The importance of measuring blood pressure accurately

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Faculty Disclosure/Conflict of Interest

The following Speaker has indicated no relevant financial relationships to disclose:

Michael Rakotz, MD

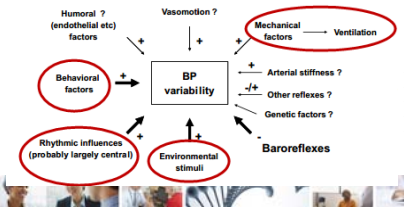
Learning Objectives

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

Blood pressure variability

Significant short and long term BP variability exists in all patients

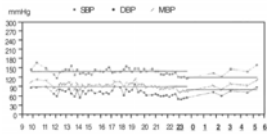


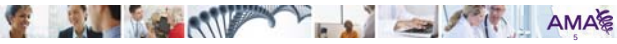
- Physical activity
- Emotional stimuli
- Sleep
- Central BP oscillations
- Mechanical forces from ventilation

4

Blood pressure variability

Typical variability in a 24 hour period





5

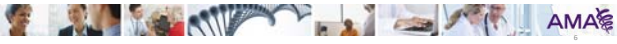
Blood pressure variability

Almost all patients will experience some degree of alerting response

- White coat hypertension: Office BP ≥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 ≥ 140/90



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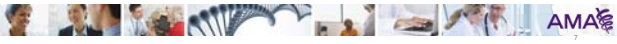
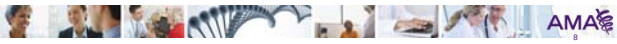
Blood pressure variability

- Lack of use of standardized BP measurement protocols contributes to BP variability and innacurate BP measurements



- Learn why measuring blood pressure (BP) accurately is critical
- Understand how common factors contribute to errors in office BP measurement and how to avoid them
- Learn which methods of measuring BP yield the most accurate and representative blood pressures readings
- Learn three methods used to measure BP in the office setting



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 they must be representative of a patient's actual BP

The importance of measuring blood pressure accurately

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?

Kerr E Zikmund-Fisher BJ, Klamerus M et al..*Ann Int Med.* 2008;148;717-727

10

The consequences of measuring blood pressure inaccurately

- If diastolic BP measured *spuriously high by* 5 mm Hg across a population – the number of Americans misdiagnosed with hypertension could increase by 54%
- If diastolic BP measured *spuriously low* by 5 mm Hg, the number of Americans with hypertension misclassified as not having HTN could increase by 42%

Daugherty SA, Hypertension detection and follow up program.
Description of the enumerated and screened population. *Hypertension.1983;5(6 Pt 2):IV 1-43.)*

11

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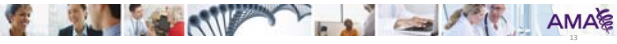
12

Common Errors Made During Office BP measurement

When the patient has...	*Blood pressure can change by an estimated*...*
Crossed Legs	2-8 mm Hg[1]
Cuff over clothing	5-50 mm Hg[2]
Cuff too small	2-10 mm Hg[2]
Full bladder	10 mm Hg[2]
Talking or active listening	10 mm Hg[2]
Unsupported arm	10 mm Hg[1,2]
Unsupported back / feet	6.5 mm Hg[3]

*These values are not cumulative

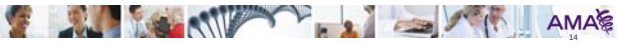
•Pickering, et al. Recommendations for Blood Pressure Measurement in Humans and Experimental Animals Part 1: Blood Pressure Measurement in Humans. Circulation. 2005;111: 697-716.
•Handler, J. The importance of accurate blood pressure measurement. The Permanente Journal/ Summer 2009/ Volume 13 No. 3 51
•Cushman, W., Cooper K, Horne Richard, Meydrech E. Effect of back support and stethoscope head on seated blood pressure determinations. *American Journal of Hypertension. March 1990-VOL 3, NO. 3*



13

Common Errors Made During Office BP measurement

Observer Factors	Patient Factors	System Factors
Wrong cuff size	Full bladder	Location of monitor/device
Cuff placed over clothing	Stimulants	Noise
Improper positioning	Recent exercise	Work Flows
No rest	Recent meal	
Terminal digit preference	Talking, texting, reading	
Talking to patient		
Too rapid cuff deflation		



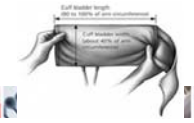
14

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,



16

Avoiding common errors in BP measurement

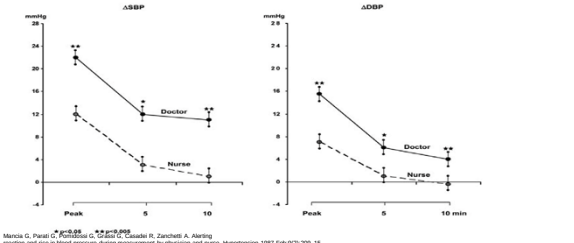
Rest and environment

- 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

17

Avoiding common errors in BP measurement

Rest



* p<0.05 ** p<0.005
Mancia G, Parati G, Pomidossi G, Grassi G, Casadei R, Zanchetti A. Alerting reaction and rise in blood pressure during measurement by physician and nurse. Hypertension 1987;Feb;9(2):209-15.

18

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

19

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

20

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

21

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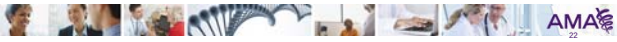


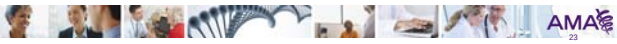
22

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



23

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

24

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

Measuring BP in the Office

Pros	Cons
Convenient	Dependent on patient, environment, observer
Possible to predicts future events	Requires time (>5 minutes)
Inexpensive	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 research protocols [1]
	Office blood pressures are rarely performed correctly

Myers MG, et al. Can Fam Physician 2014;60:127-32

25

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)

26

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27

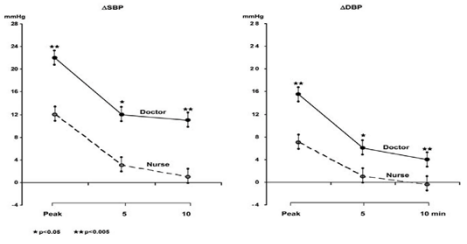
Three common methods used for office BP measurement

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

Routine Office BP Measurement

- A single routine office 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

White coat effect



Mancia G, Parati G, Pomidossi G, Grassi G, Casadei R, Zanchetti A. Alerting reaction and rise in blood pressure during measurement by physician and nurse. Hypertension 1987;Feb;9(2):209–15.

Multiple Office BP Measurements

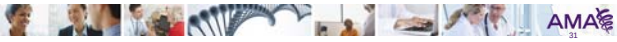
How Many BPs should be measured?
Choose a Guideline or Protocol from the Literature…

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."



31

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

32

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

33

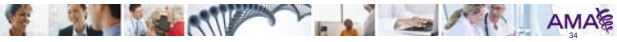
Next…standardize how your practice will measure office BPs using a protocol or checklist

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



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34

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 measure

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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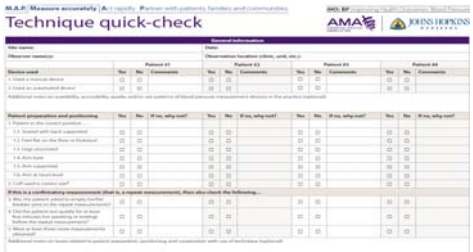
35

Improving BP Measurement

M.A.P. Measure accurately | A: rapidly, Partner with patients, families and communities

Technique quick-check

AMA | JOHNS HOPKINS



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36

How to download our tools: Go to

https://www.ama-assn.org/delivering-care/improving-blood-pressure-control

For questions
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