



A Clinician's Guide to Improving the Accuracy of Blood Pressure Measurement in Community and Worksite Settings

It is important to accurately measure blood pressure

Blood pressure determination continues to be one of the most important measurements in clinical medicine and yet it is one of the most inaccurately performed¹. The diagnosis and management of hypertension is dependent on an accurate blood pressure measurement. If the measuring device (sphygmomanometer) produces inaccurate numbers or the measurement technique is flawed, it follows that incorrect management decisions will be made.

Hypertension is a major risk factor for coronary heart disease, stroke, and kidney failure. Approximately 25 percent of Massachusetts adults have been diagnosed with hypertension², and even more disconcerting is the number of people who do not know they have hypertension or whose blood pressure is not well controlled.

- About one-third of U.S. adults, more than 74 million people, have hypertension, and of these people:
 - More than two-thirds are unaware of their hypertension
 - Seventeen percent are aware of their hypertension, but are not being treated
 - Twenty-nine percent are being treated, but their hypertension remains uncontrolled
 - Only 23 percent are taking medications that control their hypertension³

Blood pressure readings can detect high blood pressure (hypertension), a risk factor for heart attack and stroke. Community organizations (including worksites) can promote the prevention and management of hypertension by providing educational messages and lifestyle coaching services, in addition to establishing screening and referral programs for cardiovascular risk factors. Routinely scheduled health screenings, or those held specifically for blood pressure — onsite, in mobile health facilities, or in other settings — can provide people with valuable information about the risk factors for high blood pressure, and tips for preventing and treating it.

To improve the measurement of blood pressure to meet the recommendations of the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure ([JNC 7](#)), the following steps are proposed:

- Ensure that equipment is regularly inspected, calibrated, and validated;
- Ensure that the operator is trained and regularly retrained in standardized measurement technique;
- Ensure that the patient is properly prepared and positioned;
- Ensure protocols are in place to recommend follow-up care where applicable.

Where to start

It is important to understand your organization's current processes before proceeding. Taking a baseline inventory survey can provide information about organizational strengths and weaknesses. Please see Appendix A for a sample **Inventory Survey**, which you may adapt for your specific needs.

How to make systems changes

Following the inventory survey, begin to establish a specific **policy and procedure** (P&P) for your organization. Please see Appendix B for a sample P&P. You should include the following in your P&P:

Equipment Maintenance

All monitors in clinical use should be tested for accuracy and calibrated **every six months**. Your policy and procedure should include equipment maintenance, and schedules for inspection, calibration, and validation. Note that in larger organizations, a protocol for equipment maintenance may already exist.

Training

Set up a process that ensures the proper training of staff who will be responsible for measuring blood pressure. The New England Journal of Medicine produced a video demonstrating the proper way to take blood pressure: [NEJM BP Training](#).

Patient Preparation and Positioning

Your P&P should include a protocol for preparation of patients, and their proper positioning once they are in the exam room. Inform all patients of their role in helping to ensure accurate blood pressure readings.

Recommendations for Follow-up

It is important that your policy and procedure include follow-up for patients who have any of the various stages of hypertension. This may include linking people with their primary care physicians or arranging a doctor's appointment for them, as well as other services, such as lifestyle coaching.

Following the creation of your P&P, consider the changes made to your process, as you instituted the P&P into your revamped system. This is known as "process mapping" and it is an essential step to effectively redesign a system. Your ideal process map will serve as a visual aid for staff. The map may also be used to illustrate expectations, help implement a P&P that adheres to detail, and teach these processes to colleagues.

Documenting the steps you took to reach the final version of your process map may be valuable for evaluating and refining your organization's process, and the decisions you and your colleagues made along the way. This is a great opportunity to involve a multidisciplinary team, including the wellness team in the planning process, while soliciting leadership support; key elements for success.

Sites with multiple locations may require process maps specific to each location (unless the sites are identical), and baseline processes may be different across multiple locations. However it is possible that after redesigning them to reflect the new P&P, locations may come to resemble each other more.

If you work with an outside provider or vendor to conduct onsite biometric health screenings ensure that there is a specific P&P in place to address equipment training, maintenance, preparation and positioning, and a follow-up protocol for patients whose BP measurements indicate any of the stages of hypertension. In addition, consider the following checklist items:

- Ensure vendor is compliant with all federal, state and local requirements
- Ensure vendor is compliant with HIPAA privacy standards
- Ensure vendor's staff is properly trained
 - Are licenses up to date?
 - Is training ongoing or renewed regularly?

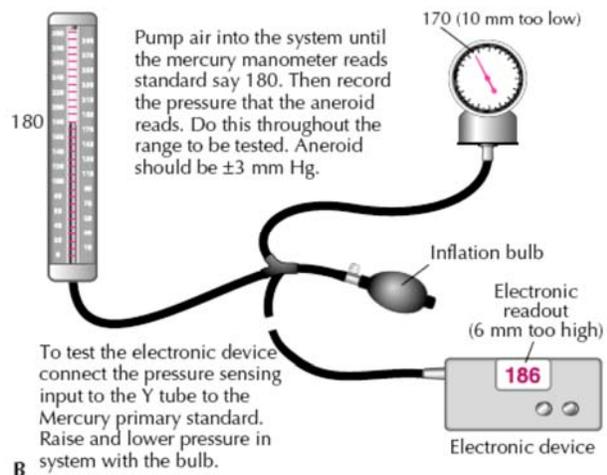
Equipment Maintenance

Once your P&P is in place, follow the plan to ensure your organization's equipment is properly calibrated and validated. Staff should be able to recognize and report broken or defective equipment.

Consult the owner's manual for equipment maintenance, and/or follow the guide below for assessing aneroid and electronic devices. (Note: in some larger organizations responsibility for maintenance may fall to a department devoted to or specializing in equipment.)

Step 1: Document that the manometer registers pressure accurately.

- Connect the device to the reference device with a Y tube
- Using the bulb connected to the Y, increase the pressure to 300 mmHg and then lower by incrementally by 10 mmHg
- Note: Any device that differs by more than 3 mmHg from the reference standard is considered to be out of calibration



Step 2: Assess the error of the BP measurement, estimated by the automated device, with simultaneous readings. If the device deflates at a constant rate of between 2 and 3 mm/sec, then simultaneous reading is possible.

- Record the BP by the auscultatory method as the automated device takes the BP
- To be certain the automatic device inflates high enough for accurate pressure, obtain the palpated systolic pressure and then document that the automatic device inflates at least 30 mmHg above that
- Listen as the automatic device deflates and record the systolic and diastolic pressure you hear
- Repeat the process three times

Check [here](#) to identify monitors that have been approved for clinical use and have met international validation standards.

Staff Training

Hypertension is the most common reason a person with a chronic condition visits a physician. Thus, accurate measurement of blood pressure is essential to ascertain blood pressure-related risk and to guide management of treatment. The type of measurement errors include terminal-digit bias (rounding off to 0), direction bias (a tendency to read too high or too low), falsification of data, and failure to follow the protocol for calibration and technique⁴. Listening to Kortotoff sounds is a developed skill. **As such, it is critical to ensure that your staff is properly trained to measure blood pressure.**

- Checklists and materials
 - Sample Training Curriculum
 - Blood Pressure Measurement Competency
 - [Blood Pressure Categories](#)
 - [Blood Pressure Simulator Arm](#)
 - [Michigan Department of Community Health](#) Features helpful information on blood pressure, including the BP Measurement Quality Improvement CD and [Web Training](#), a self-paced training that provides the latest measurement guidelines, and helps fine-tune skills to interpret and report accurate blood pressure (note: fee may apply)
 - New England Journal of Medicine's [Blood-Pressure Measurement training video and publication.](#)

Patient Preparation and Positioning

Accurate blood pressure measurement requires patients to be properly prepared and positioned. Prior to the screening, patients should:

- Avoid tobacco, caffeine, alcohol, and physical activity/exercise for at least 30 minutes before the appointment

Staff should know how to position patients properly. Seat patients comfortably with their legs uncrossed, their feet on the floor, and their backs and arms supported. The middle of the BP cuff should be at the right level of the atrium. Additionally, staff should:

- Remove/move all clothing from arm, so that cuff is placed directly on the skin
- Use appropriate cuff size, and place cuff 1 inch above the inside of the elbow
- Provide a quiet environment and minimize talking
- A minimum of two readings should be taken at least 1 minute apart, and the average should be used; if there is 5 mmHg difference or more between the first and second

- readings, one or two additional readings should be obtained, using the average of those readings
- Document BP readings, cuff size, and which arm was measured

Recommendations for Follow-up

Follow up with patients who have hypertension, and make sure they follow your recommendations to monitor or treat their blood pressure.

Initial Blood Pressure (mmHg)*	Follow-up Recommended†
Normal	Recheck in two years
Prehypertension	Recheck in one year‡
Stage 1 Hypertension	Confirm within two months‡
Stage 2 Hypertension	See physician within one month; if pressure is >180/110 mmHg, see physician immediately

Source: JNC 7, National High Blood Pressure Education Program, National Heart, Lung and Blood Institute, National Institutes of Health, U.S. Department of Health and Human Services, 2003. Publication No. 03-5231. (For details, click here, [JNC 7](#), and then on “pdf” on that page.)

* If systolic and diastolic categories are different, choose the sooner of the follow-up options (e.g., 160/86 mmHg should be evaluated or referred to source of care within one month).

† Take into consideration past BP measurements, other cardiovascular risk factors, or target organ disease when scheduling a follow-up appointment.

‡ Provide information on lifestyle modifications (see Lifestyle Modifications).

People at any age can make lifestyle modifications to reduce blood pressure, reducing their risk of developing heart disease (see [CDC lifestyle habits](#)), and worksites and communities are ideal places to distribute this valuable information that can help people reduce blood pressure. In addition, other resources can help improve employees’ health: enrolling clients in lifestyle coaching programs; developing [evidence based interventions](#); promoting adequate cost coverage or reimbursement for prescription drugs; [providing health care coverage for employees and families](#); and sponsoring [campaigns](#) to promote awareness.

Home Monitoring of Blood Pressure

Monitoring blood pressure at home can be a valuable tool. It keeps track of blood pressure changes during the day. To facilitate this, provide patients with a [printable Blood Pressure Tracker](#), information on healthy [blood pressure ranges](#), lifestyle modifications and cuff size. The bladder of the cuff should encircle at least 80% of the arm, and these size ranges will help people choose the right cuff:

- Arm circumference 22-26 cm – “small adult” 12 x 22 cm
- Arm circumference 27-34 cm – “adult” 16 x 30 cm
- Arm circumference 35-44 cm – “large adult” 16 x 36 cm
- Arm circumference 45-52 cm – “adult thigh” 16 x 42 cm

It is also important for people to measure blood pressure at about the same time each day, using the same blood pressure monitor. Providing [a guide for discussion](#) to assist communication between the patient and care provider can help the patient’s progress. In cases where a home monitor is justified, help the patient choose the monitor best for his or her circumstances.

Features on home blood pressure monitors can vary widely, from simple manual models to fully automated devices — review BP monitors [here](#). In general, we recommend a digital monitor with memory capacity, but there are also other features to consider:

- **Cuff size** — A properly fitting cuff is vital to accurate BP readings; help patients select appropriate cuff sizes
- **Display** — The display showing the blood pressure measurement should be clear and easy to read
- **Stethoscope** — If the patient’s monitor has a stethoscope, make sure the earpieces fit correctly and the sounds heard clearly
- **Accuracy** — Only validated instruments provide reliable, accurate readings; suggest that patients bring in their monitors, so you may verify accuracy

Worksites and communities should also consider providing onsite BP monitoring devices to allow for self-assessment, as long as patients/clients have sufficient information to use the monitor, including [tips](#) that on positioning to ensure an accurate reading.

Tracking Improvements in Blood Pressure Screening

According to the Centers for Disease Control, blood pressure screening and control programs should track aggregate improvements in blood pressure screening and control outcomes (collected anonymously and only reported in the aggregate) over time. This type of outcome evaluation measures the extent to which the program reaches the target population and whether blood pressure activities should be continued, expanded, or redirected. Questions to consider include:

- Has the number of clients with high blood pressure increased over the past year?
- Has the number of clients with high blood pressure, who made changes to their lifestyle (e.g. lost weight, quit smoking) following screening and counseling, increased over the past year?

If your organization does not have policies and environmental strategies in place for BP screening and control, please request a sample from MDPH (Kathy Foell, Director HSPC; (617) 624-5469 or kathy.foell@state.ma.us .)

For more information on blood pressure:

- [Michigan Department of Community Health](#)
- [Agency for Healthcare Research and Quality](#)
- [Mayo Clinic](#)

Blood Pressure Guide References

¹ Pickering TG, Hall JE, Appel LJ, Falkner BE, Graves J, Hill MN, Jones DW, Kurtz T, Sheps SG, Roccella EJ. Recommendations for Blood Pressure Measurement in Humans and Experimental Animals: Part 1: Blood Pressure Measurement in Humans: A Statement for Professionals from the Subcommittee of Professional and Public Education of the American Heart Association Council on High Blood Pressure Research. *Hypertension* 2005; 45: 142-161.

² Massachusetts Behavioral Risk Factor Surveillance System, 2009.

³ Hyman DJ and Pavlik VN. Characteristics of Patients with Uncontrolled Hypertension in the United States. *N Engl J Med* 2001; Vol. 345, No. 7, pp. 479-487.

Massachusetts Department of Public Health: Heart Disease and Stroke Control Program

⁴ Working Meeting on Blood Pressure Measurement: Summary Report. Available at: <http://www.nhlbi.nih.gov/health/prof/heart/hbp/bpmeasu.pdf>. Accessed June, 2009.

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APPENDIX A
Sample Inventory Survey

Blood Pressure Inventory Survey

The survey will assist employers with onsite healthcare facilities in assessing their current system to ensure accurate blood pressure (BP) measurement and to identify areas for improvement.

Businesses contracting with outside vendors should ensure the vendor has policies related to sections C and D of this survey in place to ensure:

- Equipment is regularly inspected, calibrated, and validated;
- Operators are trained and regularly retrained in standardized measurement technique;
- Client is properly prepared and positioned; and
- Protocols are in place to recommend follow-up care where applicable.

Organization Name: _____

A. Contact Information

	Name	Role	E-mail
1. Principal contact:	_____	_____	_____
2. Other contact	_____	_____	_____
3. Other contact	_____	_____	_____

B. About your Organization

4. How many visits per day in medical clinic?

5. Estimated number of employees with hypertension (from aggregate HRA results):

6. How many clinical staff members have responsibility for measuring blood pressure?

7. Which types of BP monitors does the center use? (Check all that apply)

- Automated/digital with manual or automatic inflation
- Mercury sphygmomanometer
- Aneroid sphygmomanometer

8. How frequently are monitors calibrated?

- Annually
- Every six months
- Never
- Don't know

9. Where are blood pressure measurements routinely taken?

- Exam room
- Intake station*
- Other _____

*Note: An intake station refers to a designated location specific for taking blood pressure measurements

10. Is blood pressure measured for all patients during every visit?

- Yes
- No

11. When a patient arrives for an appointment, which clinical staff member is likely to be responsible for taking that patient's blood pressure? (Please circle one for each type of staff)

	Very Likely ----- Very Rarely				
	1	2	3	4	5
12. Medical Assistant	1	2	3	4	5
13. LPN	1	2	3	4	5
14. RN	1	2	3	4	5
15. NP	1	2	3	4	5
16. PA	1	2	3	4	5
17. Physician	1	2	3	4	5
18. Other	1	2	3	4	5

19. Does your center currently have a policy for the accurate measurement of blood pressure?

- Yes → Please attach a current copy and continue with the inventory survey.
- No → Thank you for your input. You have completed the inventory survey.

C. Policy Assessment - Does your policy describe the following?

- 20. Its purpose Yes No
- 21. Which clinical staff members it addresses Yes No
- 22. Calibration of equipment Yes No
- 23. Training of staff Yes No
 - a. Frequency of training Yes No
 - 1. If yes, how frequently is staff training conducted?
 - Annually
 - Every six months
 - At staff orientation
 - Other _____
 - b. Training on equipment Yes No

D. Procedure Assessment - Does your procedure consider the following clinical steps?

Patient Preparation:

- | | | |
|--|------------------------------|-----------------------------|
| 24. Talking and background noise | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 25. Removing clothing that covers cuff placement | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 26. Legs uncrossed | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 27. Both feet on the floor | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 28. Back and arm supported | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 29. Cuff at the level of the right atrium | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 30. BP taken after patient rests for 5 minutes | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 31. Two measurements taken at least 1 minute apart | <input type="checkbox"/> Yes | <input type="checkbox"/> No |

Cuff Size:

- | | | |
|---|------------------------------|-----------------------------|
| 32. Appropriate cuff size for patient's arm | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 33. Use of validated wrist monitor if necessary | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
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APPENDIX B
Sample Policy and Procedure

Name of your Organization
Blood Pressure Measurement Policy and Procedure

This policy is a sample. Policies should reflect the equipment, staff and processes as defined by your organization.

Effective Date: January 1, 2010 (insert appropriate date)

Policy Title: Blood Pressure Measurement

Purpose: Blood pressure (BP) can be measured in numerous locations including clinical settings (outpatient clinics, hospitals, etc.); community sites (pharmacies, gyms, worksites, etc.), and in patients' homes. In all of these locations, the principles of accurate measurement should be followed.

It is important that people taking BP readings understand current national guidelines for identifying, referring, and managing high blood pressure. The purpose of this policy is to inform all staff who measure BP of the importance of accurate readings, and to introduce BP measurement procedures in compliance with [JNC 7 guidelines](#).

(Note: If you are contracting with an outside vendor to provide BP screenings, verify that there are policies in place that address the all of the principles below.

Background: Blood pressure determination continues to be one of the most important measurements in all of clinical medicine and is still one of the most inaccurately performed. Hypertension is a major risk factor for coronary heart disease, stroke, and renal failure, and affects approximately one-third of the American population:¹

- More than 74 million Americans — one in three adults — have high blood pressure
- African-Americans are more likely to develop high blood pressure than any other racial or ethnic group, and tend to develop it younger and more severely than others
- Diabetes affects 23.6 million Americans, increasing their chances of developing high blood pressure²
- Over 140 million American adults are overweight or obese, which increases the risk of developing high blood pressure³

Knowing a patient's blood pressure is the first step to preventing and controlling hypertension, and that can only be done by measuring BP accurately. Some common errors include:

- Using the wrong cuff size (often a cuff too small for the patient's arm)
- Improper positioning of the patient
- Inaccurate reading due to positioning of the monitor or inaccurate calibration of equipment

Policy: Staff performing BP measurement should have completed training in blood pressure measurement using approved devices.

Equipment

There are several types of sphygmomanometers than can be used to measure blood pressure, including mercury, aneroid, and electronic devices. Your policy and training should match the type of device your organization uses. All devices should be calibrated and/or validated for accuracy on a regular basis. National guidelines recommend recalibrating equipment every six months, and assessing accuracy with every use. The procedure, below, is standard for all manometers.

Mercury and Aneroid Sphygmomanometers

- Sphygmomanometer
- Cuffs and bladder (adult, large, extra large, and thigh)
- Stethoscope tubing must be long enough to allow viewing of the manometer at eye level
- Document results in patient’s file or record them on electronic medical record

Because cuff sizes are not standardized, there are no industry-wide guidelines. However, the American Heart Association has developed general guidelines for cuff sizes, summarized here:

Acceptable Bladder Dimensions for Arms of Different Sizes⁴

Arm Circumference Range at Midpoint (centimeters)	Arm Circumference Range at Midpoint (inches)	Cuff type
27 to 34 cm.	up to 13.38 in.	Adult
35 to 44 cm.	13.7 to 17.3 in.	Large adult
45 to 52 cm.	17.7 to 20.4 in.	Adult thigh cuff

Blood Pressure Measurement Procedures

- The setting should be as private and as quiet as possible.
- Allow patient to sit for at least 5 minutes before the measurement
- Assess patient’s arm for appropriate cuff size; measure diameter of upper arm if necessary
- Keep conversation to a minimum

Patient Preparation and Positioning

Accurate blood pressure measurement requires patients to be properly prepared.

- Patient should avoid tobacco, caffeine, alcohol, and physical activity/exercise for at least 30 minutes before the blood pressure measurement
- Seat patient with both feet on the floor, legs uncrossed, and back supported
- Upper arm should be bare and unconstricted by clothing.
- The arm to be measured should be supported at the level of the patient’s heart

BP measurement using a manual cuff and manometer:

- Make sure the BP device is properly calibrated; the starting and ending point should be “0”
- Palpate the location of the brachial artery
- Place the center of the cuff’s bladder directly over the brachial artery
- Apply the cuff snugly to the bare arm, about 1 inch above the inside of the elbow at the level of the heart
- The arm should rest firmly supported on a table, slightly bent, with palm up
- Inflate the cuff while palpating the radial artery and note the number at which the pulse disappears
- Allow the cuff to deflate
- Wait 15 seconds before placing the stethoscope on the brachial artery
- Inflate the cuff to a level of between 20 and 30 mmHg above where the radial pulse disappeared
- Do not pump the blood pressure cuff up too high at the beginning of the measurement; this could lead to an inaccurate reading
- Slowly release the air in the cuff at 2 mmHg per second and note when the first two consecutive beats occur (1st phase of Korotkoff sounds) this is the systolic blood pressure
- Continue deflating cuff slowly until last sounds are heard (5th phase of the Korotkoff sounds); this is the diastolic blood pressure
- Continue deflation for 10 mmHg past the last sound (this assures that the absence of sound is not a "skipped" beat, but is the true end of the sound)
- Rapidly release the remaining air if no further sounds are heard.
- Take a minimum of two readings at least 1 minute apart and use the average; if there is 5 mmHg or more difference between the first and second readings, one or two additional readings should be obtained, using the average of those readings
- Confirm elevated readings using the patient’s contralateral arm
- Record beginning sound (systolic) and end sound (diastolic) in the client record
- Document BP readings, cuff size, and which arm was measured

Electronic BP device

- Follow the manufacturer’s instructions for measuring blood pressure

When blood pressure is not measured correctly, inaccurate readings may occur. Some of the more common causes and results of errors in technique:

Cause	Effect
Cuff bladder is too small	High reading
Cuff bladder too large	Low reading
Cuff not placed over the brachial artery	High reading
Cuff not applied snugly	High reading
Cuff applied over clothing	High reading
Stethoscope placed under cuff or near tubing	False sounds
Arm positioned below heart level	High reading
Arm not fully supported	High reading
Brachial artery above heart level	Low reading

Clothing around arm too tight	Incorrect reading
Inflation rate too slow	Incorrect reading
Cuff inflated too high	Incorrect reading
Deflation of cuff too slow	High diastolic reading
Deflation of cuff too fast	Low reading

The *Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure (JNC 7)*, classifies blood pressure readings into various categories, as noted below. **Classification of Hypertension ([JNC 7](#))**

BP Classification	SBP mmHg*		DBP mmHg*
Normal	<120	and	<80
Prehypertension	120–139	or	80–89
Stage 1 hypertension	140–159	or	90–99
Stage 2 hypertension	≥160	or	≥100

*Classification determined by higher BP category.
 BP (blood pressure); SBP (systolic blood pressure); DBP (diastolic blood pressure).

Recommendations for Follow-up

Patients with hypertension should receive regular follow up with his or her primary care provider.

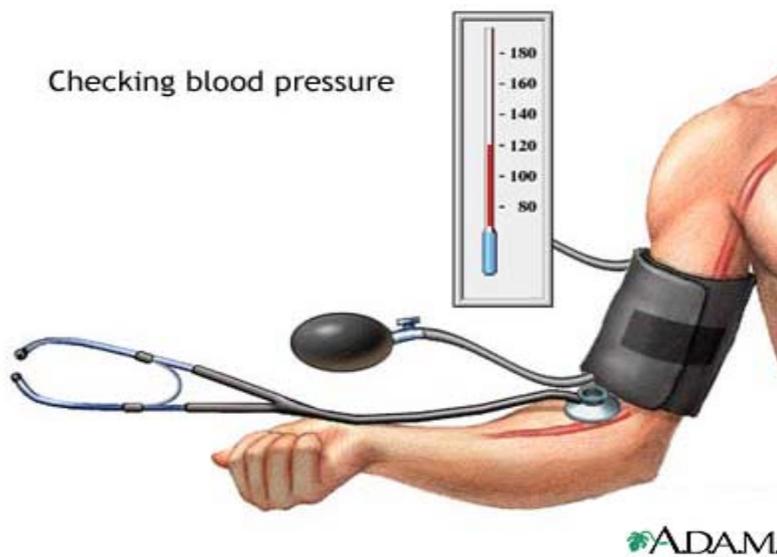
Initial Blood Pressure (mmHg)*	Follow-up Recommended†
Normal	Recheck in two years
Prehypertension	Recheck in one year‡
Stage 1 Hypertension	Confirm within two months‡
Stage 2 Hypertension	See physician within one month; if pressure is >180/110 mmHg, see physician immediately

Source: JNC-7, National High Blood Pressure Education Program, National Heart, Lung and Blood Institute, National Institutes of Health, U.S. Department of Health and Human Services, 2003. Publication No. 03-5231.

* If systolic and diastolic categories are different, choose the sooner of the follow-up options (e.g., 160/86 mmHg should be evaluated or referred to source of care within one month).

† Take into consideration past BP measurements, other cardiovascular risk factors, or target organ disease when scheduling a follow-up appointment.

‡ Provide information on lifestyle modifications [Prevention](#) or [Treatment](#).



Blood Pressure Measurement Policy References

- ¹ National Center for Health Statistics. Health, United States, 2008  [PDF 8.4M]. Hyattsville, MD: National Center for Health Statistics; 2008.
- ² Centers for Disease Control and Prevention (CDC). National diabetes fact sheet: General information and national estimates on diabetes in the United States, 2007. Atlanta: CDC; 2008.
- ³ National Center for Health Statistics. Health, United States, 2008  [PDF 8.4M]. Hyattsville, MD: National Center for Health Statistics; 2008.
- ⁴ Perloff D, Grim C, Flack J, Frohlich ED, Hill M, McDonald M, Morgenstern BZ. Human blood pressure determination by sphygmomanometry. *Circulation* 1993; 88:2460-2467.