

# Office BP Measurement: Current Challenges and Best Practices

## *1 Office BP Measurement: Current Challenges and Best Practices*



**Heart Health Now!**  
The North Carolina Cooperative for AHRQ's  
**EvidenceNOW**  
Advancing Heart Health in Primary Care

**Office BP Measurement:  
Current Challenges and Best Practices**

Funded by the Agency for Healthcare Research and Quality (AHRQ)  
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**AHEC**

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of North Carolina

**LENGTH:** About 11 minutes

Updated on 12/15/2015

## ***2 Welcome by Anthony Viera, MD, MPH***

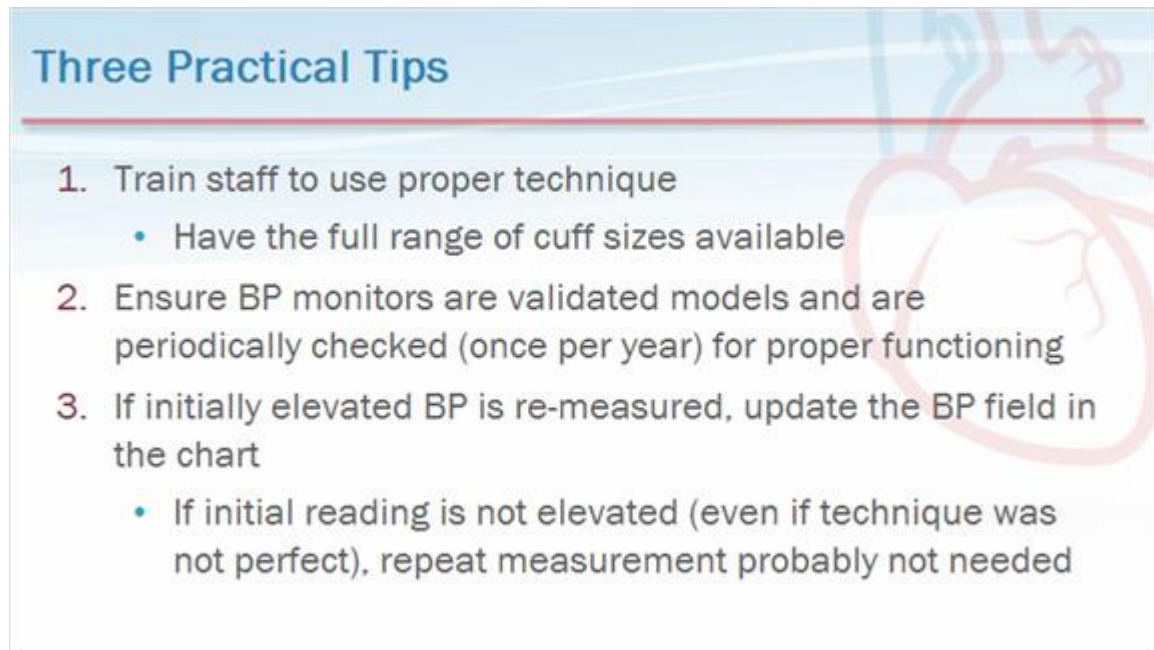


### **Welcome by Anthony Viera, MD, MPH**

*Associate Professor, Dept. of Family Medicine, Director, Hypertension Research Program, UNC - Chapel Hill*

Hi. My name is Anthony Viera. I'm with the Heart Health Now Evidence Team, and this Webinar will talk about office blood pressure measurement, current challenges, and best practices.

### **3 Three Practical Tips**



#### Three Practical Tips

1. Train staff to use proper technique
  - Have the full range of cuff sizes available
2. Ensure BP monitors are validated models and are periodically checked (once per year) for proper functioning
3. If initially elevated BP is re-measured, update the BP field in the chart
  - If initial reading is not elevated (even if technique was not perfect), repeat measurement probably not needed

I want to start by offering three practical tips. The first is to train staff to use proper technique, make sure your office has a full range of cuff sizes available. The second is to ensure that your blood pressure monitors are validated models, and they're periodically checked for proper functioning. And, the third is, if the first blood pressure measurement is elevated and it's retaken toward the end of the visit, make sure to update the blood pressure field in the chart. If the initial reading is not elevated, even if perfect technique is not followed, a repeat measurement is probably not needed.

## 4 Objectives

### Objectives

- Discuss importance of accurate BP measurement
- Review some limitations of office BP
- Describe guidelines for correctly performing office BP measurement
- Provide practical tips for improving office BP measurement



The objectives of this Webinar are to discuss the importance of accurate BP measurement, to review some of the limitations of office BP, and to describe guidelines for correctly performing office BP measurement, and to provide practical tips for improving office blood pressure measurement.

## ***5 Not Covering in this Session***



The slide features a light blue background with a faint anatomical diagram of a human head and neck. At the top, the text 'Not Covered in this Session' is written in a dark blue font. Below this, a red horizontal line separates the title from a central blue rounded rectangle. Inside this rectangle, three bullet points are listed in white text.

**Not Covered in this Session**

- Home BP monitoring
- Ambulatory BP monitoring
- Treatment

What I'm not covering in this session is home blood pressure monitoring, ambulatory BP monitoring, or treatment of high blood pressure which will be covered in another Webinar.

## 6 Clinical Case



A 44-year-old woman with BMI of 28 kg/m<sup>2</sup> presents for routine health maintenance visit; arrived 5 minutes late for her appointment

- BP taken and recorded by the MA using the office automatic monitor is 152/75 mm Hg
- No history of cardiovascular disease, and her only medication is an occasional dose of zolpidem before bed

Clinical Case

Let's begin with a clinical case. A 44-year-old woman with body mass index of 28 presents for a routine health maintenance visit. She arrives five minutes late for her appointment. The blood pressure is taken and recorded by the medical office assistant using the automatic monitor at 152/75. The patient has no history of cardiovascular disease, and her only medication is an occasional dose of Zolpidem before bedtime.

## 7 Office BP

**Office BP**


- BP measurement is basis for the most common diagnosis in adult primary care
- Accurate measurement of BP is challenging, especially in busy office practices
- Rushed atmosphere where clinicians want patients roomed promptly

Just *measuring* better improves quality

PROGRESS 25%

**Aneroid**

**Oscillometric**

The image shows two types of blood pressure monitors. The top one is an aneroid manual manometer, which is a small, boxy device with a dial and a stethoscope. The bottom one is an oscillometric automatic manometer, which is a larger, more modern device with a digital display and a cuff. The background of the slide features a faint anatomical diagram of a human torso with a red line indicating the location of the blood pressure measurement site.

Office blood pressure measurement is the basis for the most-common diagnosis in adult primary care. Unfortunately, office blood pressure measurement is fraught with error, and no practice is immune to the challenges of measuring blood pressure accurately. We are working in busy environments, and a rush atmosphere, where clinicians want patients roomed promptly. But a key is that just measuring the blood pressure better improves quality of care. There are two kinds of blood pressure monitors currently in use: The Aneroid Manual Manometer, and the Oscillometric automatic Manometer.

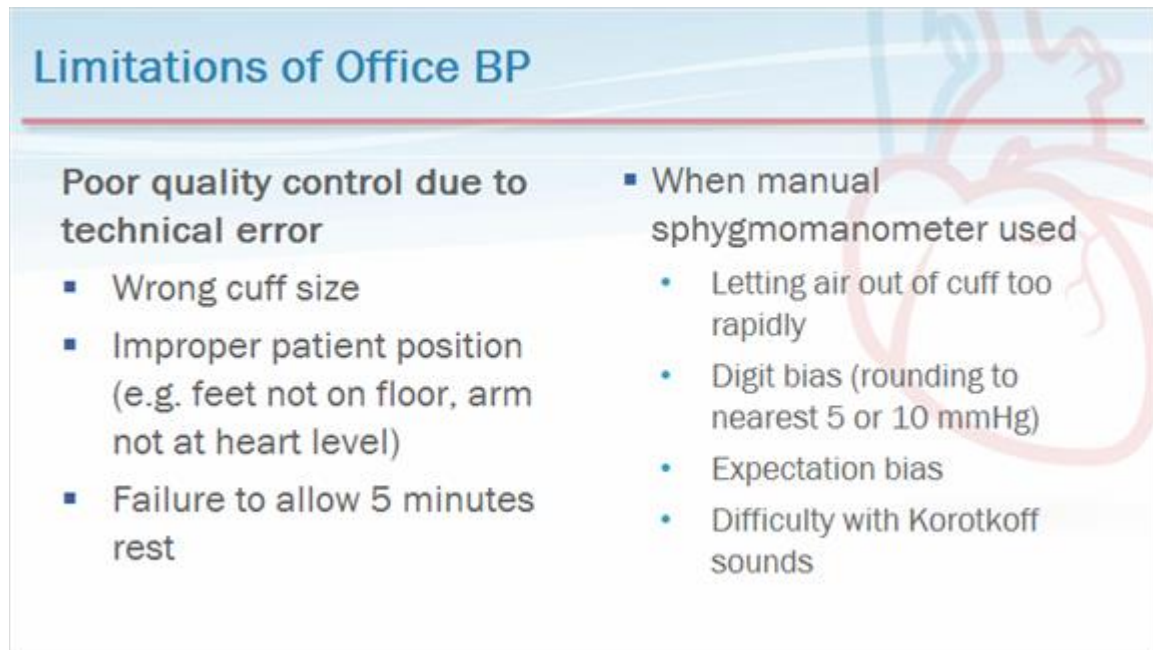
## 8 What's wrong with these pictures?



I want to pause for just a moment and let you look at these photographs and think about what's wrong with these pictures. In Picture A, you can see that the arm is not at the heart level. In Picture B, the arm is not at the heart level nor or the feet on the floor. And Picture C, the arm is not at the heart level while the patient is talking on the phone, and their feet are dangling off the exam table. And in Picture D, she's way too casual with her back not supported, her arm is not at heart level, and she might be talking to medical office assistant as well.



## 9 Limitations of Office BP

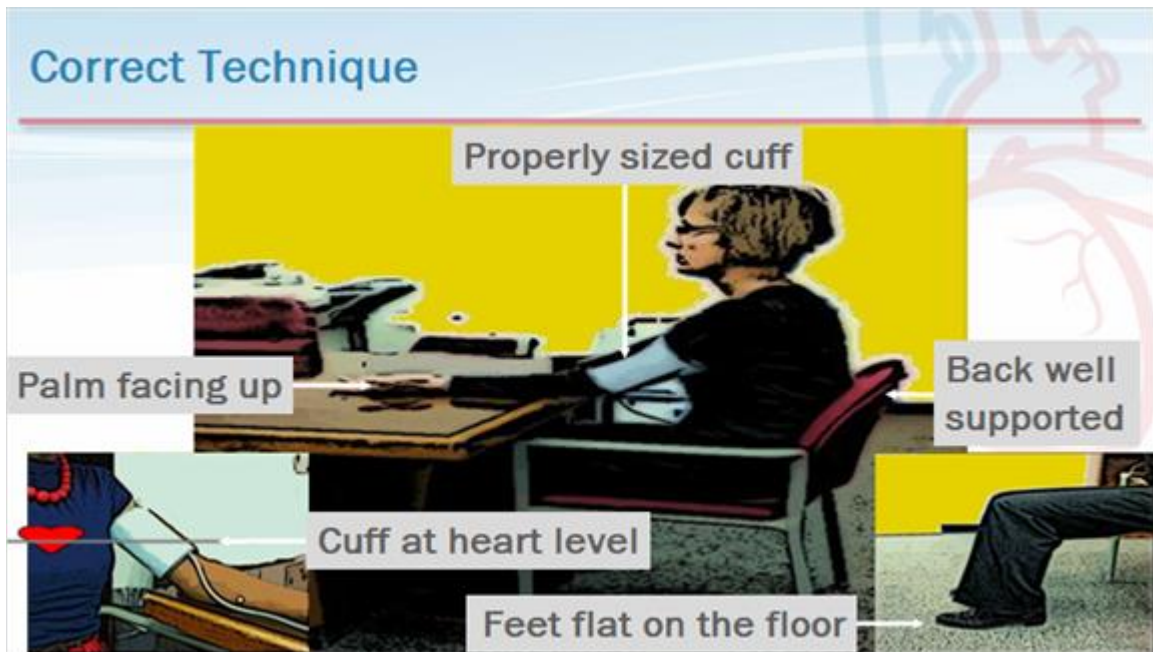


### Limitations of Office BP

- Poor quality control due to technical error
  - Wrong cuff size
  - Improper patient position (e.g. feet not on floor, arm not at heart level)
  - Failure to allow 5 minutes rest
- When manual sphygmomanometer used
  - Letting air out of cuff too rapidly
  - Digit bias (rounding to nearest 5 or 10 mmHg)
  - Expectation bias
  - Difficulty with Korotkoff sounds

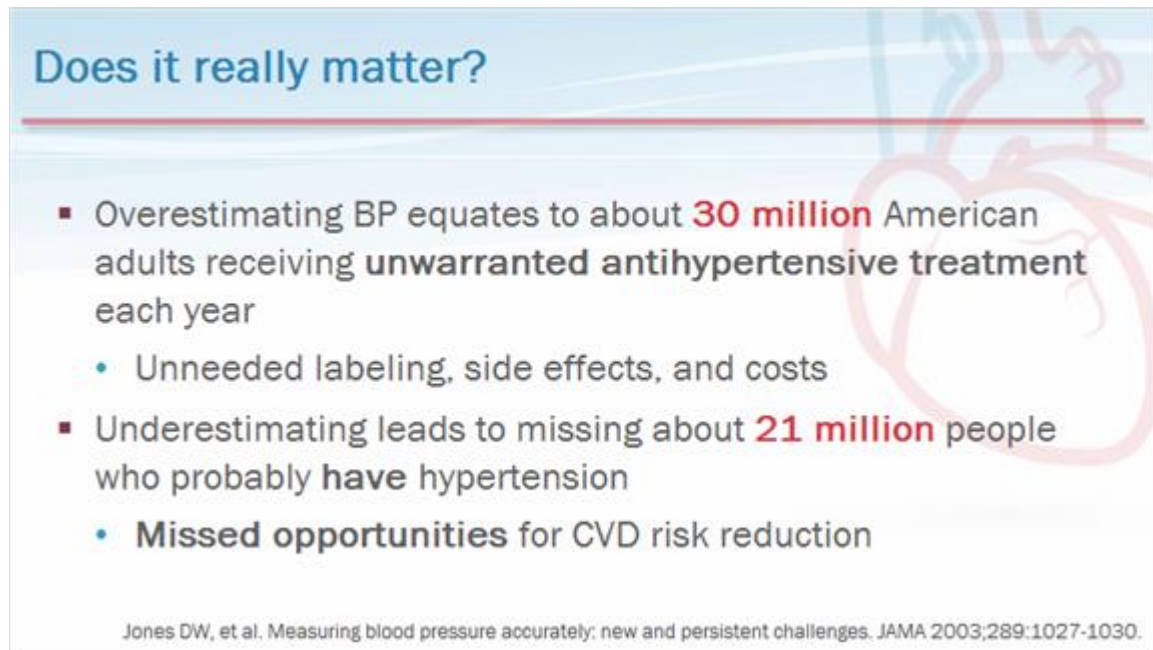
Limitations of office blood pressure are mainly around the poor quality control due to technical error. For example: Using the wrong cuff size, not positioning the patient properly, or failing to allow the five minutes of rest. When a manual sphygmomanometer is used, errors include: Letting air out of the cuff too quickly; digit bias, that is, rounding the measurement to the nearest 5 or 10 mm; expectation bias, that is, asking the patient what his or her usual blood pressure is, and, then, the measurement somehow being close to that; and, then, difficulty with Korotkoff cuff sounds – either knowing which Korotkoff sound to use, the fourth or the fifth; or, frankly, just hearing the sounds properly.

## 10 Correct Technique



This slide depicts correct technique for blood pressure measurement: Properly-sized cuff is being used with a palm facing up, and the arm supported at heart level; the feet are flat on the floor.

## 11 Does it really matter?



### Does it really matter?

- Overestimating BP equates to about **30 million** American adults receiving **unwarranted antihypertensive treatment** each year
  - Unneeded labeling, side effects, and costs
- Underestimating leads to missing about **21 million** people who probably **have** hypertension
  - **Missed opportunities** for CVD risk reduction

Jones DW, et al. Measuring blood pressure accurately: new and persistent challenges. JAMA 2003;289:1027-1030.

Does it really matter about office blood pressure and how accurate we are? Well, overestimating blood pressure equates to about 30 million American adults receiving unwarranted antihypertensive treatment each year, in addition to the unneeded labeling, side effects, and costs of such therapy. And we might not think about it as often, but underestimating blood pressure leads to missing about 21 million people who probably have hypertension which translates to missed opportunities for cardiovascular-risk reduction.

## 12 Blood Pressure Varies



- Inherent variability
- Influenced by external factors
- Diagnosis of hypertension should be based on **repeated** measurements
  - **2 visits over 2 weeks**

Blood Pressure Varies

We remember that blood pressure varies. There is inherent variability from moment to moment. As I sit here my blood pressure is different than when I would get up and walk out of the building, when I'm in busy traffic, my blood pressure will be higher, etc. It's also influenced by external factors as I mentioned. For these reasons, diagnosis of hypertension should be based on repeated measurements, ideally, two visits over about two weeks' time.

### 13 Technique




A standardized approach to technique is to document whether the right or left arm is used, and, then, take subsequent measures from the same arm. Make sure blood pressure measurements are taken in a quiet, calm environment, the patient's feet are flat on the floor with the back supported against the chair, the patient's arm is resting and supported at heart level, and the appropriate-sized cuff is used.

## 14 Cuff size

### Cuff Size

- Bladder should encircle 80% of the arm
- Bare arm ideally; no rolled sleeve “tourniquet”
- Too small a cuff: overestimates BP
- Loose application of a cuff also results in faulty measurement



PROGRESS 50%

In terms of cuff size, the bladder should encircle 80% of the arm. Ideally, the arm is bare. However, a thin-sleeve is acceptable, but there should be no rolled sleeved tourniquet cutting the circulation. Remember that too small a cuff will overestimate blood pressure and loose application of a cuff also results in a faulty reading.

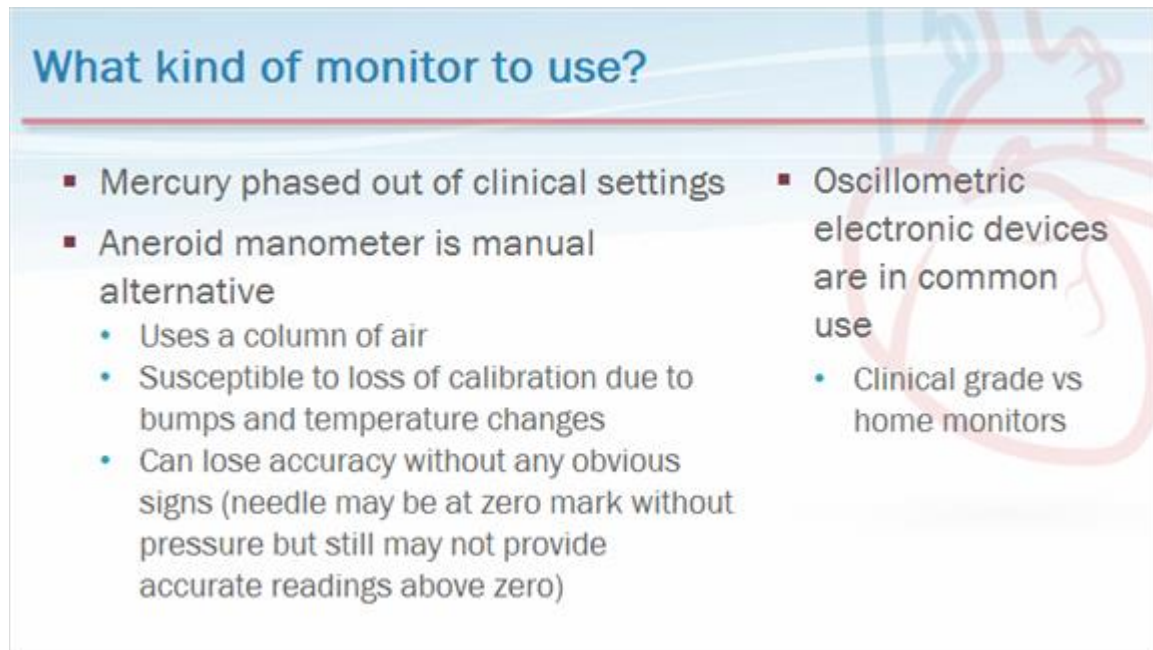
## 15 Some Factors that Increase BP

Factor	Magnitude of BP effect (mm Hg)
Arm unsupported	1-7/5-11
Back unsupported	6-10
Being cold	6/3-10
Talking	7/8
Recent smoking	6-20
Measuring on exam table	10
Full bladder	15/10
Pain or anxiety	May be large

Reeves RA. JAMA 1995;273:1211-18.

This table lists some of the factors that may increase blood pressure. As I mentioned, arm unsupported, back unsupported both raise the blood pressure, as does talking, recent smoking, and a full bladder.

## 16 What kind of monitor to use?



### What kind of monitor to use?

- Mercury phased out of clinical settings
- Aneroid manometer is manual alternative
  - Uses a column of air
  - Susceptible to loss of calibration due to bumps and temperature changes
  - Can lose accuracy without any obvious signs (needle may be at zero mark without pressure but still may not provide accurate readings above zero)
- Oscillometric electronic devices are in common use
  - Clinical grade vs home monitors

What kind of monitor should we use to measure blood pressure?

First, we know that mercury has been phased out of clinical settings. So, it is no longer used. The aneroid manometer has become the manual alternative. These manometers used a column of air instead of mercury, but they are highly susceptible to loss of calibration due to bumps and temperature changes. They can even lose accuracy without any obvious signs. The needle may be at the zero mark, but the accuracy of the monitor may still be in question. The oscillometric electronic devices are now in common use, and they help eliminate some of the sources of error. Remember that there are clinical grade monitors, as well as the home-type monitors that are oscillometric.



## 17 Oscillometric Devices



Eliminate need for stethoscope & pressure gauge, therefore avoids errors related to hearing, sight, using diaphragm instead of bell

Oscillometric Devices

Oscillometric devices eliminate some sources of systematic error such as the observer bias, terminal digital bias, and improper inflation and deflation of the cuff, because the monitor does all of those things for us. They also eliminate the need for the stethoscope and the pressure gauge and, therefore, eliminate any errors related to hearing, sight, or mistakenly using the diaphragm instead of the bell.

## 18 Oscillometric BP

### Oscillometric BP

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- Pressure sensor (transducer) captures pressure oscillations
- Automatic inflation and deflation of the cuff
- Algorithm converts to systolic and diastolic
- Validated devices are compared to mercury measurements in minimum number of patients across BP ranges
- Caution in patients in atrial fibrillation

The monitors work by using a transducer to capture pressure oscillations of the blood pressure. And, then, translating those into a systolic and diastolic via an algorithm. The validated devices are compared to mercury measurements in a minimum number of patients across a wide range of blood pressure levels. The main caution is in patients with atrial fibrillation, oscillometric monitors may not be able to capture an accurate reading.

## 19 Many Validation Studies

The screenshot displays the homepage of the dabl Educational Trust website. At the top, the title "Many Validation Studies" is prominently displayed. Below this, the website's logo and name "dabl Educational Trust" are shown, along with the tagline "Blood Pressure Monitors - Validations, Papers and Reviews" and the website URL "www.dableducational.org". A navigation menu on the left includes links for Home, About Us, Validation, Devices, Manufacturers, Library, Directory, Disclaimer, Sitemap, and a Search box. The main content area features a "Welcome to dabl Educational Trust" message, followed by three columns of text in English, German, and French, each describing the organization's focus on blood pressure measurement accuracy and clinical utility. Below this, there is a "Services Offered" section with a highlighted link for "Validation Status of Devices", which is described as "The most comprehensive and up-to-date list of tables on the validation status of all makes of BP devices - click for details". The dabl logo is also visible in the bottom left corner.

The Website shown on the screen is one that can be reviewed to make sure that the monitor you are using is indeed a validated model. When you go to the Website, you can click the link to validation status of devices.

[www.dableducational.org](http://www.dableducational.org)

## 20 Trust the Validated Oscillometric Device

**Trust the Validated Oscillometric Device**

**Automated Devices for Clinical Use**

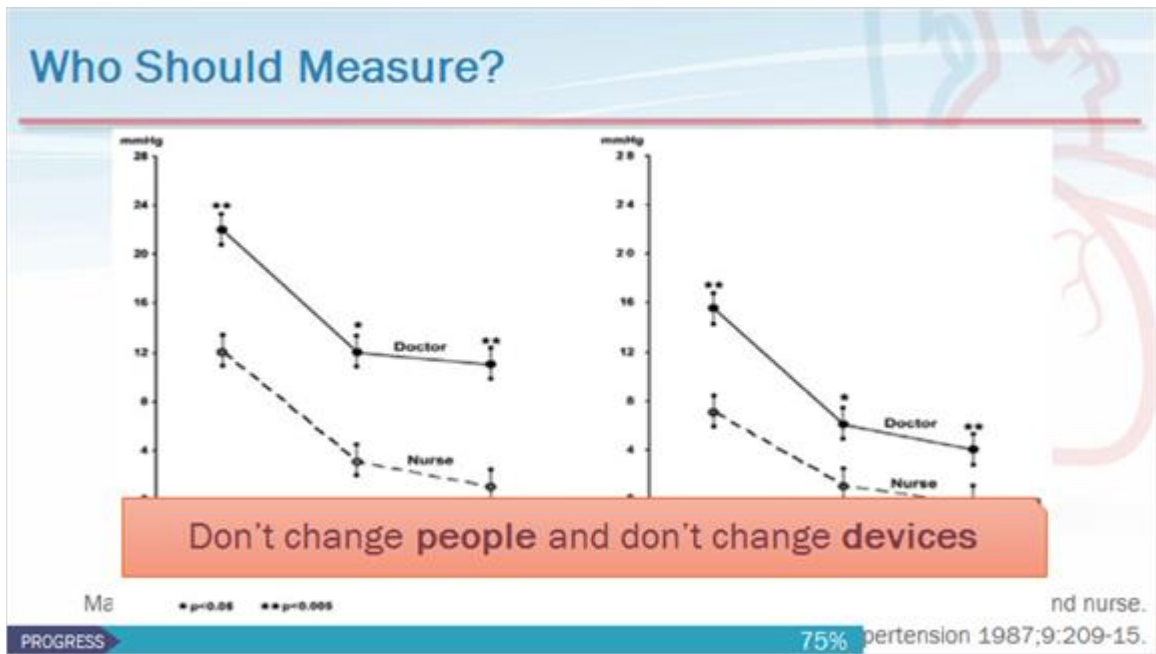
For a complete list of devices see our [Device Index](#) and for discontinued devices see our [Discontinued Devices Index](#).

FTS: Study evaluated prior to publication using the [dabi<sup>®</sup>Educational Fast Track validation Service](#) [Printable version>>](#)

Device	Mode	AAMI	BHS	ESH 2002	ESH 2010	Circumstance	Recommendation Ref
A&D TM-2564G	Osc	Pass	A/A			Serious protocol violations	Questionable 18
A&D TM-2655	Osc	Pass	A/A			Methods poorly explained	Questionable 70
A&D TM-2656	Osc	Pass	A/A			At rest	Recommended 56
A&D TM-2657	Osc	Pass	A/A			A&D TM-2656 Equivalence	Recommended E136
Andon KD-5917	Osc				Pass	At rest	Recommended 56

...which will take you to a page that looks like this. And you can see what the type of monitor you have, or its analogous model is recommended, questionable, or not recommended for use in clinical settings.

## 21 Who Should Measure?



In terms of who should measure the blood pressure, ideally the medical assistant or nurse should be taking the measurement. Physicians tend to cause a white-coat or alerting reaction that makes the blood pressure of the patient rise. The other important point is that when the medical assistant initially takes the blood pressure if you want the blood pressure repeated, and you do it yourself as the physician, then you're introducing another variable into the mix of many things that can already influence blood pressure. So, a key message is not to change people, and not to change devices. Have the same medical assistant measure the blood pressure using the same device.

## 22 Repeating Measurements

### Repeating Measurements

- Wait 1-minute between readings
- If  $>5$  mm Hg difference in diastolic, recommendation is to repeat again



Reeves RA. JAMA 1995;273:1211-18.

Wait at least one minute between readings. And if there is a greater than 5 millimeter difference in diastolic, the recommendation is to repeat it again.

### 23 What about obese arms?

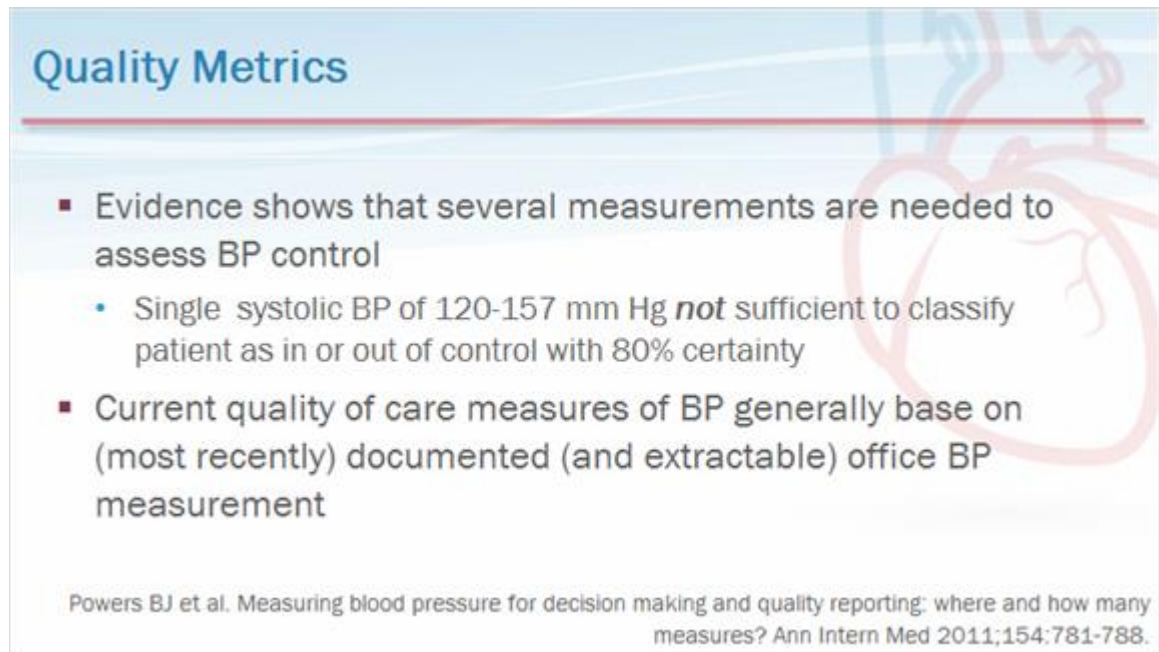


- Large cuffs available (might need "thigh" cuff)
- Forearm measurement: overestimate BP by about 4/2 mm Hg
- A challenge for cuff manufacturers
- Some wrist cuff devices have been validated but are generally *not* recommended for clinical use

What about obese arms?

What about obese arms? Ideally, you have a large enough cuff size available, and you might need to use the thigh cuff. So make sure you know where it's located. A forearm measurement can be used as very last resort, but it will overestimate blood pressure. Obese arms are, indeed, a challenge for cuff manufacturers, and there are some wrist cuff devices that have been validated, but these are not generally recommended for clinical use.

## 24 Quality Metrics



### Quality Metrics

- Evidence shows that several measurements are needed to assess BP control
  - Single systolic BP of 120-157 mm Hg **not** sufficient to classify patient as in or out of control with 80% certainty
- Current quality of care measures of BP generally base on (most recently) documented (and extractable) office BP measurement

Powers BJ et al. Measuring blood pressure for decision making and quality reporting: where and how many measures? Ann Intern Med 2011;154:781-788.

In terms of quality metrics, evidence does show that you need several measurements to assess blood pressure control. A single systolic blood pressure in the range of 120 to 157, for example, is not sufficient to classify a patient as in- or out-of-control with 80% certainty. However, current quality-of-care measures of blood pressure generally base the quality on the most-recently documented blood pressure.



## 25 Clinical Case

### Clinical Case

- Near the end of the visit, you ask the MA to repeat the BP measurement, ensuring the cuff is correct size, feet are on floor, arm is supported at heart level, and no talking during measurements
- 129/72 mm Hg
- MA updates BP in chart



Let's return to our clinical case. Near the end of the visit you ask the medical assistant to repeat the blood pressure measurement ensuring the cuff is the correct size, her feet are on the floor, her arm is supported heart level, and she's not talking during the measurements. The repeat measurement is 129/72. The medical office assistant updates the blood pressure in the chart and, indeed, this patient's blood pressure is in control.

## 26 Three Practical Tips

### Three Practical Tips

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1. Train staff to use proper technique
  - Have the full range of cuff sizes available
2. Ensure BP monitors are validated models and are periodically checked (once per year) for proper functioning
3. If initially elevated BP is re-measured, update the BP field in the chart
  - If initial reading is not elevated (even if technique was not perfect), repeat measurement probably not needed

Let me recap with the three practical tips. Train staff to use proper technique, making sure the office has the full range of cuff sizes available; make sure monitors are validated models, and are periodically checked for proper functioning. If the first BP is elevated, repeat it and update that blood pressure field in the chart. If the initial reading is not elevated, even if perfect technique was not used, a repeat measurement is probably not needed.

## 27 Congratulations

Congratulations on Completing the Module

Click *Exit* at top right of screen

Please review the attachments and begin the next course.

## **28 The Evidence Team**

### The Evidence Team

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## **29 The Evidence Team**

### The Evidence Team

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