Rhode Island Department of Health
Chronic Care and Disease Management Program Presents:

The Importance of Measuring Blood Pressure Accurately

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Estimated time to complete: 30 minutes
There are no prerequisites for participation.

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Disclaimer
This educational program is designed to present scientific information and opinion to health professionals, to stimulate thought, and further investigation.

Learning Objectives

At the conclusion of this session, attendees should be able to:

• Explain why measuring blood pressure (BP) accurately is critical
• Identify common factors contributing to errors in office BP measurement and how to avoid them
• Determine which method of measuring BP yields the most accurate and representative blood pressures
• Name three methods used to measure BP in the office setting

Target Audience
Practice teams including physicians, nurses, nurse care managers, medical assistants, and other team members as well as public health professionals.
CME Accreditation

This activity has been planned and implemented in accordance with the accreditation requirements and policies of the Accreditation Council for Continuing Medical Education (ACCME) through the joint providership of the Warren Alpert Medical School of Brown University and the Rhode Island Department of Health. The Alpert Medical School is accredited by the ACCME to provide continuing medical education for physicians.

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Nursing Contact Hours & Criteria for Successful Completion

This continuing nursing education activity was approved for 1 CEU by the Northeast Multi-State Division Association, an accredited approver by the American Nurses Credentialing Center’s Commission on Accreditation.

• In order to obtain 1 CEU credit, learners must complete the webinar and submit a completed evaluation form.

• It hardcopy evaluation forms to Chronic Care and Disease Management Program (CCDM) by:
  – e-mail at DOH.community@health.ri.gov (subject line: webinar)
  – or mail to RI Department of Health, 3 Capitol Hill, Room 408, Providence, RI 02908, Attn: Chronic Care and Disease Management Program/webinar

• For questions regarding webinar content, contact Chronic Care and Disease Management Program at DOH.community@health.ri.gov (subject line: webinar)
Faculty Disclosure/Conflict of Interest

The following have indicated that they have no relevant financial relationships to disclose:

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Questions or Comments?
Contact Us at CME@Brown.edu
The importance of measuring blood pressure accurately

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OBJECTIVES

• Why measuring blood pressure (BP) accurately is critical

• Common factors contributing to errors in office BP measurement and how to avoid them

• Which method of measuring BP yields the most accurate and representative blood pressures

• Three methods used to measure BP in the office setting
Blood pressure variability

Significant short and long term BP variability exists in all patients

- Physical activity
- Emotional stimuli
- Sleep
- Central BP oscillations
- Mechanical forces from ventilation

Blood pressure variability

Typical variability in a 24 hour period
Blood pressure variability

Almost all patients will experience some degree of alerting response

• **White coat hypertension**: Office BP $\geq 140/90$ mm Hg in a patient whose out of office BP is not elevated

But some will experience none at all…

• **Masked hypertension**: Office BP $< 140/90$ mm Hg in a patient whose out of office BP is $\geq 140/90$

Blood pressure variability

• Lack of use of standardized BP measurement protocols contributes to BP variability and inaccurate BP measurements
The importance of measuring blood pressure accurately

Why is minimizing variability and standardizing BP technique so important?

1. Accurate BP readings are needed to make sound clinical decisions

2. For office BPs to be predictive of future cardiovascular events (outcomes) they must be representative of a patient’s actual BP

The leading reason clinicians fail to diagnose and treat elevated office BPs is uncertainty about whether the BP is representative of the patient’s “true” BP

• This leads to poor clinical decisions (diagnostic or therapeutic)

How might this affect patient outcomes?

The consequences of measuring blood pressure inaccurately

- If diastolic BP measured *spuriously high* (poor technique, white coat effect) by 5 mm Hg across a population – the number of Americans misdiagnosed with hypertension could increase by 54%.

- If diastolic BP measured *spuriously low* (poor technique, masked effect) by 5 mm Hg, the number of Americans with hypertension misclassified as not having HTN could increase by 42%.

**OBJECTIVES**

- Why measuring blood pressure (BP) accurately is critical

- Common factors contributing to errors in office BP measurement and how to avoid them

- Which method of measuring BP yields the most accurate and representative blood pressures

- Three methods used to measure BP in the office setting
Common Errors Made During Office BP measurement

Common problems that account for inaccurate blood pressure measurement

<table>
<thead>
<tr>
<th>When patient has...</th>
<th>BP can change by this much...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cuff over clothing</td>
<td>10–40 mm Hg</td>
</tr>
<tr>
<td>Full bladder</td>
<td>10–15 mm Hg</td>
</tr>
<tr>
<td>Conversation or is talking</td>
<td>10–15 mm Hg</td>
</tr>
<tr>
<td>Unsupported arm</td>
<td>10 mm Hg</td>
</tr>
<tr>
<td>Unsupported back</td>
<td>5–10 mm Hg</td>
</tr>
<tr>
<td>Unsupported feet</td>
<td>5–10 mm Hg</td>
</tr>
<tr>
<td>Crossed legs</td>
<td>2–8 mm Hg</td>
</tr>
</tbody>
</table>

Observer Factors
- Wrong cuff size
- Cuff placed over clothing
- Improper positioning
- No rest
- Terminal digit preference
- Talking to patient
- Too rapid cuff deflation

Patient Factors
- Full bladder
- Stimulants
- Recent exercise
- Recent meal
- Talking, texting, reading

System Factors
- Location of monitor/device
- Noise
- Work Flows

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Avoiding common errors in BP measurement

Wrong cuff size used is the most common error

A properly-fitted cuff should have

- Bladder length that is 80-100% of the circumference of the arm
- Bladder width that is at least 40% of the circumference of the arm,

Avoiding common errors in BP measurement

Rest and environment

- Rest for five minutes prior (if you cannot, take BP as last vital)
- No talking (patient or observer)
- No listening (to music, telephone, etc.)
- No texting, reading, writing
- BP device should not be mounted over exam table
- Seasonality/ Temperature: Winter raises BP 5 mm Hg
  Summer decreases 5 mm Hg
Avoiding common errors in BP measurement

Rest

Avoiding common errors in BP measurement

Body positioning

• Sitting in a chair with back and arm supported (1)
• Legs uncrossed, feet on the ground or a stool (2)
• Cuff over a bare arm (3)
• Correct Cuff Size
• No talking or texting
Avoiding common errors in BP measurement
Physiologic Factors and Stimulants

If possible…
• Empty bladder
• No meal within at least 30 minutes
• No exercise within at least 30 minutes
• No smoking within at least 15 minutes
• No stimulants (caffeine, decongestants, etc.) within at least 2-3 hours
• Pain and anxiety are factors

Avoiding common errors in BP measurement
Terminal Digit Preference

• Rounding to 0 or 5 is extremely common (80-85% in some studies)

• Can be eliminated with automated devices if BP is recorded accurately
OBJECTIVES

• Why measuring blood pressure (BP) accurately is critical

• Common factors contributing to errors in office BP measurement and how to avoid them

• Which method of measuring BP yields the most accurate and representative blood pressures

• Three methods used to measure BP in the office setting

Which method of measuring BP yields the most accurate and representative blood pressures

24-Hour Ambulatory Blood Pressure Monitoring (ABPM)

Pros
• Most evidence for accurate diagnosis of HTN
• Best predictor of future CV events
• Rule-out white coat HTN
• Identifies patients with masked HTN
• Gives BP information during sleep

Cons
• Expensive
• Inconvenient for patients
• Hard to get scheduled
Which method of measuring BP yields the most accurate and representative blood pressures

Self-Measured Blood Pressure (SMBP) or Home Blood Pressure Monitoring

Pros
• Compares well to 24-hour ABPM for accuracy (not equal)
• Better predictor of future events than routine office BP
• Rule-out white coat HTN
• Identifies patients with masked HTN
• Inexpensive
• Convenient

Cons
• Requires the patient have a home monitor
• Does not give asleep BP
• Requires clinical support for maximum benefit

Measuring BP in the Office

Pros
Convenient
Possible to predicts future events
Inexpensive

Cons
Dependent on patient, environment, observer
Requires time (>5 minutes)
Terminal digit preference is common
Cannot diagnose white coat hypertension
Cannot diagnose masked hypertension
Routine manual office BPs are 9/6 mm Hg higher than BPs performed during protocols
Office blood pressures are rarely performed correctly

Why use Office BP Measurement?

- Most opportunities to obtain BPs
- Technology has improved measurement reliability (validated automated machines → less human error and bias)
- Protocols improve standardization, reduce variability and errors
- By reducing errors and increasing reliability of BP measurement, clinicians are less likely to hesitate when initiating or escalating treatment (clinical inertia)

OBJECTIVES

- Why measuring blood pressure (BP) accurately is critical
- Common factors contributing to errors in office BP measurement and how to avoid them
- Which methods of BP measurement provide the most accurate and representative BPs for diagnosing and assessing control of hypertension (HTN)
- Three methods used to measure BP in the office setting
Three common methods used for office BP measurement

1. Routine office BP measurement
2. Multiple office BP measurements
3. Automated office BP measurements (AOBP)

1. Routine Office BP Measurement

- A single BP measurement is not reliable
- Even if you do everything right, which is difficult, office BP is less reliable and less predictive of future events than other methods of BP measurement
- Higher rate of misclassification of HTN, especially if the BP is above 140/90
2. Multiple Office BP Measurements

How Many BPs should be measured?
Choose a Guideline or Protocol from the Literature…

European Society of Hypertension / European Society of Cardiology 2013

“Take at least two BP measurements, in the sitting position, spaced 1–2 min apart, and additional measurements if the first two are quite different. Consider the average BP, if deemed appropriate.”

American Society of Hypertension / International Society of Hypertension 2014

“It is preferable to take two readings, 1–2 minutes apart and use the average of these measurements.”

Next…standardize how your practice will measure office BPs using a protocol or checklist

When using office BP measurement, it is best to obtain multiple measurements in a standardized fashion:

- Use a validated, automated device, if possible
- Use the correct cuff size on a bare arm
- Ensure patient is positioned correctly*
- Ensure patient has emptied their bladder
- Ensure patient has rested quietly for at least five minutes
- It is preferable to take at minimum two BP measurements. Three is better than two. Taking the mean of all three, or the mean of the second and third measurements will increase diagnostic accuracy.

*Evidence-based tips for correct positioning
Ensure patient is seated comfortably with:
- Back supported
- Arm supported
- Cuff at heart level
- Legs uncrossed
- Feet flat on the ground or supported by a foot stool
- No one talking during measurement

3. Automated Office Blood Pressure (AOBP)

- Validated, automated BP monitors with multiple cuff sizes
- Monitors can take 3-6 measurements with no clinical staff in the room
- Intervals can be set at 1-5 minutes between measurements
- The machines averages the BPs
Why Use Automated Office Blood Pressure (AOBP)?

- Routine office BPs do not correlate well with research BPs or daytime mean ambulatory BPs (predicting future cardiovascular events)
- AOBP correlates well with both research BPs and with daytime mean BP during 24-hour testing
- “White coat” effect is eliminated in most cases by AOBP machines
- More accurate/representative BPs reduce clinical uncertainty and hesitation to act when a high blood pressure occurs

Putting it all together

For screening BP measurement
- Automated validated device
- Sitting in a chair with back and arm supported (1)
- Legs uncrossed, feet on the ground or a stool (2)
- Cuff over a bare arm (3)
- Correct Cuff Size
- No talking or texting

If the screening BP is > 140/90 mm Hg, obtain confirmatory BP measurements

For confirmatory BP measurements, same as above, plus
- Ensure patient has an empty bladder
- Rest for at least 5 minutes
- Obtain the average of at least 3 measurements (using AOBP if possible)
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For questions, contact Michael Rakotz, MD at michael.rakotz@ama-assn.org
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