make blood pressure readings inaccurate and identify strategies to overcome those factors
- Use Measure Accurately and Patient-Measured Blood Pressure tools to identify opportunities for improving accuracy and reliability of blood pressure measurement
- Discuss use of self-measured blood pressure (SMBP) monitoring for clinical management of hypertension (HTN)
- Demonstrate measurement techniques for in-office and SMBP
Importance of measuring BP accurately

- BP variability exists in everyone
- A single office-based measurement correlates poorly with a patient’s true BP
- Many office-based measurements are taken with poor technique
- Varying BP phenotypes exist (e.g. white coat HTN, masked HTN)
- BP measurements taken in and out of clinical settings can be used to confirm diagnoses and assess BP control

Accurate and reliable measurement is essential for diagnosis and management of high blood pressure

Accurate BP measurement guidance

- 2017 ACC/AHA Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults


Polling question

How do you primarily take blood pressure in your organization?
Manual office blood pressure

Convenient and inexpensive

Devices require frequent calibration

Higher likelihood of terminal digit preference

Requires more time and skill compared to semi-automated and automated blood pressure

Can be impacted by observer, patient and environmental factors

Semi-automated blood pressure

Single measurement taken upon activation

Reduces the potential for technique-related errors compared to manual BP

Accurate and reliable when using validated devices, calibrated regularly with proper patient preparation, cuff selection and positioning

Allows for more time to be spent on patient preparation, cuff selection and positioning

Automated office blood pressure (AOBP)

Fully automated devices can take three BP measurements and average them

Can be integrated into primary care workflows- total measurement time ~5 min

Allows for unattended measurement

Correlates well with daytime mean BP during ambulatory BP monitoring (ABPM)

Ambulatory blood pressure monitoring (ABPM)

- Most evidence from clinical trials for diagnostic accuracy and predicting future CV events

- Can be used to identify BP patterns (eg, white coat HTN and masked HTN) that cannot be identified with office BP alone

- Provides BP information during sleep as well as awake hours

- Requires placement of an ABPM device on a patient for 24 hours and interpretation; access may be limited
Self-measured blood pressure (SMBP)

- Better predicts future CV events than single conventional in-office measurement

- Can be used to identify BP patterns that cannot be identified with office BP alone

- With clinical support/co-interventions, can be effective at lowering BP and improving BP control rates

BP measurement training, skills, and competence

Regardless of device or method, BP measurement accuracy relies on competence of observer

• Training and skills assessment should include:
  – Patient preparation and positioning
  – Selecting the appropriate cuff
  – Obtaining accurate, representative results
  – Documentation and communication

• Retraining of health care professionals every 6 months to 1 year should be considered

• Patients also need to be trained by a health care professional to self-measure their own BP

Muntner P, Shimbo D, Carey R et al; on behalf of the American Heart Association Council on Hypertension; Council on Cardiovascular Disease in the Young; Council on Cardiovascular and Stroke Nursing; Council on Cardiovascular Radiology and Intervention; Council on Clinical Cardiology; and Council on Quality of Care and Outcomes Research. Measurement of blood pressure in humans: a scientific statement from the American Heart Association. Hypertension. 2019;71:e35–e66. DOI: 10.1161/HYP.000000000000087
Action Steps for Measuring Accurately
What can we do to improve the quality in-office of BP measurements?

- Use validated devices, calibrate when appropriate
- Use correct measurement technique
- Perform the proper number of BP measurements
Use validated, calibrated devices
Only devices that have been independently validated using an internationally accepted established protocol should be used

- US Blood Pressure Validated Device Listing (VDL™) launched in 2020 – ValidateBP.org

- International validated device listings also available
  - Stride BP: stridebp.org/bp-monitors
  - Hypertension Canada: hypertension.ca/bpdevices
  - British and Irish Hypertension Society: bihsoc.org/bp-monitors/
How often are your blood pressure devices checked for accuracy?
Calibration of devices

- Ensures ongoing proper device function
  - Every 12-24 months for automated devices
  - Every 6 months for wall-mounted manual devices
  - Every 2-4 weeks for handheld manual devices
  - Work with biomed department to develop guideline-supported calibration process

Use correct measurement technique
Obtain initial BP measurement

At first visit for a new patient, one BP measurement should be performed on each arm
- Arm with higher BP = “BP arm”
- “BP arm” should be arm used going forward; document in the chart

For all patients, take initial BP measurement
- Use correct technique and positioning
- Document initial measurement in vitals field in EHR

What error do you see most commonly occur during blood pressure measurement?
Common measurement errors and effect on BP

<table>
<thead>
<tr>
<th>When the patient has….</th>
<th>Blood pressure can change by an estimated*…</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crossed Legs</td>
<td>2–8 mm Hg(^1)</td>
</tr>
<tr>
<td>Cuff over clothing</td>
<td>5–50 mm Hg(^2)</td>
</tr>
<tr>
<td>Cuff too small</td>
<td>2–10 mm Hg(^2)</td>
</tr>
<tr>
<td>Full bladder</td>
<td>10 mm Hg(^2)</td>
</tr>
<tr>
<td>Talking or active listening</td>
<td>10 mm Hg(^2)</td>
</tr>
<tr>
<td>Unsupported arm</td>
<td>10 mm Hg(^1,2)</td>
</tr>
<tr>
<td>Unsupported back/feet</td>
<td>6.5 mm Hg(^3)</td>
</tr>
</tbody>
</table>

* These values are not cumulative

2 Handler J. The importance of accurate blood pressure measurement. The Permanente Journal/Summer 2009/Volume 13 No. 3 51
Choosing correct cuff size

Wrong size cuff → most common error in BP measurement

Cuff bladder length: 75%–100% of the patient’s measured arm circumference

Cuff bladder width: 37%–50% of the patient’s arm circumference

Correct cuff placement

Key Tips:

– Use an upper-arm cuff
– Place cuff on bare skin
– Center the cuff bladder over the brachial artery, at heart level
– 1 finger should fit easily at the top and bottom of the cuff; 2 fingers should fit but will be very snug

* Photos courtesy of National Health and Nutrition Examination Survey (NHANES) blood pressure procedures manual 2019

BP Cuff Demonstration
Patient preparation

- Avoid caffeine, exercise and tobacco for ≥ 30 minutes before measurement
- Empty bladder, if full
- Find a quiet environment
- Rest in seat 3-5 minutes

Patient positioning

• Back supported
• Legs uncrossed
• Feet flat on the floor or a step stool
• Arm supported
• Proper sized cuff placed on bare skin
• Middle of cuff at heart level
Exam room considerations for preparation and positioning

Aneroid device should be at eye level of observer.

Chair with back support and arm rest.

Desk is an option for arm support.

Consider a foot stool for petite patients.

The footrest or exam table can be used for arm support.
Perform BP measurements
BP measurements

• A single reading is inadequate for clinical decision-making\(^1\)

• BP should be measured \(\geq 2\) times at clinic visits\(^2\)

• Separate repeated measurements 1-2 minutes apart\(^2\)

• Average the readings\(^2\)


Notification for high BP

- Notify provider of high BP

- Determine method to notify provider if BP is high
  - Verbal alert
  - EHR alert (ensure this is visible to the provider)
  - Visual cue
    - Options for visual cues include a heart sticker or magnet placed in the exam room or on exam room door, using a flag outside room, a laminated card on keyboard or the BP cuff left on patient
Self-measured blood pressure
Self-measured blood pressure (SMBP)

SMBP monitoring refers to the regular measurement of BP by a patient at their home or elsewhere outside the clinical setting.

Polling question

*Do providers at your organization currently recommend patients to measure their blood pressure at home?*
Self-measured blood pressure

• Use upper-arm, validated devices

• Cuff size should be appropriate for the patient’s arm circumference
  – Home BP cuffs usually have a standard-sized cuff that will fit upper arms starting at 8” up to 14-18” (XL options available for some devices)

Who provides training and education on SMBP to patients?
Training patients to self-measure correctly

- Teach them how to prepare themselves for the measurement
  - Empty bladder
  - Rest 5 minutes
  - No talking or texting

- Show them how to use the device and properly put the BP cuff on their designated BP arm

Training patients to self-measure correctly

• Tell them how to position themselves during the measurement
  – Seated with back supported
  – Feet flat on floor, legs uncrossed
  – Cuff on bare arm
  – Arm with cuff supported on flat surface or table

• Tell them how often and when to measure
  – Take two blood pressure measurements in the morning and two in the evening
  – Perform measurements one minute apart
• Calculate average of all measurements

• Document average systolic and average diastolic BP in medical record

• Share measurement results with provider for interpretation and treatment

• Notify patient of treatment and follow-up plan
SMBP Device Demonstration
Care team tools and resources

https://targetbp.org/
Tools and resources

Technique Quick Check

Positioning Infographic
Tools and resources

Measure Accurately
Quick-start Guide

Measure Accurately
Pre-assessment
Tools and resources

Competency Manual BP

Measure accurately
Staff competency for manual office blood pressure measurement

Clinical staff should be trained and tested on measuring blood pressure (BP) accurately. It is important for staff to understand the importance of accurate BP measurement for both in-office and out-of-office settings and to be able to explain these processes in a manner the patient will understand.

Using an essential competency like this not only helps demonstrate that staff is trained and can effectively perform BP measurement, it also helps strengthen the education staff provides to patients who will self-measure their BP.

How to use competency form

- Competencies should be performed no less than twice annually

Competency Semi-auto and AOBP

Measure accurately
Staff competency for semi-automated and automated office blood pressure measurement

Clinical staff should be trained and tested on measuring blood pressure (BP) accurately. It is important for staff to understand the importance of accurate BP measurement for both in-office and out-of-office settings and to be able to explain these processes in a manner the patient will understand.

Using an essential competency like this not only helps demonstrate that staff is trained and can effectively perform BP measurement, it also helps strengthen the education staff provides to patients who will self-measure their BP.

How to use competency form

- Competencies should be performed no less than twice annually
- Fill in space of knowledge and training
In-office BP average calculator

In order to obtain a representative blood pressure (BP) to guide the diagnosis and treatment of hypertension, take two or more BP readings when a patient's initial in-office BP is high and then average them. Use this tool to quickly calculate a patient's average systolic and diastolic BP.

<table>
<thead>
<tr>
<th>BP READING</th>
<th>SYSTOLIC BP</th>
<th>DIASTOLIC BP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[Add BP Reading]

[Clear/Restart]  [Calculate]

https://www.ama-assn.org/node/27271
Tools and resources

SMBP Quick Start Guide

https://tinyurl.com/look-at-SMBP
Tools and resources

7 Day Recording Log

Patient Training Checklist
Tools and resources

SMBP Patient Infographic

How to measure your blood pressure at home
Follow these steps for an accurate blood pressure reading

1. PREPARE
   - Avoid caffeine, alcohol, and other stimulants 30-60 minutes before you measure your blood pressure.
   - Sit for at least 10 minutes before you measure.
   - Sit with your back straight and feet on the floor.

2. POSITION
   - If sitting, place your arm on a table and rest your hand on a table or armrest.
   - If standing, sit on a chair with your arm resting on a table.
   - Keep your arm at heart level.

3. MEASURE
   - Wrap the cuff around your upper arm snugly, leaving about 1 inch of space between the cuff and your skin.
   - Inflate the cuff until the pressure is just above your systolic pressure.

- Stop inflation when you hear a Korotkoff sound.
- Wait 1 minute before taking another measurement.
- Record your blood pressure measurements.

SMBP Training Video

SMBP Training Video (English)
SMBP Training Video (Spanish)
What next steps will you take to improve BP measurement accuracy?
Together, we can reduce the number of Americans who have heart attacks and strokes.