



Self-Measured **Blood Pressure** Monitoring

ACTION STEPS for Clinicians

Acknowledgments

We would like to extend special thanks to the following individuals for their assistance in the development and review of this document:

American Medical Association

Donna Daniel, PhD

Janet Williams, MA

Centers for Disease Control and Prevention

Barbara Bowman, PhD

Peter Briss, MD, MPH

Mary George, MD, MSPH, FACS, FAHA

Cathleen Gillespie, MS

Allison Goldstein, MPH*

Amy Heldman, MPH

Fleetwood Loustalot, FNP, PhD

Brita Roy, MD, MPH

Hilary K. Wall, MPH*

Janet Wright, MD, FACC

Health Resources and Services Administration

Cindy Adams

Northwestern Medical Group, Northwestern University

Michael Rakotz, MD

Office of the National Coordinator for Health Information Technology

Peter Ashkenaz

Maggie Wanis, DrPH

Michael Wittie, MPH

* Denotes guide preparers

For More Information

Allison Goldstein, MPH

Division for Heart Disease and Stroke Prevention

Centers for Disease Control and Prevention

agoldstein@cdc.gov

Suggested Citation

Centers for Disease Control and Prevention. *Self-Measured Blood Pressure Monitoring: Actions Steps for Clinicians*. Atlanta, GA: Centers for Disease Control and Prevention, US Dept of Health and Human Services; 2014.

Website addresses of nonfederal organizations are provided solely as a service to readers. Provision of an address does not constitute an endorsement of this organization by CDC or the federal government, and none should be inferred. CDC is not responsible for the content of other organizations' web pages.

Contents

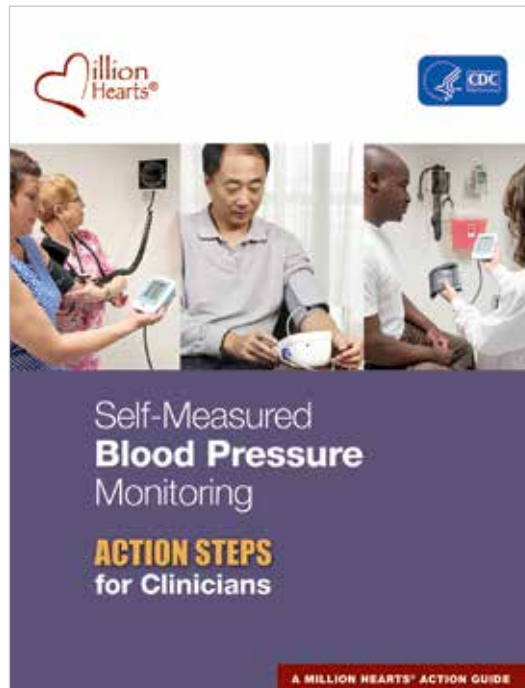
Executive Summary	1
Self Measured Blood Pressure Monitoring.....	2
Definition and Indications	2
Action Steps for Clinicians	2
Table 1. Actions to Prepare Care Teams to Support SMBP	4
Table 2. Actions to Select and Incorporate Clinical Support Systems for SMBP	5
Table 3. Actions to Empower Patients to Use SMBP.....	6
Table 4. Actions to Encourage Coverage for SMBP Plus Additional Clinical Support.....	7
Burden of Hypertension	8
Prevalence and Consequences of Hypertension.....	8
Health Reform and the Health Care System.....	8
Evidence for SMBP Plus Additional Clinical Support	8
Additional Clinical Support Strategies for SMBP	9
Home Blood Pressure Monitors and Cuffs Used for SMBP	11
Table 5. Preferred Characteristics of a Home Blood Pressure Monitor	11
Table 6. Proper Cuff Size for Accurate Measurement of Blood Pressure.....	12
Current Insurance Coverage of Home Blood Pressure Monitors and Additional Support	13
Table 7. Current Insurance Coverage/Reimbursement of Home Blood Pressure Monitors and Additional Support. . .	13
Conclusion.....	13
Resources.....	14
For Clinicians.....	14
For Clinicians to Give to Patients	15
References	16
Appendix A: Proper SMBP Preparation and Technique	20
Suggested SMBP Measurement Protocol	20
Retraining Clinicians.....	20
Table 8. Proper Patient Positioning for Blood Pressure Accuracy.....	20
Table 9. Blood Pressure Variability	21
Appendix B: Clinical Support Interventions That Are Effective with SMBP	22
Table 10. Additional Support Interventions for Implementation in a Variety of Settings.....	22
Appendix C: How to Check a Home Blood Pressure Monitor for Accuracy.....	24
Appendix D: Additional Burden and Cost of Hypertension	25
Costs of Hypertension	25
Acronyms.....	27

Executive Summary

Million Hearts® is a U.S. Department of Health and Human Services initiative, co-led by the Centers for Disease Control and Prevention (CDC) and the Centers for Medicare & Medicaid Services (CMS), with the goal of preventing one million heart attacks and strokes by 2017. To help achieve this goal, Million Hearts® aims to increase by 10 million the number of people in the United States whose blood pressure is under control.¹ Self-measured blood pressure monitoring (SMBP) plus additional clinical support* is one strategy that can reduce the risk of disability or death due to high blood pressure. SMBP is defined as regular measurement of blood pressure by the patient outside the clinical setting, either at home or elsewhere. It is sometimes called “home blood pressure monitoring.” Additional clinical support includes regular one-on-one counseling, Web-based or telephonic support tools, and educational classes and is further defined on page 9.

This guide provides action steps and resources on SMBP for clinicians and is not meant to replace individual clinical judgment. It includes the following elements:

- ▷ Action steps clinicians can take to implement SMBP plus additional support.
- ▷ A description of the burden of hypertension.
- ▷ A summary of the scientific evidence establishing the significance and effectiveness of SMBP plus additional support.
- ▷ An explanation of additional support strategies for SMBP.
- ▷ Types and costs of home blood pressure monitors used for SMBP.
- ▷ Current health insurance coverage for SMBP.



The purpose of this guide is to facilitate the implementation of SMBP plus clinical support in four key areas: Preparing care teams to support SMBP, selecting and incorporating clinical support systems, empowering patients, and encouraging health insurance coverage for SMBP plus additional clinical support. For each area, the guide lists actions that can facilitate the implementation of SMBP plus additional support. Beside each action step, it provides corresponding electronic resources to assist with these actions. It also includes appendices that describe proper SMBP preparation and technique, clinical support interventions that are effective when used with SMBP, the proper way to check a home blood pressure monitor for accuracy, and the burden and cost of hypertension.

*** In July 2012, the Agency for Healthcare Research and Quality (AHRQ) published a comparative effectiveness review of SMBP. The only finding with strong evidence of effectiveness was the implementation of SMBP with additional clinical support; that is, evidence was not sufficient to support SMBP alone as an effective intervention for improving blood pressure.**

Self-Measured Blood Pressure Monitoring

Definition and Indications

SMBP plus additional clinical support is one alternative to traditional office care that could improve access to care and quality of care for individuals with hypertension while making blood pressure control more convenient and accessible across the population. SMBP, or home blood pressure monitoring, is the regular measurement of blood pressure by a patient at home or elsewhere outside the clinic setting using a personal home measurement device.² A Joint Scientific Statement from the American Heart Association (AHA), American Society of Hypertension (ASH), and Preventive Cardiovascular Nurses Association (PCNA) encourages increased regular use of SMBP by clinicians for the majority of patients with known or suspected hypertension³ as a way to increase patients' engagement and ability to self-manage their condition, enabling the care team to assist in timely achievement and maintenance of control and preventing heart attacks and strokes. It further states that SMBP may be particularly useful in certain types of patients, including the elderly, people with diabetes or chronic kidney disease, pregnant women, and those with suspected or confirmed white coat hypertension.³

A Joint Scientific Statement from AHA, ASH, and PCNA encourages increased regular use of SMBP by clinicians for the majority of patients with known or suspected hypertension³ as a way to increase patients' engagement and ability to self-manage their condition.

Although public education campaigns can encourage patients to monitor their blood pressure at home, clinician support is critical for empowering patients, training them on proper measurement techniques, monitoring home readings, and providing timely advice on needed medication titrations and lifestyle changes.

Action Steps for Clinicians

Clinicians are key to the widespread implementation of SMBP plus additional clinical support. Although public education campaigns can encourage patients to monitor their blood pressure at home, clinician support is critical for empowering patients, training them on proper measurement techniques, monitoring home readings, and providing timely advice on needed medication titrations and lifestyle changes. **This guide provides a comprehensive plan and resources for clinicians who want to support SMBP in their practices and health care systems.** Figure 1 lists evidence-based strategies that clinicians can use to implement a comprehensive SMBP initiative. The strategies are organized into four categories of actions:

- ▷ Preparing care teams to engage patients in SMBP (Table 1)
- ▷ Selecting and incorporating clinical support systems for SMBP (Table 2)
- ▷ Empowering patients to use SMBP (Table 3)
- ▷ Encouraging coverage for SMBP plus additional clinical support (Table 4)

By incorporating all of these strategy types into their workflow, clinicians can make SMBP a seamless part of routine care for patients with hypertension.

Figure 1. Steps to Implementing a Comprehensive SMBP Program

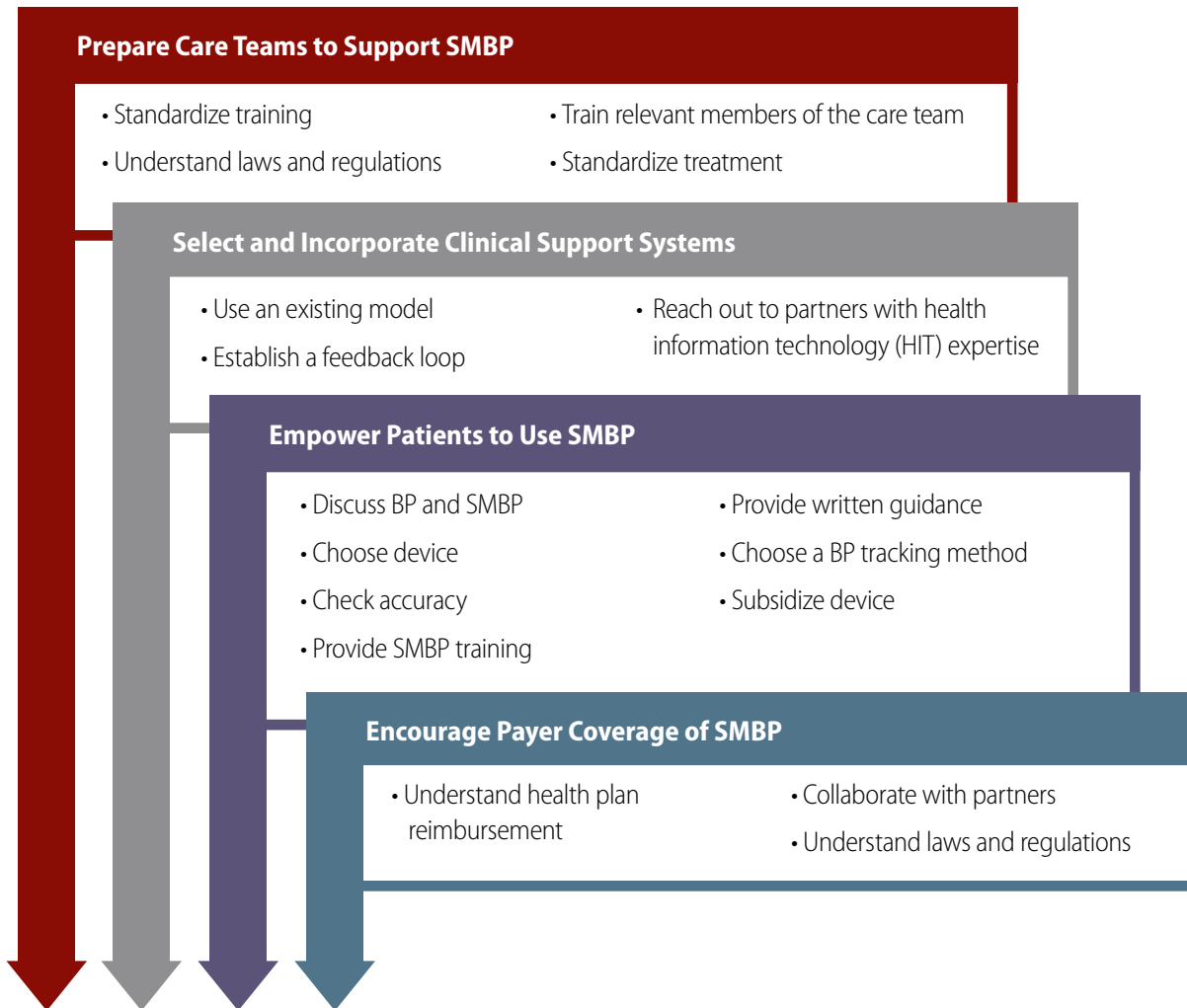


Table 1. Actions to Prepare Care Teams to Support SMBP

Recommended Actions	Resources
<p>Standardize training of clinicians to take blood pressure readings and teach SMBP techniques to their patients.</p> <ul style="list-style-type: none"> • Conduct an initial clinician competency exam for pertinent staff and new employees to demonstrate proper technique in: <ul style="list-style-type: none"> ◊ Cuff selection. ◊ Patient positioning. ◊ Measurement without talking. ◊ Accurate observation of the blood pressure level.⁴ • Consider additional competency training for all employees at regular intervals. 	<ul style="list-style-type: none"> • Appendix A: Proper SMBP Preparation and Technique • American Medical Group Foundation. Measure Up/Pressure Down Provider Toolkit (p. 13): http://bit.ly/1rwuHaa • New England Journal of Medicine. Blood-Pressure Measurement (video): http://bit.ly/1CnW6RM • Washington State Department of Health. Improving the Screening, Prevention, and Management of Hypertension—An Implementation Tool for Clinic Practice Teams (pp. 69–100): http://go.usa.gov/fjq3
<p>Learn how state laws and regulations relating to scope of practice and licensing of telemedicine providers affect clinician roles in SMBP support (e.g., which clinician types may titrate medications and in which states, and whether telemedicine provider services can cross state lines).</p>	<ul style="list-style-type: none"> • CDC. Select Features of State Pharmacist Collaborative Practice Laws: http://go.usa.gov/fbsG • U.S. Public Health Service. Improving Patient and Health System Outcomes through Advanced Pharmacy Practice: http://bit.ly/ZFQNAF • CDC. Self-Measured Blood Pressure Monitoring: Action Steps for Public Health Practitioners: http://go.usa.gov/fbsz • American Academy of Physician Assistants. PA Scope of Practice Prescriptive Authority: http://bit.ly/1xUm2DW • Barton Associates. NP Scope of Practice Laws: http://bit.ly/1sW44SE • HealthIT.gov. Are There State Licensing Issues Related to Telehealth? http://go.usa.gov/fbM5
<p>Train relevant team members (e.g., PAs, NPs, nurses, pharmacists) to lead the clinical support piece of SMBP interventions. Clinical support programs should be delivered only by clinicians specifically trained for the intervention.⁵</p> <p>Incorporate this clinical support into existing disease management programs.</p>	<ul style="list-style-type: none"> • Appendix C: How to Check a Home Blood Pressure Monitor for Accuracy • Clinical Advisor. How to Implement Home Blood Pressure Monitoring: http://bit.ly/1017uHD
<p>Implement standardized hypertension treatment protocols and related order sets and referral templates to enable the full care team to titrate medications.</p> <ul style="list-style-type: none"> • Use preferred clinical guidelines to define entry criteria, treatment goals, preferred medications, and management of side effects.⁶⁻⁸ 	<ul style="list-style-type: none"> • CDC. Million Hearts® Protocol Resources: http://go.usa.gov/fbsP • American Medical Group Foundation. Measure Up/Pressure Down Provider Toolkit (p. 29): http://bit.ly/1rwuHaa • Joint National Committee 7: Full Report and Physician Reference Card, Slide Shows, and Free Patient Education Materials: http://go.usa.gov/fbJH

Table 2. Actions to Select and Incorporate Clinical Support Systems for SMBP

Recommended Actions	Resources
<p>Explore existing evidence-based clinical support models for SMBP and determine the most feasible type of support for your work environment. Consider:</p> <ul style="list-style-type: none"> • Staff (e.g., physicians, nurses, PAs, NPs, pharmacists, cardiology department, medical assistants). • HIT capacity (e.g., electronic health record [EHR] functionality, patient portals, secure e-mail). • Budget. 	<ul style="list-style-type: none"> • Appendix B: Clinical Support Interventions That Are Effective with SMBP
<p>Establish a secure feedback loop that follows the Health Insurance Portability and Accountability Act (HIPAA) regulations. Use an existing product or newly developed health information technology for regular communication of SMBP readings and timely treatment advice/adjustments between patients and clinicians. Incorporate it into your EHR system if possible. Examples include:</p> <ul style="list-style-type: none"> • Secure patient portals that can: <ul style="list-style-type: none"> ◊ Receive patient SMBP readings. ◊ Request medication refills. ◊ Make appointments. ◊ Use secure messaging to contact health care team members. ◊ Provide clinic visit summaries with instructions for patients when they leave the clinic. • Personal health records that interface with the EHR. • Secure e-mail between patients and clinicians. • Telemedicine devices that transmit readings from patients to clinicians, paired with follow-up counseling. • Handwritten logs that are routinely shared. 	<ul style="list-style-type: none"> • AHA. Heart360 Patient Portal: http://bit.ly/1rwunYJ • NextGen. Patient Portal: http://bit.ly/1wad0DA • Microsoft HealthVault: http://bit.ly/1sL0wBo • HealthIT.gov. Patient Portal Increases Communication Between Patients and Providers: http://go.usa.gov/fbhR • Direct Project: http://bit.ly/1rwuQtZ • U.S. Department of Health and Human Services. Summary of the HIPAA Privacy Rule: http://go.usa.gov/fbhd • Figure 2: Feedback Loop Between Patients and Clinicians Supporting SMBP
<p>Reach out to partners with HIT expertise:</p> <ul style="list-style-type: none"> • Regional Extension Centers can advise clinicians in all phases of electronic health record implementation. • Health Center Controlled Networks (HCCNs) exchange information and establish collaborative mechanisms to meet HIT and clinical quality objectives. • State departments of health may have informatics or analytic expertise (e.g., epidemiologists, data analysts). • Quality Improvement Organizations (QIOs) support Cardiac Learning and Action Networks that clinicians can join. • Local users' groups for your EHR system may exist in your area. 	<ul style="list-style-type: none"> • HealthIT.gov. Listing of Regional Extension Centers: http://go.usa.gov/fbHW • Health Resources and Services Administration. Health Center Controlled Networks: http://go.usa.gov/fbzT • State and local government websites and health officials: <ul style="list-style-type: none"> ◊ State, County, and City Government Website Locator: http://bit.ly/11q5hG4 ◊ State Associations of County and City Health Officials: http://bit.ly/1wad6el • QualityNet. QIO Directories: http://bit.ly/1npLBvW • CMS. QIO Fact Sheet: http://go.usa.gov/fbHC

Table 3. Actions to Empower Patients to Use SMBP

Recommended Actions	Resources
<p>Discuss with your patients⁹:</p> <ul style="list-style-type: none"> • The importance of effectively controlling high blood pressure (BP). • The link between measuring BP and controlling high BP. • Adherence to strategies aimed at managing hypertension, such as lifestyle and dietary modifications and medication. • How SMBP enables patients to actively and appropriately manage their BP rather than overmanaging based on a single reading. 	<ul style="list-style-type: none"> • AHRQ. Effectiveness of Self-Measured Blood Pressure Monitoring in Adults With Hypertension: http://go.usa.gov/fbs4 • AHRQ. Measuring Your Blood Pressure at Home: A Review of the Research for Adults: http://go.usa.gov/fjqT
<p>Review the types of available SMBP devices and work with patients to choose the best option.</p>	<ul style="list-style-type: none"> • Page 11: Home Blood Pressure Monitors and Cuffs Used for SMBP • Clinical Advisor. How to Implement Home Blood Pressure Monitoring: http://bit.ly/1017uHD
<p>Check the home device for accuracy by comparing readings to a reliable office device.</p>	<ul style="list-style-type: none"> • Appendix C: How to Check a Home Blood Pressure Monitor for Accuracy • Clinical Advisor. How to Implement Home Blood Pressure Monitoring: http://bit.ly/1017uHD
<p>Train patients on proper SMBP technique. Explain:</p> <ul style="list-style-type: none"> • How to operate the device. • Patient preparation. • Proper positioning and technique. • When to measure BP (time of day/frequency). 	<ul style="list-style-type: none"> • Appendix A: Proper SMBP Preparation and Technique • American Medical Group Foundation. Measure Up/Pressure Down Provider Toolkit: http://bit.ly/1rwuHaa
<p>Suggest a method patients can use to track BP values:</p> <ul style="list-style-type: none"> • Electronic trackers: <ul style="list-style-type: none"> ◊ Patient portal. ◊ Heart360. ◊ Smartphone applications. ◊ Paper trackers <p>Patients should communicate all BP records to a clinician.</p>	<ul style="list-style-type: none"> • AHA. Heart360 Patient Portal: http://bit.ly/1rwunYJ • AHA. Printable Log to Record Home Blood Pressure Measurements: http://bit.ly/1sUFssq

Recommended Actions	Resources
Provide written information or videos for patients on how to properly perform SMBP. Include links to online materials in patient portals.	<ul style="list-style-type: none"> • Washington State Department of Health. How to Check Your Blood Pressure: http://go.usa.gov/fbhF • AHA. Instructional Video: Monitoring Blood Pressure at Home: http://bit.ly/1pffQBp • AHA. How to Monitor and Record Your Blood Pressure: http://bit.ly/1vfP4hS
Provide a contact at the practice for patients to call with questions.	
If patient access/cost is a barrier, purchase high-quality devices in bulk. ¹⁰ Sell them to patients at cost, or loan them to patients at no cost.	

Table 4. Actions to Encourage Coverage for SMBP Plus Additional Clinical Support

Recommended Actions	Resources
<p>Understand how the health plans you work with reimburse for SMBP devices and remote counseling services.</p> <p>Medicare Accountable Care Organizations (ACOs) may have the flexibility to cover remote monitoring as an extended benefit under their population management mandate.</p>	<ul style="list-style-type: none"> • Page 13: Table 7. Current Insurance Coverage/ Reimbursement of Home Blood Pressure Monitors and Additional Support • CDC. Self-Measured Blood Pressure Monitoring: Action Steps for Public Health Practitioners (Appendix A): http://go.usa.gov/fbsz
<p>Work with payers, public health practitioners, and professional medical associations to promote coverage of SMBP devices and remote clinical support:</p> <ul style="list-style-type: none"> • Ask payers to provide benefit coverage for fully automated, upper arm home BP monitors with properly sized cuffs. • Ask payers to reimburse for services related to SMBP, such as time spent training patients on selecting an accurate monitor, proper cuff size, and measurement techniques, as well as time spent checking the monitor for accuracy, interpreting SMBP readings, and providing medication and lifestyle adjustments and counseling. • Healthcare Common Procedure Coding System (HCPCS) code S9110 can be used by private insurers, but not CMS, for home telehealth reimbursement. 	<ul style="list-style-type: none"> • CDC. Self-Measured Blood Pressure Monitoring: Action Steps for Public Health Practitioners: http://go.usa.gov/fbsz • Home Health News Source. Information on Code S9110 to Reimburse for Home Telehealth: http://bit.ly/1rwuPXb
<p>Understand how state and local laws and regulations relating to scope of practice and telehealth affect reimbursement for aspects of SMBP support (e.g., which clinician types can be reimbursed for remote counseling).</p>	<ul style="list-style-type: none"> • Page 13: Table 7. Current Insurance Coverage/ Reimbursement of Home Blood Pressure Monitors and Additional Support • National Conference of State Legislatures. State Coverage for Telehealth Services: http://bit.ly/1wacS6X • CDC. Self-Measured Blood Pressure Monitoring: Action Steps for Public Health Practitioners (Appendix A): http://go.usa.gov/fbsz

Burden of Hypertension Prevalence and Consequences of Hypertension

Hypertension is the most common reason for a person with any chronic condition to visit a clinician,¹¹ and it is a major risk factor for heart disease, stroke, and kidney disease. Even small increases in blood pressure increase the risk for cardiovascular disease and mortality; the risk of death from ischemic heart disease and stroke doubles for every 20 mmHg increase in systolic blood pressure (SBP) or 10 mmHg increase in diastolic blood pressure (DBP).^{3,12,13} Hypertension

Replacing some face-to-face primary care visits with other forms of care, such as electronic and phone communication, could make care safer and more effective, patient-centered, timely, and efficient.²²

affects almost one-third of American adults aged 18 or older (72 million people) and is uncontrolled in nearly half of those (35 million people).¹⁴ This population with uncontrolled hypertension represents a large pool of patients for whom clinicians could consider further clinical intervention, including SMBP. For more information on the burden and cost of hypertension, see Appendix D.

Health Reform and the Health Care System

The clinical care workload is expected to increase by 29% between 2005 and 2025 as 80 million baby boomers retire and become Medicare eligible¹⁵; currently, 68% of people over the age of 65 have hypertension.¹⁴ Moreover, the volume of hypertensive patients in the primary care system¹⁶ is expected to increase with the expansion

of insurance coverage to more than 30 million U.S. residents through the Patient Protection and Affordable Care Act¹⁷ by 2019. At the same time, the United States is facing a shortage of primary care physicians, warranting new models of care to improve preventive care delivery and reduce time pressures on physicians.^{15,18–21}

Face-to-face visits will likely continue to be an important form of interaction for relationship building and physical examination, but many face-to-face visits may not be wanted or needed. Replacing some face-to-face primary care visits with other forms of care, such as electronic and phone communication, could make care safer and more effective, patient-centered, timely, and efficient.²² Electronic, telephonic, and other forms of non-face-to-face communication also may allow clinicians to spend more of their time improving the quality of the face-to-face visits that do occur.²²

Traditional office-based and fee-for-service models of health care delivery and payment reimburse clinicians only for office-based visits and services. Thus, new delivery and care models, such as patient-centered medical homes, ACOs, and bundled/episode-based payments, are needed.²³ These models may provide opportunities for health plans to promote SMBP plus clinical support interventions through unique features such as incentives, care management fees, and shared savings/risk tied to performance on quality measures.²⁴ For SMBP interventions to be successful at a population level, clinicians must have innovative methods to streamline data into user-friendly reports so they can focus care delivery.²⁵

Evidence for SMBP Plus Additional Clinical Support

A 2012 comparative effectiveness review by AHRQ examined the effectiveness of SMBP alone compared to SMBP plus additional support to usual care.^{2,26} Patients using SMBP at home only took readings themselves or had a caretaker take them. They then shared the readings with

clinicians in a variety of ways. AHRQ found strong evidence that SMBP plus additional clinical support was more effective than usual care in lowering blood pressure and improving control among patients with hypertension.² In the studies AHRQ examined, all six “quality A” trials reported statistically significant reductions in blood pressure among patients using SMBP plus additional support (see Appendix B for a detailed table of select effective clinical support interventions). The mean net reduction in SBP ranged from 3.4 to 8.9 mmHg, and the mean net decrease in DBP ranged from 1.9 to 4.4 mmHg at up to 12 months follow-up.^{27–32}

Additional Clinical Support Strategies for SMBP

The type of additional support in the studies AHRQ examined varied widely but fell into three main categories: regular one-on-one counseling,^{7,28,29,31,33,34} Web-based or telephonic support tools that did not involve face-to-face interaction,^{27,30–32,35,36} and educational classes.^{29,37,38}

- ▷ **One-on-one counseling:** Examples included regular telephone calls from nurses to manage blood pressure–lowering medication⁷ and in-person counseling sessions with trained pharmacists.³⁴
- ▷ **Web-based or telephonic support:** Examples included an interactive computer-based

AHRQ found strong evidence that SMBP plus additional clinical support (defined below) was more effective than usual care in lowering blood pressure and improving control among patients with hypertension.²

telephone feedback system³⁰ and secure patient website training plus pharmacist care management delivered through Web communications,³¹ both in response to patient-reported blood pressure readings.

- ▷ **Educational classes:** Examples included telephone-based education by nurses on blood pressure–lowering behaviors, delivered only when patients reported poor blood pressure readings,²⁹ and small-group classes on SMBP technique and lifestyle changes that help lower blood pressure, taught by PAs.³⁷

More research is needed to determine whether one form of support is most effective.² However, with one exception, all forms of additional support in the trials that successfully lowered patients’ blood pressure were administered by clinicians (e.g., pharmacists, NPs, PAs) specifically

Many different kinds of SMBP plus additional support interventions have successfully lowered blood pressure in patients with hypertension. Common elements of successful SMBP plus additional support interventions for patients are^{7,27–38}:

- ▶ Delivery of intervention by trained clinicians (e.g., pharmacists, NPs, PAs, health educators).
- ▶ Regular patient communication of SMBP readings to clinicians.
- ▶ A patient/clinician “feedback loop” in which clinician support and advice are customized based on patients’ reported information (see Figure 2).

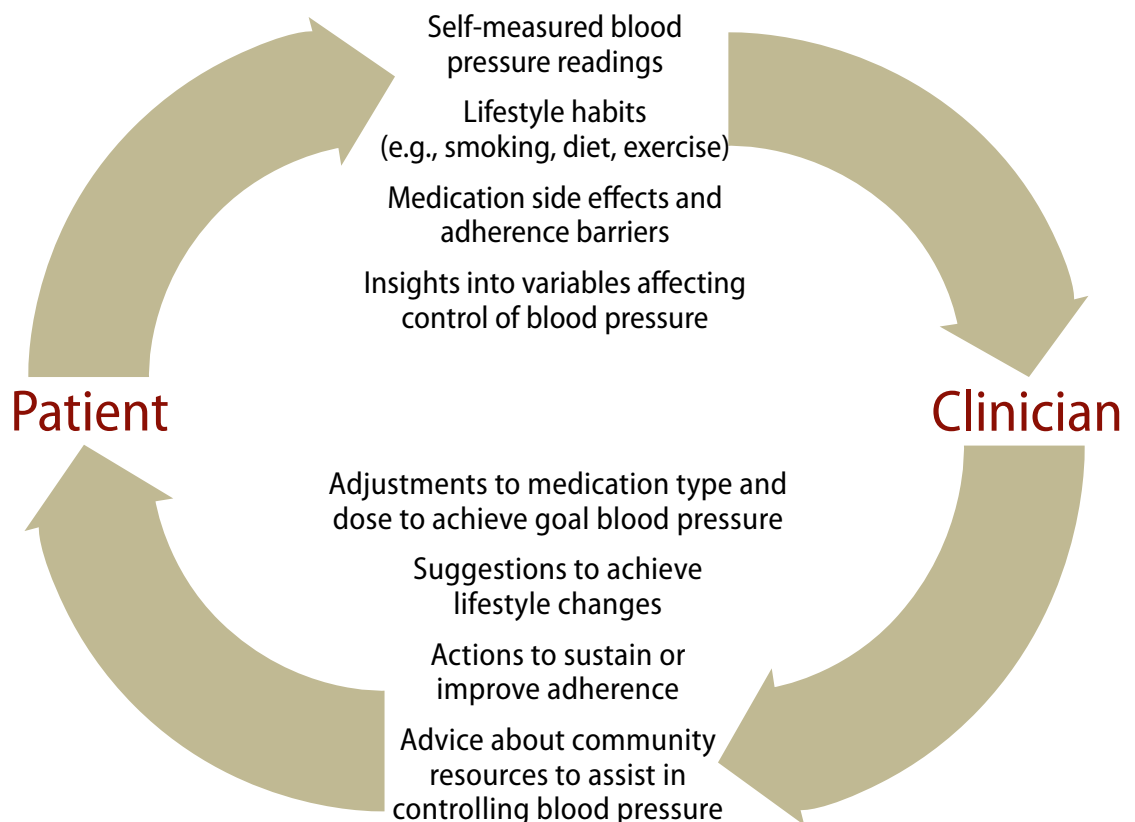
Common Elements of Successful SMBP Support

When SMBP is done at home, it could help reduce hypertension-related disparities among vulnerable populations because clinicians can collect information about patients' blood pressure, medications, and health behaviors without requiring them to pay for and travel to a doctor's office for every blood pressure reading.^{7,27–32,35,37}

trained to deliver the intervention, and the intervention content was adjusted based on patients' reported SMBP readings. Upon additional analysis of the interventions, multiple common elements were noted across all types of clinical support (see Common Elements of Successful SMBP Support below).^{7,27–38}

If maintained over time, interventions using SMBP plus additional support could contribute to improved blood pressure control for many patients with hypertension. The delivery and components of successful SMBP plus additional clinical support interventions vary widely, and this flexibility may mean clinicians can implement interventions across numerous health care settings and patient populations. However, more formal evaluation of these approaches is needed.

Figure 2.
Feedback loop
between patients
and clinicians
supporting SMBP



Some studies suggest that when SMBP is done at home, it could help reduce hypertension-related disparities among vulnerable populations because clinicians can collect information about patients' blood pressure, medications, and health behaviors without requiring them to pay for and travel to a doctor's office for every blood pressure reading.^{7,27–32,35,37} One challenge is the current requirement that clinicians deliver services in person to be reimbursed. This may become less of an issue as payment models transition from fee-for-service to pay-for-value. See Table 7 for information on current coverage.

Home Blood Pressure Monitors and Cuffs Used for SMBP

Available home blood pressure monitors range from manual (auscultatory) devices to partially or fully automated (oscillometric) devices.³⁹ Automated devices require less skill than manual devices, are widely available, and are likely to reduce the risk of error in home blood pressure measurements.^{3,39} Although upper arm, wrist, and finger monitors are available, upper arm monitors are recommended by AHA, ASH, and PCNA, among others, for accuracy of measurement.³⁹

Patients should expect to pay in the range of \$50 to \$100 for an accurate upper arm home blood pressure monitor.^{3,40} Wrist cuffs may be used as an alternative for patients who are obese or have other difficulties using upper arm cuffs, but the accuracy of readings may be inconsistent.³ Finger cuffs are not accurate and should not be used.^{3,39} For a summary of preferred home blood pressure monitor features, see Table 5.

To choose the best option for the patient, consider

- ▷ Preferred monitor characteristics (Table 5).
- ▷ Cuff size measurement (Table 6).
- ▷ Insurance coverage (Table 7).

Clinicians should encourage patients to bring home blood pressure monitors in for comparison with in-office readings taken by a trained clinician (see Appendix C for detailed instructions). Such visits are also a good opportunity to educate patients and their family members about the proper use of their SMBP devices (see Appendix A). Patients with atrial fibrillation or other types of irregular heartbeat (arrhythmias), as well as those with certain physical or mental conditions, may have difficulty taking accurate readings using automated home blood pressure monitors.³ However, this does not mean that

Table 5. Preferred Characteristics of a Home Blood Pressure Monitor³

Preferred	Not Preferred
Automated	Manual
Upper arm cuff	Wrist cuff*
Properly sized cuff	Too-large or too-small cuff
Memory storage capacity	No memory storage
Printing capacity	No printer
Ability to upload BP readings to computer or other electronic device	No ability to upload
Accuracy checked by clinician after purchase	Patient uses monitor without consulting clinician

* Wrist cuffs may be used as an alternative for patients who are obese or have other difficulties using upper arm cuffs, but the accuracy of readings may be inconsistent.

Table 6. Proper Cuff Size for Accurate Measurement of Blood Pressure⁴

Adult Arm Circumference	Recommended Cuff Size
22–26 cm / 8.7–10.2 in	12 × 22 cm (small adult)
27–34 cm / 10.6–13.4 in	16 × 30 cm (adult)
35–44 cm / 13.8–17.3 in	16 × 36 cm (large adult)
45–52 cm / 17.7–20.5 in	16 × 42 cm (adult thigh)
> 52 cm / 20.5 in	Wrist cuff

SMBP is contraindicated in these patient populations. Rather, clinicians must remember that these patients' blood pressure values may vary depending upon where systole occurs during the measurement.⁴¹

The most common error in blood pressure measurement is use of an improperly sized cuff. The bladder length recommended by the AHA is 80% of the patient's arm circumference, and the ideal width is at least 40%.⁴ See Table 6 for recommended cuff sizes.

For correct cuff placement, the midline of the cuff bladder (commonly marked on the cuff by the manufacturer) should be positioned over the arterial pulsation in the patient's upper arm following palpation of the brachial artery in the antecubital

Experts from AHA, ASH, and PCNA have recommended that payers cover both the purchase of validated home blood pressure monitors and the time that clinicians spend training patients in SMBP techniques, validating patients' measurement techniques, interpreting SMBP readings, and providing counseling based on SMBP readings.³

fossa. For an obese patient whose arm does not easily fit inside a standard cuff, a wrist cuff may be preferable, as long as proper technique is followed.⁴

New Technology in Blood Pressure Monitoring

Increasing use of technology has resulted in many mobile blood pressure monitoring devices that can be used with smartphones, tablets, etc. One example of these devices is a mobile arm cuff that plugs directly into a smartphone and, with a downloadable application, can measure and record blood pressure onto the phone. Multiple companies are beginning to market such devices, some of which are FDA approved or validated with the EHS test protocol. Cuffless blood pressure monitoring using heartbeat and pulse data captured with smartphone microphones is another new technology being developed.⁴² Most of these strategies have not yet been properly validated by international standards. Another type of device that is widely available is the blood pressure kiosk, often found in pharmacies, worksites, and retail stores. Current kiosks may be inaccurate and unreliable.⁴³ These machines allow patients to save their blood pressure readings and track them over time or share them with their clinicians. Such devices could play a large role in SMBP in the future, but current research in this area is limited.

Current Insurance Coverage of Home Blood Pressure Monitors and Additional Support

Insurance benefits for SMBP vary by payer: for example, some payers may cover monitors but not additional support services provided by clinicians. Traditional office-based and fee-for-service models of health care delivery and payment reimburse clinicians only for office-based visits and services (see Table 7). For patients whose insurance does not cover the purchase of home blood pressure monitors, the cost of a monitor may be reimbursed under a health care flexible spending account.⁴⁴

Conclusion

Clinicians can play an integral role in the widespread implementation of SMBP plus additional clinical support. Clinician support is key to

seamlessly integrate SMBP plus clinical support into routine care by changing systems and empowering patients. This guide provides a comprehensive plan and resources for clinicians who want to support SMBP in their practices and health care systems, outlining four categories of evidence-based strategies that clinicians can use to implement a comprehensive SMBP initiative:

- ▷ Preparing care teams to support SMBP.
- ▷ Selecting and incorporating clinical support systems.
- ▷ Empowering patients to use SMBP.
- ▷ Encouraging coverage for SMBP plus additional clinical support.

By incorporating actions from these strategies into their regular workflow, clinicians can make SMBP plus clinician support a regular part of patient care, which can improve outcomes for patients with hypertension.

Table 7. Current Insurance Coverage/Reimbursement of Home Blood Pressure Monitors and Additional Support

Coverage Type	Benefits
Medicare Part B (Traditional fee-for-service Medicare)	<ul style="list-style-type: none"> • Covers ambulatory blood pressure monitoring.³ • Covers physician interpretation of results for the diagnosis of white coat hypertension.³ • Does not cover home blood pressure monitors used for SMBP. • Does not cover clinician interpretation of readings for treatment of hypertension.
Medicare Part C (Medicare Advantage Plans)	<ul style="list-style-type: none"> • Not mandated, but may cover supplemental coverage of home blood pressure monitors or additional support programs for enrollees.⁴⁵
Medicaid	<ul style="list-style-type: none"> • Coverage for home blood pressure monitors and additional support varies by state.
Private insurance carriers and self-insured employers	<ul style="list-style-type: none"> • Decision to cover home blood pressure monitors and additional support is made by each individual plan • Some private insurance plans provide these types of benefits only for beneficiaries who are enrolled in disease-management programs for hypertension or other medical conditions that increase the risk of heart disease and stroke.⁴⁶ • HCPCS code S9110 can be used by private insurers, but not CMS, for home telehealth reimbursement.

Resources

For Clinicians

AHA. Heart360 Patient Portal: <http://bit.ly/1rwunYJ>

AHRQ. Effectiveness of Self-Measured Blood Pressure Monitoring in Adults With Hypertension: <http://go.usa.gov/fbs4>

AHRQ. Self-Measured Blood Pressure Monitoring: Comparative Effectiveness: <http://go.usa.gov/fbsk>

American Academy of Physician Assistants. PA Scope of Practice Prescriptive Authority: <http://bit.ly/1xUm2DW>

American Medical Association. Physician Resource Guide to Patient Self-Management Support: <http://bit.ly/1rdFq9z>

American Medical Group Foundation. Measure Up/Pressure Down Provider Toolkit: <http://bit.ly/1rwuHaa>

ASH. Hypertension Guidelines: Eight Sets of Guidelines from U.S., European, and International Societies: <http://bit.ly/1npL1hw>

Barton Associates. NP Scope of Practice Laws: <http://bit.ly/1sW44SE>

CDC. Million Hearts® Protocol Resources: <http://go.usa.gov/fbsP>

CDC. Select Features of State Pharmacist Collaborative Practice Laws: <http://go.usa.gov/fbsG>

CDC. Self-Measured Blood Pressure Monitoring: Action Steps for Public Health Practitioners: <http://go.usa.gov/fbsz>

Clinical Advisor. How to Implement Home Blood Pressure Monitoring: <http://bit.ly/1017uHD>

CMS. QIO Fact Sheet: <http://go.usa.gov/fbHC>

Direct Project: <http://bit.ly/1rwuQtZ>

HealthIT.gov. Are There State Licensing Issues Related to Telehealth? <http://go.usa.gov/fbM5>

HealthIT.gov. Listing of Regional Extension Centers: <http://go.usa.gov/fbHW>

HealthIT.gov. Patient Portal Increases Communication Between Patients and Providers: <http://go.usa.gov/fbhR>

Health Resources and Services Administration. Health Center Controlled Networks: <http://go.usa.gov/fbzT>

Home Health News Source. Information on Code S9110 to Reimburse for Home Telehealth: <http://bit.ly/1rwuPXb>

Joint National Committee 7: Full Report and Physician Reference Card, Slide Shows, and Free Patient Education Materials: <http://go.usa.gov/fbJH>

Microsoft HealthVault: <http://bit.ly/1sL0wBo>

National Association of Community Health Centers. Health Center Information: <http://bit.ly/1stbBFL>

National Conference of State Legislatures. State Coverage for Telehealth Services: <http://bit.ly/1wacS6X>

New England Journal of Medicine. Blood-Pressure Measurement (video): <http://bit.ly/1CnW6RM>

NextGen. Patient Portal: <http://bit.ly/1wad0DA>

QualityNet. QIO Directories: <http://bit.ly/1nplBvW>

Robert Wood Johnson Foundation. Partnering in Self-Management Support: A Toolkit for Clinicians: <http://bit.ly/1wLoqMc>

State Associations of County and City Health Officials: <http://bit.ly/1wad6el>

State, County, and City Government Website Locator: <http://bit.ly/11q5hG4>

The Community Guide. Cardiovascular Disease Prevention and Control: Team-Based Care to Improve Blood Pressure Control: <http://bit.ly/ZFQGVZ>

U.S. Department of Health and Human Services. Summary of the HIPAA Privacy Rule: <http://go.usa.gov/fbhd>

U.S. Public Health Service. Improving Patient and Health System Outcomes through Advanced Pharmacy Practice: <http://bit.ly/ZFQNAF>

Washington State Department of Health. How to Check Your Blood Pressure: <http://go.usa.gov/fbhF>

Washington State Department of Health. Improving the Screening, Prevention, and Management of Hypertension—An Implementation Tool for Clinic Practice Teams: <http://go.usa.gov/fjq3>

For Clinicians to Give to Patients

AHA. Blood Pressure Monitoring: <http://bit.ly/11q5Gs8>

AHA. How to Monitor and Record Your Blood Pressure: <http://bit.ly/1vfP4hS>

AHA. Instructional Video: Monitoring Blood Pressure at Home: <http://bit.ly/1pffQBp>

AHA. Printable Log to Record Home Blood Pressure Measurements: <http://bit.ly/1sUFssq>

AHRQ. Measuring Your Blood Pressure at Home: A Review of the Research for Adults: <http://go.usa.gov/fjqT>

References

1. Frieden TR, Berwick DM. The “Million Hearts” initiative—preventing heart attacks and strokes. *N Engl J Med*. 2011;365:e27.
2. Uhlig K, Balk EM, Patel K, Ip S, Kitsios GD, Obadan NO, et al. *Self-Measured Blood Pressure Monitoring: Comparative Effectiveness*. Comparative Effectiveness Review No. 45. (Prepared by the Tufts Evidence-based Practice Center under Contract No. HHS A 290-2007-10055-I.) AHRQ Publication No. 12-EHC002-EF. Rockville, MD: Agency for Healthcare Research and Quality, US Dept of Health and Human Services; 2012 www.effectivehealthcare.ahrq.gov/ehc/products/193/893/CER45_SMBP_20120131.pdf. Accessed October 10, 2014.
3. Pickering TG, Miller NH, Ogedegbe G, Krakoff LR, Artinian NT, Goff D. Call to action on use and reimbursement for home blood pressure monitoring: executive summary: a joint scientific statement from the American Heart Association, American Society of Hypertension, and Preventive Cardiovascular Nurses Association. *J Am Soc Hypertens*. 2008;2:192–202.
4. Pickering TG, Hall JE, Appel LJ, Falkner BE, Graves J, Hill MN, et al. 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;45:142–61.
5. Centers for Disease Control and Prevention. *Self-Measured Blood Pressure Monitoring: Action Steps for Public Health Practitioners*. Atlanta, GA: Centers for Disease Control and Prevention, US Dept of Health and Human Services; 2013.
6. Frieden TR, King SM, Wright JS. Protocol-based treatment of hypertension: a critical step on the pathway to progress. *JAMA*. 2014;311:21–2.
7. Rudd P, Miller NH, Kaufman J, Kraemer HC, Bandura A, Greenwald G, et al. Nurse management for hypertension: a systems approach. *Am J Hypertens*. 2004;17:921–7.
8. Go AS, Bauman MA, Coleman King SM, Fonarow GC, Lawrence W, Williams KA, et al. An effective approach to high blood pressure control: a science advisory from the American Heart Association, the American College of Cardiology, and the Centers for Disease Control and Prevention. *Hypertension*. 2014;63:878–85.
9. Eisenberg JM. *Effectiveness of Self-Measured Blood Pressure Monitoring in Adults with Hypertension*. Rockville, MD: Agency for Healthcare Research and Quality, US Dept of Health and Human Services; 2012.
10. Angell S, Guthartz S, Dalal M, Foster V, Pogue V, Wei A, et al. Integrating self blood pressure monitoring into the routine management of uncontrolled hypertension: translating evidence to practice. *J Clin Hypertens*. 2013;15:180–5.
11. Schappert SM, Rechtsteiner EA. Ambulatory medical care utilization estimates for 2006. *Natl Health Stat Rep*. 2008;(8):1–29.
12. Centers for Disease Control and Prevention. Vital signs: awareness and treatment of uncontrolled hypertension among adults—United States, 2003–2010. *MMWR*. 2012;61:703–9.
13. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL Jr., et al. The seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 report. *JAMA*. 2003;289:2560–72.

14. Nwankwo T, Yoon SS, Burt V, Gu Q. Hypertension among adults in the United States: National Health and Nutrition Examination Survey, 2011–2012. NCHS data brief, no. 133. Hyattsville, MD: National Center for Health Statistics, Centers for Disease Control and Prevention, US Dept of Health and Human Services; 2013.
15. Schwartz MD. Health care reform and the primary care workforce bottleneck. *J Gen Intern Med.* 2012;27:469–72.
16. Fang J, Alderman MH, Keenan NL, Ayala C, Croft JB. Hypertension control at physicians' offices in the United States. *Am J Hypertens.* 2008;21:136–42.
17. Sommers BD, Bindman AB. New physicians, the Affordable Care Act, and the changing practice of medicine. *JAMA.* 2012;307:1697–8.
18. Jacobson PD, Jazowski SA. Physicians, the Affordable Care Act, and primary care: disruptive change or business as usual? *J Gen Intern Med.* 2011;26:934–7.
19. Association of American Medical Colleges. *Physician Shortages to Worsen Without Increases in Residency Training.* 2013. www.aamc.org/download/153160/data/physician_shortages_to_worsen_without_increases_in_residency_tr.pdf. Accessed October 10, 2014.
20. Association of American Medical Colleges Center for Workforce Study. The Complexities of Physician Supply and Demand: Projections through 2025. 2008. <https://members.aamc.org/eweb/upload/The%20Complexities%20of%20Physician%20Supply.pdf>. Accessed October 10, 2014.
21. Gillespie C, Kuklina EV, Briss PA, Blair NA, Hong Y. Vital signs: prevalence, treatment, and control of hypertension—United States, 1999–2002 and 2005–2008. *MMWR.* 2011;60:103–8.
22. Committee on Quality of Health Care in America, Institute of Medicine. *Crossing the Quality Chasm: A New Health System for the 21st Century.* Washington, DC: National Academies; 2001.
23. Higgins A, Stewart K, Dawson K, Bocchino C. Early lessons from accountable care models in the private sector: partnerships between health plans and providers. *Health Aff.* 2011;30:1718–27.
24. America's Health Insurance Plans. *Issue Brief: Transforming Care Delivery.* 2012. www.ahip.org/Issues/Documents/2012/Transforming-Care-Delivery.aspx. Accessed October 10, 2014.
25. Magid DJ, Olson KL, Billups SJ, Wagner NM, Lyons EE, Kroner BA. A pharmacist-led, American Heart Association Heart360 Web-enabled home blood pressure monitoring program. *Circ Cardiovasc Qual Outcomes.* 2013;6:157–63.
26. Uhlig K, Patel K, Ip S, Kitsios G, Balk E. Self-measured blood pressure monitoring in the management of hypertension: A systematic review and meta-analysis. *Ann Intern Med.* 2013;159:185–94.
27. Shea S, Weinstock RS, Starren J, Teresi J, Palmas W, Field L, et al. A randomized trial comparing telemedicine case management with usual care in older, ethnically diverse, medically underserved patients with diabetes mellitus. *J Am Med Inform Assoc.* 2006;13:40–51.
28. Artinian NT, Flack JM, Nordstrom CK, Hockman EM, Washington OG, Jen KL, et al. Effects of nurse-managed telemonitoring on blood pressure at 12-month follow-up among urban African Americans. *Nurs Res.* 2007;56:312–22.

29. Bosworth HB, Powers BJ, Olsen MK, McCant F, Grubber J, Smith V, et al. Home blood pressure management and improved blood pressure control: results from a randomized controlled trial. *Arch Intern Med*. 2011;171:1173–80.
30. Friedman RH, Kazis LE, Jette A, Smith MB, Stollerman J, Torgerson J, et al. A telecommunications system for monitoring and counseling patients with hypertension: impact on medication adherence and blood pressure control. *Am J Hypertens*. 1996;9:285–92.
31. Green BB, Cook AJ, Ralston JD, Fishman PA, Catz SL, Carlson J, et al. Effectiveness of home blood pressure monitoring, Web communication, and pharmacist care on hypertension control: a randomized controlled trial. *JAMA*. 2008;299:2857–67.
32. McManus RJ, Mant J, Bray EP, Holder R, Jones MI, Greenfield S, et al. Telemonitoring and self-management in the control of hypertension (TASMINH2): a randomised controlled trial. *Lancet*. 2010;376:163–72.
33. Bosworth HB, Olsen MK, Grubber JM, Neary AM, Orr MM, Powers BJ, et al. Two self-management interventions to improve hypertension control: a randomized trial. *Ann Intern Med*. 2009;151:687–95.
34. Zillich AJ, Sutherland JM, Kumbera PA, Carter BL. Hypertension outcomes through blood pressure monitoring and evaluation by pharmacists (HOME study). *J Gen Intern Med*. 2005;20:1091–6.
35. Rinfret S, Lussier MT, Peirce A, Duhamel F, Cossette S, Lalonde L, et al. The impact of a multidisciplinary information technology-supported program on blood pressure control in primary care. *Circ Cardiovasc Qual Outcomes*. 2009;2:170–7.
36. Park MJ, Kim HS, Kim KS. Cellular phone and Internet-based individual intervention on blood pressure and obesity in obese patients with hypertension. *Int J Med Inform*. 2009;78:704–10.
37. Mühlhauser I, Sawicki PT, Didjurgeit U, Jörgens V, Trampisch HJ, Berger M. Evaluation of a structured treatment and teaching programme on hypertension in general practice. *Clin Exp Hypertens*. 1993;15:125–42.
38. Sawicki PT, Mühlhauser I, Didjurgeit U, Baumgartner A, Bender R, Berger M. Intensified antihypertensive therapy is associated with improved survival in type 1 diabetic patients with nephropathy. *J Hypertens*. 1995;13:933–8.
39. O'Brien E, Asmar R, Beilin L, Imai Y, Mallion JM, Mancia G, et al. European Society of Hypertension recommendations for conventional, ambulatory and home blood pressure measurement. *J Hypertens*. 2003;21:821–48.
40. Pickering TG. Why is self-monitoring reimbursed for blood glucose but not blood pressure? *J Clin Hypertens*. 2004;6:526–31.
41. Davis L. How to Implement Home BP Monitoring. Clinical Advisor Web site. 2011. www.clinicaladvisor.com/how-to-implement-home-bp-monitoring/article/206808. Accessed October 10, 2014.
42. Chandrasekaran V, Dantu R, Jonnada S, Thiyagaraja S, Subbu KP. Cuffless differential blood pressure estimation using smart phones. *IEEE Transactions Biomed Eng*. 2013;60:1080–9.
43. Alpert B. Are kiosk blood pressure readings trustworthy? *Blood Press Monit*. 2012;17:257–58.
44. Internal Revenue Service. Medical and Dental Expenses (including the Health Coverage Tax Credit). IRS Pub. 502. Washington, DC: GPO; 2011.

45. Centers for Medicare and Medicaid Services. *Announcement of Calendar Year (CY) 2013 Medicare Advantage Capitation Rates and Medicare Advantage and Part D Payment Policies and Final Call Letter*. 2012. www.cms.gov/Medicare/Health-Plans/MedicareAdvtgSpecRateStats/Downloads/Announcement2013.pdf. Accessed October 10, 2014.
46. Butcher L. Plans slow to cover at-home BP monitoring. *Manag Care*. 2008;17:35–7.
47. Pickering TG, White WB; American Society of Hypertension Writing Group. ASH Position Paper: Home and ambulatory blood pressure monitoring. When and how to use self (home) and ambulatory blood pressure monitoring. *J Clin Hypertens*. 2008;10:850–5.
48. Niiranen TJ, Johansson JK, Reunanen A, Jula AM. Optimal schedule for home blood pressure measurement based on prognostic data: the Finn-Home Study. *Hypertension*. 2011;57:1081–6.
49. Parati G, Stergiou GS, Asmar R, Bilo G, de Leeuw P, Imai Y, et al. European Society of Hypertension practice guidelines for home blood pressure monitoring. *J Hum Hypertens*. 2010;24:779–85.
50. National Institute for Health and Clinical Excellence. *The Clinical Management of Primary Hypertension in Adults: Clinical Guideline 127*. London: NICE; 2011. www.guidance.nice.org.uk/cg127. Accessed October 10, 2014.
51. Ogihara T, Kikuchi K, Matsuoka H, Fujita T, Higaki J, Horiuchi M, et al. The Japanese Society of Hypertension Guidelines for the Management of Hypertension (JSH 2009). *Hypertens Res*. 2009;32:3–107.
52. HealthPartners. *Blood Pressure Accuracy and Variability Quick Reference*. 2014. www.measureuppressuredown.com/HCProf/Find/Toolkit/Plank1Tool11.pdf. Accessed October 10, 2014.
53. Margolis KL, Asche SE, Bergdall AR, Dehmer SP, Groen SE, Kadrmaz HM, et al. Effect of home blood pressure telemonitoring and pharmacist management on blood pressure control: a cluster randomized clinical trial. *JAMA*. 2013;310:46–56.
54. American Heart Association. Instructional Video: Monitoring Blood Pressure at Home Web site. 2012. www.heart.org/HEARTORG/Conditions/HighBloodPressure/Symptoms-DiagnosisMonitoringofHighBloodPressure/Instructional-Video---Monitoring-Blood-Pressure-at-Home_UCM_303324_Article.jsp. Accessed October 10, 2014.
55. National Center for Health Statistics. *National Health and Nutrition Examination Survey Health Tech/Blood Pressure Procedures Manual*. Hyattsville, MD: Centers for Disease Control and Prevention, US Dept of Health and Human Services; 2009.
56. Heidenreich PA, Trogon JG, Khavjou OA, Butler J, Dracup K, Ezekowitz MD, et al. Forecasting the future of cardiovascular disease in the United States: a policy statement from the American Heart Association. *Circulation*. 2011;123:933–44.
57. Trogon JG, Finkelstein EA, Nwaise IA, Tangka FK, Orenstein D. The economic burden of chronic cardiovascular disease for major insurers. *Health Promot Pract*. 2007;8:234–42.

Appendix A: Proper SMBP Preparation and Technique

Proper patient positioning is important for blood pressure accuracy (Table 8). In addition, exercise, smoking, alcohol consumption, muscle tension, urinary bladder distension, room temperature, and background noise can affect measurement. Table 9 shows the effects of these factors on blood pressure readings.

Suggested SMBP Measurement Protocol

To help manage blood pressure for patients with uncontrolled hypertension, clinicians can use SMBP readings to help assess the effects of antihypertensive treatment, including medication changes and lifestyle modifications. Multiple international guidelines^{47–51} suggest that the optimal protocol for obtaining an accurate picture of a patient's blood pressure using SMBP includes

- ▷ Taking two or three measurements, each 1 minute apart, in the morning and again in the evening.
- ▷ Monitoring blood pressure preferably for 7 days and at least for 3 days.
- ▷ Recording an average of these measurements.

Guidance on how often well-controlled hypertensive patients should perform regular SMBP as part of long-term follow-up remains a matter of debate. Thus, there is a need for future research on this topic.

Retraining Clinicians

To maintain correct blood pressure measurement technique, clinicians must pay careful attention to all steps in the protocol and to retraining. Federally funded multisite clinical trials of hypertension care and control have set the standard for retraining, requiring all blood pressure observers to be retrained at regular intervals. Retraining involves checking a clinician's competency in several aspects of measurement technique⁴:

- ▷ Cuff selection.
- ▷ Patient positioning.
- ▷ Allowing no talking.
- ▷ Accurate auditory or visual observation of the patient's blood pressure level.

Table 8. Proper Patient Positioning for Blood Pressure Accuracy⁴

- | |
|--|
| • Have the patient sit quietly for 5 minutes before taking blood pressure. |
| • Place the cuff on a bare arm . |
| • Use the proper size cuff . If two cuff sizes fit, use the larger one. |
| • Place the artery marker over the brachial artery . |
| • Apply the cuff carefully, allowing room for no more and no fewer than two fingers underneath. |
| • Make sure the patient's back is supported and relaxed . |
| • Make sure the patient's feet are supported and legs are uncrossed . |
| • Keep the upper arm supported, relaxed, and at heart level . |
| • Ask the patient to keep the arm still and not talk during the measurement. |

The American Medical Group Foundation created a toolkit of materials on how to train direct care staff to properly take blood pressure measurements. The toolkit can be found on the group's Measure Up/Pressure Down website (<http://bit.ly/1rwuHaa>); "Plank 1" includes the following tools for training direct care staff in accurate blood pressure measurement:

- ▷ Hypertension Medical Assistant Training
- ▷ Checking Blood Pressures Nursing Competency
- ▷ Competency Checklist Blood Pressure Measurement
- ▷ Competency Checklist Orthostatic Blood Pressure Measurement
- ▷ Correct Blood Pressure Measurement Technique Handout
- ▷ Blood Pressure Measurement: What Not to Do
- ▷ Blood Pressure Measurement: The Proper Way
- ▷ New Employee Blood Pressure Measurement Competency Checklist
- ▷ Blood Pressure Champion and CDS Education and Auditing Process for New Staff
- ▷ Quarterly Blood Pressure Auditing Tool
- ▷ Blood Pressure Accuracy and Variability Quick Reference
- ▷ Staff Engagement Poster
- ▷ Correct Blood Pressure Technique Poster

Table 9. Blood Pressure Variability⁵²

Factor	Systolic (mmHg)
Cuff too small	10–40 ↑
Cuff over clothing	10–40 ↑ or ↓
Back/feet unsupported	5–15 ↑
Legs crossed	5–8 ↑
Arm tense	15 ↑
Not resting 3 to 5 minutes	10–20 ↑
Anxiety/white coat hypertension	As much as 30 ↑
Patient talking	10–15 ↑
Labored breathing	5–8 ↑
Full bladder	10–15 ↑
Pain	10–30 ↑
Arm below or above heart level	10 ↑ or ↓ For every 1 cm above or below heart level, blood pressure varies by 0.8 mmHg.
Factor	Diastolic (mmHg)
Arm extended and unsupported	Diastolic ↑ 10%

▷ Accurate Blood Pressure Measurement Video

Appendix B: Clinical Support Interventions That Are Effective with SMBP

Implementing an already-investigated model that you believe is promising and feasible for your practice can help reduce heterogeneity in SMBP monitoring and additional support protocols you use. The table below lists examples of additional support interventions that have been successfully implemented in a variety of settings. AHRQ conducted a comparative effectiveness review that included 24 studies; the review found the interventions in 11 of these studies to be effective. Table 10 below includes interventions from four

studies rated “quality A”, AHRQ’s highest quality rating, according to the AHRQ’s review methodology; two “quality A” studies were not included because their interventions could not feasibly be translated into clinical practice. Two additional effective studies were published after the AHRQ review; they were deemed “quality A” by two independent reviewers and are thus included in the table. None of the studies found to have ineffective interventions employed the interventions in the table. All studies provided patients with a free, automated, upper arm cuff home blood pressure monitor and proper training on SMBP. Please refer to individual studies for full descriptions of the study populations, interventions, and results.

Table 10. Additional Support Interventions for Implementation in a Variety of Settings

Additional Support Intervention	Intervention Staff	BP Measurement Frequency	HIT/BP Transmission	Cost
Telephone-based nurse counseling at regular intervals, covering lifestyle modification and medication adherence ²⁸	Nurse Primary care physician (PCP)	3 days a week, once a day in the morning	A telemedicine device connected to the home BP monitor transmitted readings to a server, which compiled reports and sent them to the PCP and nurse.	No cost data available
Nurse-delivered patient-specific behavioral intervention OR nurse- and physician-led medication management intervention OR combination of both ²⁹	Nurse PCP	Every 2 days	A telemedicine device connected to the home BP monitor transmitted readings to a server.	\$947 for behavior management \$1,275 for medication management \$1,153 for combination
Patient portal Web training + automated reminders + counseling and medication management by pharmacists ²⁵	Clinical pharmacy specialist PCP	At least three times a week	Patients uploaded BP readings to Heart360 patient portal connected to office EHR.	No cost data available

Additional Support Intervention	Intervention Staff	BP Measurement Frequency	HIT/BP Transmission	Cost
Telemonitoring of BP readings + pharmacist counseling and medication management via phone ⁵³	Pharmacist PCP	At least six readings a week (three in the morning and three in the evening)	The BP monitor transmitted readings via modem to a secure website	Direct program costs: \$1,045/patient for 12 months. About half was for care management services; remainder was for telemedicine services (discounted rate).
Web training + pharmacist care management to develop action plan and medication management, delivered through Web communications ³¹	Clinical pharmacist PCP	At least 2 days a week (two measurements each time)	Patients e-mailed BP readings to physicians.	No cost data available
Telemonitoring of home BP measurements with clinician alert + self-titration of antihypertensive drugs following titration schedule designed by PCP ³²	PCP	Two measurements per morning (5 minutes apart), daily for 1 week each month	A telemedicine device connected to the home BP monitor transmitted readings.	No cost data available

Appendix C: How to Check a Home Blood Pressure Monitor for Accuracy

The first step in choosing an accurate monitor is to choose one that has passed a formal validation protocol; all SMBP devices sold in the United States meet Food and Drug Administration–required testing standards.⁴ However, even a device that has passed an accepted validation test will not provide accurate readings in all patients; the error may be consistently ± 5 mmHg in many individuals, especially elderly or diabetic patients.⁴ For this reason, clinicians should encourage patients to take any home blood pressure monitor they use to their doctor's office to measure its accuracy against a mercury sphygmomanometer or comparable device before the readings are accepted. A simple version of the European Society of Hypertension International Protocol has been developed for this purpose and can be done quickly by the physician or other health care clinician and the patient.³ The following steps to ensure accuracy take approximately 10 minutes⁴:

1. Have the patient sit down with his or her arm at heart level. The arm should be completely relaxed.^{13,41}
2. Allow the patient to rest for 5 minutes.⁴¹
3. Avoid any conversation during the measurements to prevent an increase in blood pressure.⁴¹
4. Take a total of five sequential same-arm blood pressure readings, no more than 30 seconds apart.⁴¹
5. Have the patient take the first two readings with his or her device.⁴¹
6. The healthcare clinician takes the third reading, preferably with a mercury sphygmomanometer or comparable device.⁴¹
7. Have the patient take the fourth reading.⁴¹
8. The fifth and final reading is taken by the healthcare clinician.⁴¹
9. Compare the difference between the readings from the two cuffs.
10. BP readings will usually decline over the five measurements. The final SBP reading may be as much as 10 mmHg systolic BP lower than the first.⁴¹
11. If the difference is 5 mmHg or less, the comparison is acceptable.
12. If the difference is greater than 5 mmHg but less than 10 mmHg, do the calibration again.
13. If the difference is greater than 10 mmHg, the device may not be accurate.
14. Repeat this procedure annually.^{41,54} Though there is no established target for how close the readings from the patient's cuff should be to those from the clinician's cuff, this exercise can provide a general sense of the SMBP device's accuracy, which can be taken into consideration for future measurements recorded at home.⁴¹ To further ensure accuracy, consider statically calibrating the clinic and home devices following the National Health and Nutrition Examination Survey (NHANES) Health Tech/Blood Pressure Procedures Manual.⁵⁵

Appendix D: Additional Burden and Cost of Hypertension

Of the 35 million people in the United States with uncontrolled hypertension

- ▷ Approximately 13 million are not aware that they have hypertension.
- ▷ Approximately 5 million are aware of their hypertension but are untreated.
- ▷ Approximately 17 million are aware of their hypertension and are on treatment, but their hypertension is still uncontrolled (see Figure 3).¹⁴

Costs of Hypertension

Along with increased cardiovascular morbidity and mortality, hypertension is associated with increased use of health care resources.¹³

Direct health care costs related to hypertension amount to approximately \$131 billion each year.⁵⁶ Moreover, treatment for cardiovascular disease is estimated to account for 12% of annual spending by both private insurers and Medicaid and for nearly 30% of annual Medicare spending.⁵⁷

Hypertension-attributable costs are almost 7% of total medical expenditures in the United States.⁴ A 2007 study using the 2000–2003 Medical Expenditure Panel Survey estimated that the hypertension-attributable cost per person with hypertension was \$1,598⁵⁷:

- ▷ \$781 per person receiving Medicare.⁵⁷
- ▷ \$1,608 per person receiving Medicaid.⁵⁷
- ▷ \$845 per person with private insurance.⁵⁷

The prevalence of untreated and uncontrolled hypertension does not arise from a lack of health care coverage. Of adults with uncontrolled hypertension, more than 28 million have health insurance (see Figure 4), 30 million have a usual source of care, and almost 25 million have been seen by physicians at least twice in the last 12 months.¹⁴

Figure 3.
Hypertension among Adults in the United States, NHANES 2011–2012.¹⁴

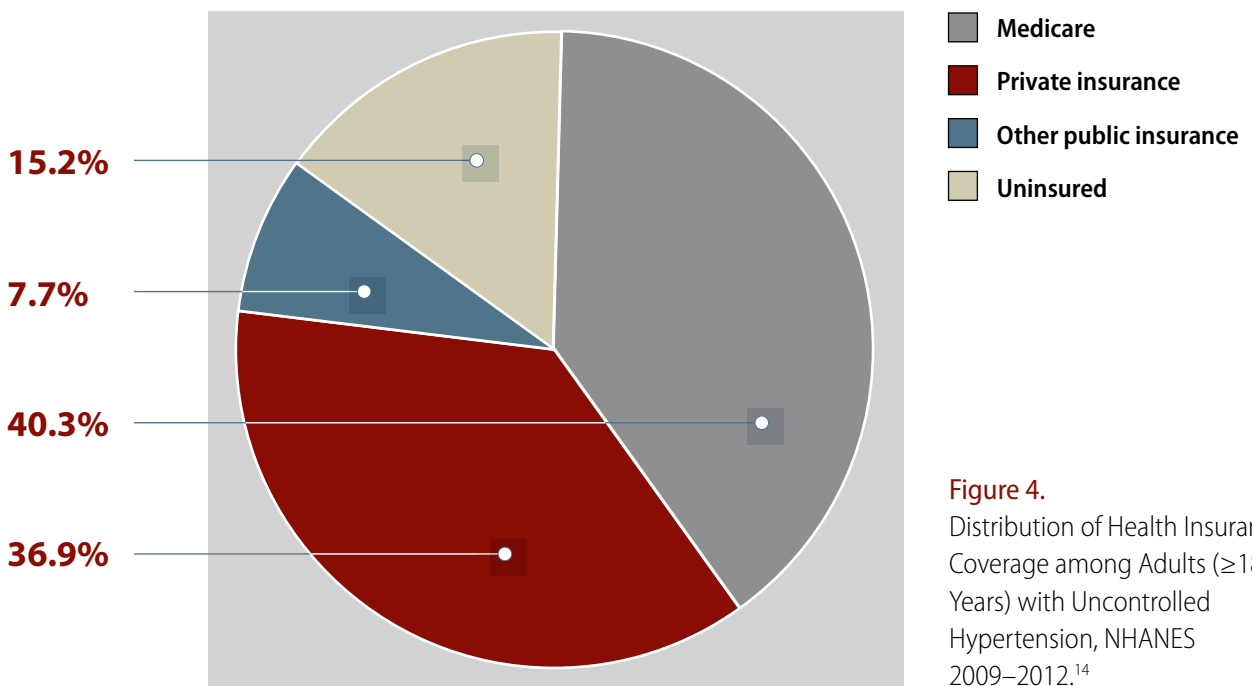
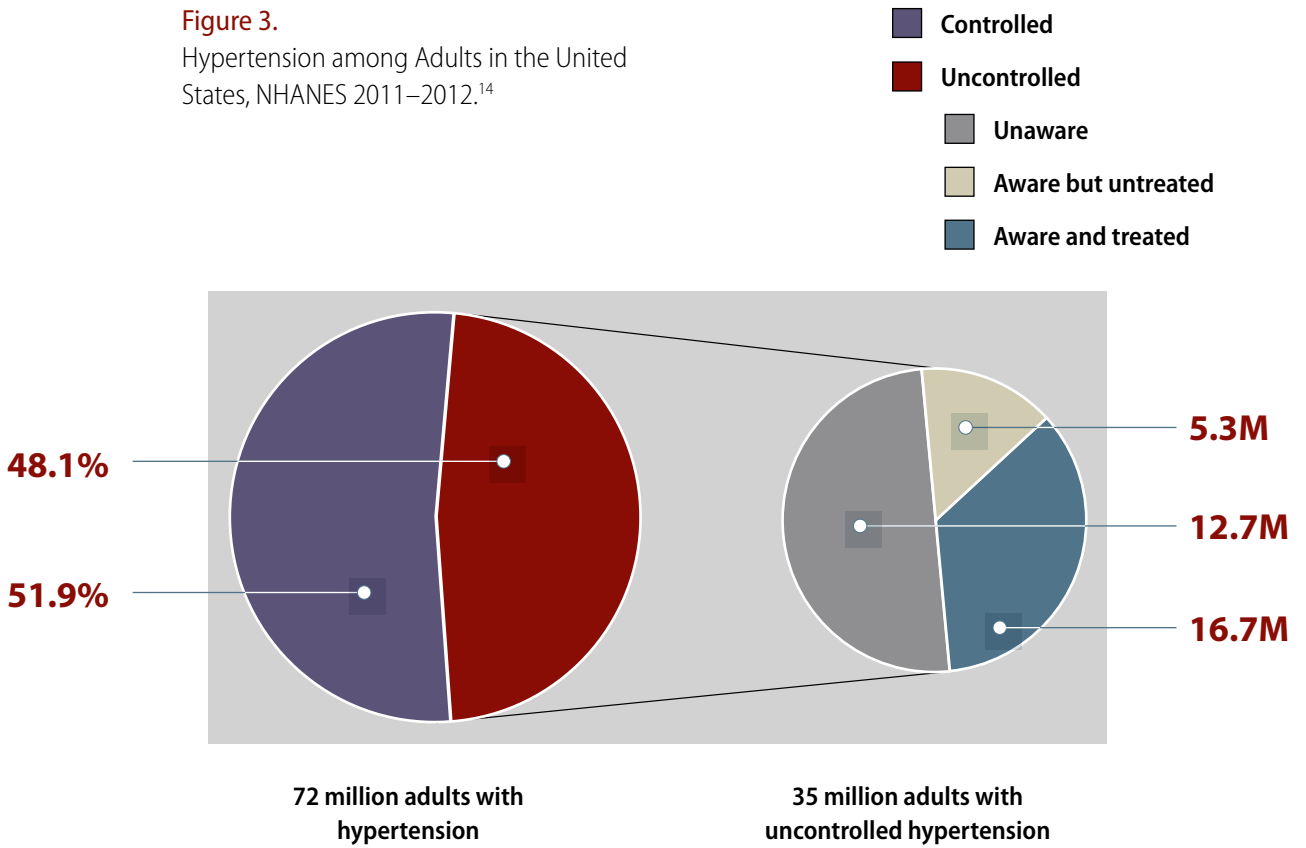


Figure 4.
Distribution of Health Insurance Coverage among Adults (≥18 Years) with Uncontrolled Hypertension, NHANES 2009–2012.¹⁴

Acronyms

ACA	Patient Protection and Affordable Care Act
ACO	Accountable care organization
AHA	American Heart Association
AHRQ	Agency for Healthcare Research and Quality
AMGF	American Medical Group Foundation
ASH	American Society of Hypertension
BP	Blood pressure
CDC	Centers for Disease Control and Prevention
CMS	Centers for Medicare & Medicaid Services
EHR	Electronic health record
FDA	Food and Drug Administration
FSA	Flexible spending account
HCCN	Health Center Controlled Network
HIPAA	Health Insurance Portability and Accountability Act
HRSA	Health Resources and Services Administration
HIT	Health information technology
MUPD	Measure Up/Pressure Down
NHANES	National Health and Nutrition Examination Survey
NP	Nurse practitioner
PA	Physicians assistant
PCMH	Patient-centered medical home
PCP	Primary care physician
PCNA	Preventive Cardiovascular Nurses Association
QIO	Quality improvement organization
REC	Regional extension center
SMBP	Self-measured blood pressure monitoring



Million Hearts® is a U.S. Department of Health and Human Services initiative that is co-led by the Centers for Disease Control and Prevention and the Centers for Medicare & Medicaid Services, with the goal of preventing one million heart attacks and strokes by 2017.