The M.A.P. Framework and Hypertension Control
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Objectives
• Understand the need to improve blood pressure control
• Learn best practices to measure blood pressure accurately and reduce clinical inertia
• Understand how to engage residents and/or healthcare workers in care of their hypertension (HTN)

The M.A.P. framework
- Measure blood pressure accurately
- Act rapidly to manage uncontrolled hypertension
- Partner with patients, families, and communities
- Promote self-management
- Actionable data
- Evidence-based tools
- Adaptive change
Prototyping tools and resources

Partner: Johns Hopkins Medicine
- Armstrong Institute for Patient Safety and Quality (Dr. Peter Pronovost)
- Center to Eliminate Cardiovascular Health Disparities (Dr. Lisa Cooper)

Advisory group of national experts in HTN care

Patient and family advisory group

10 Diverse Practice Sites
- From solo practitioner to multispecialty practice with 14 physicians
- Diverse patient panels ranging from 95% African-American to 87% Latino, 65% Medicaid to 33% Medicare

Feedback on a framework, tools and resources and curriculum

Hypertension statistics

48% uncontrolled
54% uncontrolled in Wisconsin

2015 – Prevalence rate 33%
2030 – Prevalence rate 41% (projected)

62% increase in annual deaths related to hypertension

Blood pressure levels vary by age

Hypertension statistics

70 Million American Adults
1 in 3

48% uncontrolled
54% uncontrolled in Wisconsin

2015 – Prevalence rate 33%
2030 – Prevalence rate 41% (projected)

62% increase in annual deaths related to hypertension

Blood pressure levels vary by age
Hypertension statistics

- HTN is the leading cause of death and disability in every country
- HTN is the most common primary diagnosis for office visits in U.S.
- HTN is ranked as the number one nursing home diagnosis in Wisconsin on the Minimum Data Set (MDS)
- The estimated cost of treating high blood pressure in the U.S. in 2011 was $46 billion


Hypertension statistics

Wisconsin costs for treating all cardiovascular disease
- > $8 billion

Wisconsin costs for treating high blood pressure
- $600 million


Hypertension statistics

These risk factors can lead to an increased risk of cardiovascular disease.

This graph shows the rates of each risk factor among Wisconsin adults.
Hypertension statistics

Long-term care facilities

- 57% of men (mean age 80)
- 60% of women (mean age 81)
- Prevalence of HTN and diabetes = 76%


Blood pressure control

- “Better blood-pressure control can save far more lives than any other clinical intervention” Tom Frieden, MD MPH
- Every 10% increase in the number of people effectively treated for hypertension prevents an additional 14,000 deaths per year

Blood pressure control

Patient/resident factors
- Non-adherence
- Financial
- Literacy/Social Determinants

Physician factors
- Time
- Competing conditions
- Knowledge of evidence

System factors
- Quality reporting / dashboard / registry availability
- Workflow
- Management / Administration
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
Why measuring blood pressure accurately is important

- Uncertainty of patients’ true blood pressure is the leading cause for failure of a clinician to act on a high blood pressure in the office
- Significant BP variability exists in all patients
- Poor measurement technique decreases reliability of a patient’s BP, which can lead to poor clinical decisions, adversely affecting the health of a patient

How does this impact clinicians in practice?


It’s estimated that a 1 mm Hg rise in blood pressure above normal on average reduces life expectancy by one year
Blood pressure measurement

Factors that can affect blood pressure measurement

Observer Factors | Resident Factors | System Factors
---|---|---
Incorrect cuff size | Full Bladder | Location of monitor/device
Cuff placed over clothing | Stimulants | Noise
Improper positioning | Recent exercise | Work flows
No rest period | Recent meal |
Terminal digit preference | Talking, texting, reading |
Talking to patient | |
Cuff deflation too rapid | | |

White coat effect (WCE) is a transient increase in blood pressure due to being in a medical environment.

WCE is a major problem in clinical practice because:

- It prevents BPs obtained in a clinical setting from being representative of a patient’s ‘true’ BP
- WCE can be > 25 mm Hg in some patients
- People with hypertension may continue exhibit WCE making it difficult to determine when control has been achieved
Measure BP accurately

Minimizing variability and standardizing BP technique to measure BP accurately are critical for two reasons:

1. Accurate BP readings are needed to make sound clinical decisions
2. For BPs to be predictive of future cardiovascular events (outcomes) they must be representative of the actual BP


Measure BP accurately

• If diastolic BP measured spuriously high (poor technique, white coat effect) by 5 mm Hg across a population – the number of Americans diagnosed 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 it could increase by 42%


Accurate methods of BP measurement for diagnosing HTN

24-Hour Ambulatory Blood Pressure Monitoring (ABPM)

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

Cons
• Expensive
• Inconvenient
• Hard to get one scheduled
Accurate methods of BP measurement for diagnosing HTN

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 masked HTN
• Inexpensive
• Convenient

Cons
• Requires having a home monitor
• Requires clinical support for maximum benefit

 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

Automated blood pressure devices

• 2014 guidelines of the International Society of Hypertension/American Society of Hypertension: "The electronic device is preferred (to record BP) because it provides more reproducible results than the older (auscultatory) method and is not influenced by variations in technique or by the bias of observers"
• More importantly is the recognition that manual BP measurement, regardless of the type of sphygmomanometer used, is inferior because it is subject to multiple sources of error in routine clinical practice
Cuff size and cuff placement

- Using the wrong size cuff is the most common error in BP measurement
- Wrist and finger cuffs are not recommended – use upper arm cuff
- Mid-arm, center the cuff bladder over brachial artery, at heart level

<table>
<thead>
<tr>
<th>Adult Arm Circumference</th>
<th>Recommended cuff size - width x length</th>
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<tbody>
<tr>
<td>22 to 26 cm</td>
<td>12 x 22 cm</td>
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<tr>
<td>27 to 34 cm</td>
<td>16 x 30 cm (adult)</td>
</tr>
<tr>
<td>35 to 44 cm</td>
<td>16-17 x 36 cm (large adult)</td>
</tr>
<tr>
<td>45 to 52 cm</td>
<td>19-20 x 42 cm (adult thigh)</td>
</tr>
</tbody>
</table>

The best way to know you have the correct cuff size is to use the guide markings on the cuff. The edge of the cuff when wrapped around the arm should fall between the lines for the "range".

Manual BP measurement technique tips

- Inflate cuff until you cannot feel radial pulse, then 10 mm Hg higher
- Deflate at 2 mm Hg / second. Record BP
- Repeat inflating 30 mm Hg higher than palpated pressure. If change between the first two pressures is > 5 mm Hg, take a 3rd BP
- Training required every six months to maintain skill
Manual BP measurement technique tips

Terminal Digit Preference

- Rounding to 0 or 5 is extremely common (80-85% in some studies)
- Eliminated with automated devices

For more information on manual blood pressures and Korotkoff sounds go to:
http://goo.gl/yqF1ki

Rest and environment

- Rest for five minutes
- No talking
- No listening (to music, no one talking to you, etc.)
- No texting, reading, writing
- BP device not mounted over bed
- Winter raises BP 5 mm Hg, summer decreases 5 mm Hg

Physiologic factors and stimulants

- 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 a factor
Validation, calibration and biomed stickers

Use a validated, automated machine (AAMI, BHS, ESH)

- www.dableeducational.org
- Aneroid sphygmomanometer and automated clinic devices cannot be calibrated
- Aneroid devices, if out of alignment, need to be serviced by the manufacturer
- Automated devices, if tested and is not accurate, need to be serviced by the manufacturer

Most biomed inspectors look for cracks in tubing and holes in bladders

- Most do not check for accuracy

How many errors in BP measurement do you see?

1. Back is not supported
2. Arm is not supported near heart level
3. Cuff is over sweatshirt
4. Legs are crossed
5. Legs are not both flat on the stool
6. She is talking
7. She is listening
Measure BP accurately

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/resident has an empty bladder
- Rest for at least 5 minutes
- Obtain the average of at least 3 measurements (using automated blood pressure monitor if possible)
The most common factors contributing to uncontrolled hypertension

1. Clinicians miss opportunities to treat patients with BPs ≥140/90 because of:
   • Failure to make a diagnosis of hypertension
   • Failure to initiate or escalate therapy
   • Failure to recommend frequent follow up until BP is controlled

2. Patients are non-adherent to treatment plans:
   • Usually due to not taking medications as instructed

Act Rapidly to Manage Uncontrolled BP

• Use an evidence-based treatment protocol
• Emphasize frequent follow up until BP is controlled
• Use single-pill combinations to improve medication adherence and BP control

Use an evidence-based treatment protocol

• Provides a systems approach that can be implemented by all members of the care team
• Like a playbook for the whole team to follow
• Tells you who needs treatment, what treatment to use, when to change or escalate therapy how soon follow up should occur
• Keeping protocols simple helps, and they should be adjusted to the needs of a community or population where they are being used
Evidence-based treatment protocols are important

In patients with HTN with systolic BPs >150 mm Hg, increased risk of acute cardiovascular events or death can occur with
• Delays in medication intensification >6 weeks
• Delays in follow-up appointments >10 weeks after medication intensification

Evidence-based treatment protocols

• Treatment protocols
  – Million Hearts
    https://nccd.cdc.gov/MillionHearts/Protocol/
  – American Heart Association
    http://www.heart.org/do/groups/heart-
    public/@wcm/@hcm/documents/downloadable/ucm_461839.pdf
  – Kaiser Permanente

How single-pill combination therapy can help

Single-pill combination therapy gets patients to goal more quickly by
• Expediting escalation of therapy
• Using fewer prescriptions

Non-adherence to medications, another barrier to achieving blood pressure control, is reduced with single-pill combinations
• Using single-pill combination therapy improves adherence rates 26% compared to non-combination medications
Medication non-adherence

In Wisconsin, both hypertension and diabetes medication adherence are close to 40%, or 2 in 5

Kaiser-Permanante: An example of success

What are some reasons for clinical inertia?
Factors leading to clinical inertia

CLINICIAN
- Failure to initiate treatment
- Failure to titrate to goal
- Failure to recommend follow-up
- Failure to identify and manage comorbid conditions
- Not enough time

PATIENT/RESIDENT
- Medication side effects
- Failure to take meds
- Too many medications
- Cost of medications
- Denial of disease
- Absence of symptoms

HEALTH SYSTEM
- Lack of treatment guideline
- Lack of care coordination
- Poor communication between office staff
- No hypertension registry
- No patient outreach
Target improvement work

- BP high
- Did you treat?
- Did you reassess & adjust?
- Is the patient’s BP controlled?

Interventions to:
- Reduce clinical uncertainty
- Manage competing demands
- Engage patients
- Prescribe preferred medications

Interventions to:
- Improve follow-up
- Improve follow-through

Interventions to:
- Assess adherence barriers
- Support adherence
- Engage patients

Barriers to Overcoming Clinical Inertia

1. Unreliable blood pressure measurements
2. Lack of using a treatment protocol
3. Variable treatment adherence
4. Competing factors (# chronic conditions)
5. Patient-physician communication

Case Scenario

- Mrs. Johnson is a 78 year old female who had been seeing her primary care physician, Dr. Jones, for 20 years. She does not have a current diagnosis of hypertension. She last saw Dr. Jones 8 months ago when she was planning to have hip replacement surgery.
  - Vital signs: P 68, R 16, BP 140/87
- Mrs. Johnson had an orthopedic surgeon visit prior to her planned surgery. The physician notes her BP is just at the border of elevated, it’s the first time that they know of and decide it’s due to anxiety and pain.
  - Vital signs: P 70, R 18, BP 144/88
Case Scenario

- Her surgery and post-op stay was unremarkable. She had pain that was 8/10 day one and 6/10 day two but diminished to 4-5/10 by discharge. She began physical therapy per rehab protocol.
  - Pre-op vital signs (averaged)
    - P 80, R 20, BP 146/92
  - Post-op vital signs in recovery (averaged)
    - P 82, R 16, BP 160/92
  - Vital signs during hospitalization (averaged)
    - P 78, R 16, BP 154/90

Case Scenario

- Mrs. Johnson is now in a rehab facility for physical therapy. Her pain continues and she rates it at 5-6/10 most days. Her progression is slow and she complains that she cannot keep up with the schedule.
  - Vital signs (one week average): P 82, R 20, BP 162/94
- The nurse notices that Mrs. Johnson’s blood pressure is elevated and contacts the physician. They feel it may be due to the stress of rehab and her continuing pain. They decide to ‘keep an eye on it’.
- Mrs. Johnson is discharged home after 3 weeks of rehab and will continue with home health physical therapy. The clinical staff notes her BP is still elevated but think it might get better after she goes home.
  - Vital signs (average week 2 and 3 in rehab): P 78, R 16, BP 148/88

Case Scenario

- Mrs. Johnson follows up with her primary care physician 2 weeks after getting home from rehab. Her blood pressure continues to be elevated. The physician sees that it has been elevated throughout her hospitalization and rehab stay.
  - VS: P 72, R 16, BP 150/86
- He suggests starting on a low dose anti-hypertensive. She says she thinks it is from the stress of everything and wants to wait. He tells her to watch her diet, decrease her sodium and increase her physical activity. She said she will. A follow up appointment is scheduled for three months later.
Use evidence-based communication strategies

- Patient and resident engagement is important if we expect them to adhere to therapy
- When clinicians use this style of communicating – which is essentially talking less and listening more – we often learn important details that help us determine a preferred treatment approach
- When using this kind of communication, people are more engaged/committed, and as a result, are more likely to adhere
- Using these communication techniques does not lengthen visits (it actually shortens them), especially if all practice/facility staff are using them

<table>
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<th>STRATEGY</th>
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<tr>
<td>Begin with open-ended questions about adherence, including recent medication use</td>
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<tr>
<td>Explore reasons for possible non-adherence</td>
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<tr>
<td>Elicit patient views on options and priorities to customize a care plan for each patient</td>
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<tr>
<td>Remain non-judgmental at all times</td>
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<tr>
<td>Use teach-back to ensure understanding of the care plan</td>
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**Lifestyle management changes**

**DASH diet: Dietary Approaches to Stop Hypertension**
- Eating plan rich in fruits and vegetables, and low-fat or non-fat dairy, with whole grains. It is a high fiber, low to moderate fat diet, rich in potassium, calcium, and magnesium
- Proven to lower blood pressure and also found to assist in weight loss
- Can help eliminate medications in some with pre-hypertension
- Improves response to medication in those with more severe hypertension
- www.dashdiet.org

**Sodium reduction**
- Average sodium intake = 3,400 mg daily
- Safe upper limit = 2,300 mg daily
- American Heart Association suggests < 1,500 mg daily
- Pay attention to labels and what is used to prepare foods
- High levels of sodium found in processed foods (snacks, deli meats, frozen dinners) and canned foods (soups, tomatoes)

**Exercise**
- Benefits from endurance, dynamic resistance and isometric resistance
- Exercise and weight loss in older adults with moderate to severe HTN can potentiate the effects of medications
- AHA recommends 30 minutes/5 days per week; 40 minutes lowering blood pressure
  - This can be broken up into 10 minute segments per day

**References**
Impact of lifestyle changes for improving blood pressure in patients with HTN

<table>
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<tr>
<th>LIFESTYLE CHANGE</th>
<th>CAN LOWER SBP/DBP UP TO</th>
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<tr>
<td>DASH diet, compared with typical American diet</td>
<td>11/6/5.3 mm Hg</td>
</tr>
<tr>
<td>Reduce sodium intake by average of 1150 mg/d</td>
<td>4/2 mm Hg</td>
</tr>
<tr>
<td>Average weight loss of 11 lbs</td>
<td>4.4/3.6 mm Hg</td>
</tr>
<tr>
<td>40 minutes of moderate intensity aerobic physical activity, 3–4 times a week</td>
<td>5/4 mm Hg</td>
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Self-measured blood pressure (SMBP)

- SMBP monitoring is use of a personal BP monitor for the diagnosis/management of HTN
- People who will perform SMBP are typically trained to use automated blood pressure monitors in familiar settings, usually their homes.
- These BP readings are shared with their healthcare provider
- Provides multiple BPs over a longer period of time (representative)
- Eliminates white coat effect

Self-measured blood pressure

- There is sufficient evidence of the effectiveness for SMBP to improve BP when used alone (training provided for proper use and communication)
- There is strong evidence for the effectiveness of SMBP when combined with additional support (i.e., patient counseling, education or web-based support)
Self-measured blood pressure

SMBP can increase precision in the diagnosis of hypertension

- Confirming elevated office readings (USPSTF recommendation, October 2015)
- Differentiates between white coat and sustained HTN
- Helps to identify patients with masked HTN


Self-measured blood pressure

SMBP is more predictive of cardiovascular outcomes than office BPs:

- Target organ damage
- Risk of future cardiovascular events
- Mortality


Self-measured blood pressure

SMBP for assessment of blood pressure control

- Provides a reliable estimate of effectiveness of antihypertensive treatment
- Assesses control at different times across a 24 hour period
- Allows for better treatment decisions to be made in a timely fashion


Implementing a SMBP program

SMBP improves adherence to therapy

- Empowers people to be more involved in self-management
- Improves medication adherence with clinical support


People without a diagnosis of HTN:

- People with elevated office BPs who are suspected of having HTN (to make Dx)
- Suspected white coat hypertension
- Suspected masked hypertension

People with a diagnosis of HTN

- Increases engagement, adherence to treatment and can improve BP control
- To assess treatment effect on BP control
- Difficult to control BPs to determine if treatment resistant HTN is present

Recommend a validated automated upper arm BP monitor (with memory and averaging preferred)

- Do not recommend a wrist cuff (unless brachial readings impossible)
- Finger devices should never be used
- Appropriate fitting cuff essential (learn how to teach patients to measure)
  - Many devices have multiple cuff options
Implementing a SMBP program

- How can this be done in your setting?
  - Create a kiosk

- All staff should be trained to teach residents on proper SMBP measurement technique and communication of results

Validated Device:
- European Society of Hypertension International Protocol (ESH)
- British Hypertension Society Protocol (BHS)
- Association for the Advancement of Medical Instrumentation Protocol (AAMI)

List of validated home blood pressure monitors:
- Dabl Educational Trust website: www.dableducational.org
- British Hypertension Society website: www.bhsoc.org/bp-monitors/bp-monitors/

Training patients to self-measure accurately

Prior to measuring:
- For 30 minutes
  - No exercise, large meals, caffeine, alcohol, nicotine, decongestants

- Empty bladder if needed, then rest for 5 minutes sitting comfortably
Training to self-measure accurately

During the measurement:
• Continue to sit with back supported, legs uncrossed and feet flat on the floor
• Following the instructions for your device, put the cuff on by wrapping it around your bare arm 2-3 cm above the elbow
• Face the palm of hand up to relax arm muscles
• Rest arm on a table or another flat surface at the level of the heart
• No talking, reading, texting or watching TV during the measurement
• Continue to follow directions of the monitor, pressing the start button to begin

Training to self-measure accurately

After the measurement:
• The date, time, systolic and diastolic BP and pulse should be recorded immediately
• Wait one minute and repeat (always take at least two readings in a sitting)
• Remove the cuff and place the device in a safe and dry place.
• Clear instructions must be given for the patient to follow for communicating blood pressures (especially high, low, or BPs associated with symptoms)

Frequency of self-measurement

For initial evaluation, and assessment of change in medication, perform SMBP for seven consecutive days (3 minimum)
• Measure daily morning and evening before taking medication
• Each measurement should be in duplicate 1-2 minutes apart
• Discard the first days readings and average the remaining
• This should be performed for one week prior to each office visit

Less frequent checks are necessary in a patient with stable controlled BP though more frequent checks may be used for engagement
Interpreting self-measured blood pressure readings

What are normal BPs using SMBP?
• BPs < 130/80 mm Hg are considered normal

What is HTN or Uncontrolled BP using SMBP?
• BPs ≥ 135/85 mm Hg are considered elevated

Effective use of self-measured blood pressure

High Blood Pressure in Adults: Screening
Release Date: October 2015

Recommendation Summary

<table>
<thead>
<tr>
<th>Population</th>
<th>Recommendation</th>
<th>Grade [what’s this?]</th>
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<tbody>
<tr>
<td>Adults aged 18 years or older</td>
<td>The U.S.P.I.C. recommends screening for high blood pressure in adults aged 18 years or older. The U.S.P.I.C. recommends obtaining measurements outside of clinical settings for diagnostic confirmation before starting treatment (see the Clinical Considerations section).</td>
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</table>

Effective use of self-measured blood pressure

When added to SMBP additional clinical support strengthens its utility and effectiveness
• Delivery of the additional support must involve a trained clinician (e.g., physician, NP, PA, RN, MA, pharmacist or other health educator)
• Regular communication of SMBP data to clinicians
• A feedback loop between patient and clinician in which support and advice are customized based on the patient's reported information
Closing the SMBP data loop

Self-measured blood pressure readings
Lifestyle habits
(e.g., smoking, diet, exercise)
Medication side effects and adherence barriers
Insights into unvaried affecting control of blood pressure

Adjustments to medication type and dose to achieve goal blood pressure
Suggestions to adverse lifestyle changes
Advice on how to sustain or improve adherence
Advice about community resources to assist in combating blood pressure

About half of the intervention effect in this multifaceted trial to improve hypertension control was attributable to the combination of self-monitoring and medication intensification.

Among hypertensive patients at high risk of cardiovascular disease, self-monitoring with self-titration of antihypertensive medication, compared with usual care, resulted in lower systolic blood pressure at 12 months.
### Tools and resources to enhance SMBP

#### Tools for clinical team education

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Clinical Competency: Patient SMBP at home (page 7)
Tools and resources to enhance SMBP

Tools for patients/residents

Self-measured blood pressure at home patient guide (p.19-21)

- Importance of self-measuring blood pressure
- Choosing a home blood pressure monitoring device
- Measuring your blood pressure accurately

Self-measured blood pressure technique: How to take your own blood pressure

Tools and resources to enhance SMBP

Tools for patients

At-home measurement graphic (page 21)

Self-measured blood pressure monitoring at home - flow sheet

Tools and resources to enhance SMBP

Tools for patients

Patient blood pressure measurement flow sheet (page 22)