



Hypertension

This care pathway is intended to provide guidance for the evaluation and treatment of Hypertension (HTN) for Penn State Health and affiliated providers. The guidance provided in this document is based on evidence-based standards. This document provides an approach applicable for most patients; however, providers should use clinical judgement and adapt to individual patients and situations.

BACKGROUND

Hypertension is common and is a major risk factor for MI, stroke, chronic kidney disease, heart failure and other conditions. An increased risk of CVD associated with higher SBP and DBP has been reported across a broad age spectrum, from 30 to >80 years of age. The relative risk of incident CVD associated with HTN is smaller at older ages, but the corresponding HTN-related increase in absolute risk is larger in older persons (≥65 years), since the absolute risk of CVD is higher in this age group. Effective blood pressure control reduces this risk significantly.

GOALS

1. Know and implement the accepted method for measuring blood pressure.
2. Use the most clinically appropriate and specific diagnosis codes for hypertension.
3. Understand and implement current diagnostic criteria and BP targets for treatment.
4. Perform appropriate initial evaluation and management (non-pharmacologic and pharmacologic).
5. Give special considerations for sub-populations of patients.

OUTCOMES MEASUREMENT

In order to reach our goals for Hypertension, Penn State Health will measure the most recent office BP readings in people with

- Hypertension
- Atherosclerotic vascular disease
- Diabetes

And in the future, chronic kidney disease and other conditions.

CARE TEAM OPPORTUNITIES

Care Management Opportunities:

- Contact patients with inadequate BP control to provide education and support re: medication adherence and non-pharmacologic interventions, and provide (or arrange for) ongoing health coaching as needed.

Pharmacist Intervention Opportunities:

- Review patient’s medication list to ensure safety and optimum dosing for anti-hypertension agents.
- Provide consultation for education on proper use of medication, simplification of regimen to improve adherence, and potential for lower cost alternatives as appropriate.

(Continued on Page 2)

QUICK REFERENCE

ICD-10 Codes	2
Diagnosis and Initial Evaluation	3
Home BP Machine Procedures	3
White Coat Hypertension	4
Secondary Hypertension	5
Initial Management	6
Nonpharma Interventions	7
Mono vs Combination Therapy	7
Mgmt of Sub-Populations	8



Recommendations to Clinicians and other Care Team members:

The following are based on the goals and measures for this care pathway, as well as general operational practices.

1. Clinicians/care teams review their list of patients with hypertension, ASCVD, and DM whose recent BPs are above target, and evaluate strategies to improve control.
2. Clinicians/Care teams ensure that currently recommended methods of BP measurement are being used at their practice sites.
3. Clinicians/care teams optimize the use of home blood pressure monitoring, to best assess BP diagnosis and control.
4. Clinicians/care teams identify opportunities for Pharmacist and Care Management interventions.

ICD-10 CODES FOR HYPERTENSION

I10 - Essential (primary) hypertension

I11 - Hypertensive heart disease

- I11.0 - Hypertensive heart disease with heart failure
- I11.9 - Hypertensive heart disease without heart failure

I12 - Hypertensive chronic kidney disease

- I12.0 - Hypertensive chronic kidney disease with stage 5 chronic kidney disease or end stage renal disease
- I12.9 - Hypertensive chronic kidney disease with stage 1 through stage 4 chronic kidney disease, or unspecified chronic kidney disease

I13 - Hypertensive heart and chronic kidney disease

- I13.0 - Hypertensive heart and chronic kidney disease with heart failure and stage 1 through stage 4 chronic kidney disease, or unspecified chronic kidney disease
- I13.1 - Hypertensive heart and chronic kidney disease without heart failure
 - I13.10 with stage 1 through stage 4 chronic kidney disease, or unspecified chronic kidney disease
 - I13.11 with stage 5 chronic kidney disease, or end stage renal disease
- I13.2 - Hypertensive heart and chronic kidney disease with heart failure and with stage 5 chronic kidney disease, or end stage renal disease

I15 - Secondary hypertension

- I15.0 - Renovascular hypertension
- I15.1 - Hypertension secondary to other renal disorders
- I15.2 - Hypertension secondary to endocrine disorders
- I15.8 - Other secondary hypertension
- I15.9 - Secondary hypertension, unspecified

I16 - Hypertensive crisis

- I16.0 - Hypertensive urgency
- I16.1 - Hypertensive emergency
- I16.9 - Hypertensive crisis, unspecified



Clinical Pathway: The clinical pathway provided on the following pages was adapted primarily from the [2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults](#). Another important reference:

Pharmacologic Treatment of Hypertension in Adults Aged 60 Years or Older to Higher Versus Lower Blood Pressure Targets: A Clinical Practice Guideline from the American College of Physicians and the American Academy of Family Physicians. *Ann Intern Med.* 2017; 166:430-437; 166:430-437.

Note: The tables and figures in this Care Pathway (below) have been selected from the ACC/AHA Guidelines, and relate to particularly common and practical aspects of daily clinical care for adult patients. They are organized by three topics: I. Diagnosis and Initial Evaluation, II. Initial Management, and III. Management of Selected Sub-populations. (Classes of Recommendations and Levels of Evidence are on page 12.)

I. DIAGNOSIS AND INITIAL EVALUATION

Categories of BP in Adults* (2017 AHA Guideline, Table 6, Pg. 22)

BP Category	SBP		DBP
Normal	< 120 mm Hg	and	< 80 mm Hg
Elevated	120-129 mm Hg	and	< 80 mm Hg
Hypertension			
Stage 1	130-139 mm Hg	or	80-90 mm Hg
Stage 2	≥ 140 mm Hg	or	≥ 90 mm Hg

*Individuals with SBP and DBP in 2 categories should be designated to the higher BP category. BP indicates blood pressure (based on an average of ≥ 2 careful readings obtained on ≥ 2 occasions, as detailed in Section 4); DBP, diastolic blood pressure; and SBP, systolic blood pressure. Measure the BP in both arms at the first office visit.

Procedures for Use of Home Blood Pressure Machine (2017 AHA Guideline, Table 10, Pg. 30)

Patient training should occur under medical supervision, including:

- Information about hypertension
- Selection of equipment
- Acknowledgement that individual BP readings may vary substantially
- Interpretation of results

Devices:

- Verify use of automated validated devices. Use of auscultatory devices (mercury, aneroid, or other) is not generally useful for HBPM because patients rarely master the technique required for measurement of BP with auscultatory devices.
- Monitors with provision for storage of readings in memory are preferred.
- Verify use of appropriate cuff size to fit the arm (Table 9, Pg. 29).
- Make sure the difference in blood pressure between the right and left arm is less than 10 mm.
- If difference is greater than 10mm, instruct patient to measure BPs in the arm with higher readings.

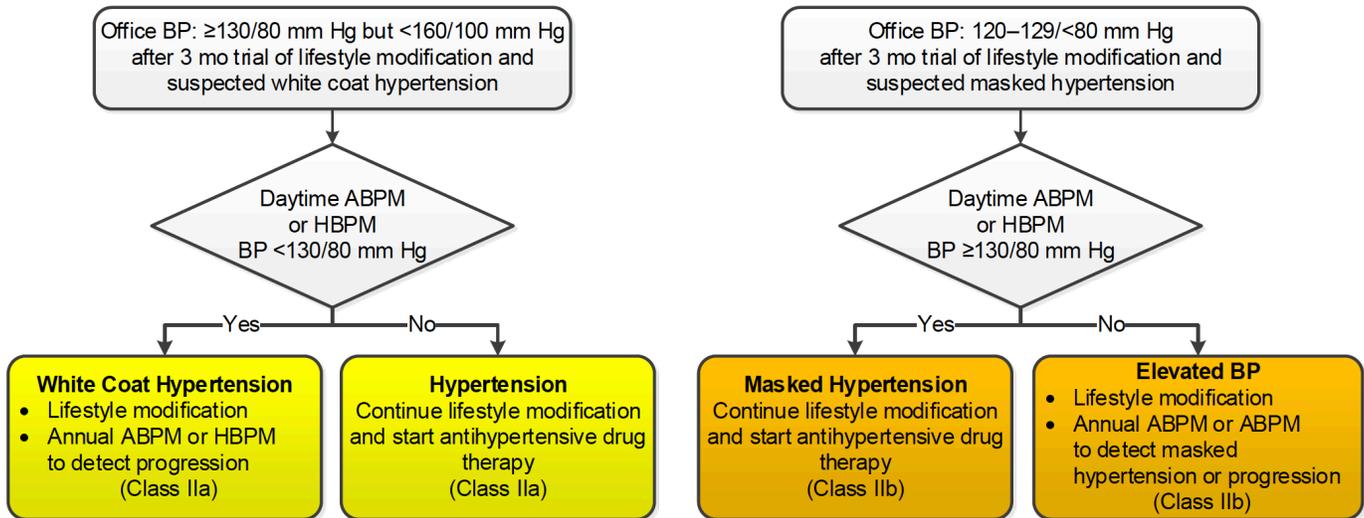
Instructions on HBPM procedures:

- Remain still:
 - Avoid smoking, caffeinated beverages, or exercise within 30 min before BP measurements.
 - Ensure ≥ 5 min of quiet rest before BP measurements.



- Measure your blood pressure when you are not talking or listening to someone else.
- Sit Correctly:
 - Sit with back straight and supported (on a straight-backed dining chair, for example, rather than a sofa).
 - Sit with feet flat on the floor and legs uncrossed
 - Keep arm supported on a flat surface (such as a table), with the upper arm at heart level.
 - Bottom of the cuff should be placed directly above the antecubital fossa (bend of the elbow)
- Taking multiple readings:
 - Take at least 2 readings 1 min apart in the morning before taking medications and in evening before supper. Optimally, measure and record BP daily. Ideally, obtain weekly BP readings beginning 2 weeks after a change in the treatment regimen and during the week before a clinic visit.
- Record all readings accurately:
 - Monitors with built-in memory should be brought to all clinic appointments.
 - BP should be based on an average of readings on ≥ 2 occasions for clinical decision making.

Detection of White Coat Hypertension or Masked Hypertension in Patients Not on Drug Therapy (2017 AHA Guideline, Figure 1, Pg. 36)



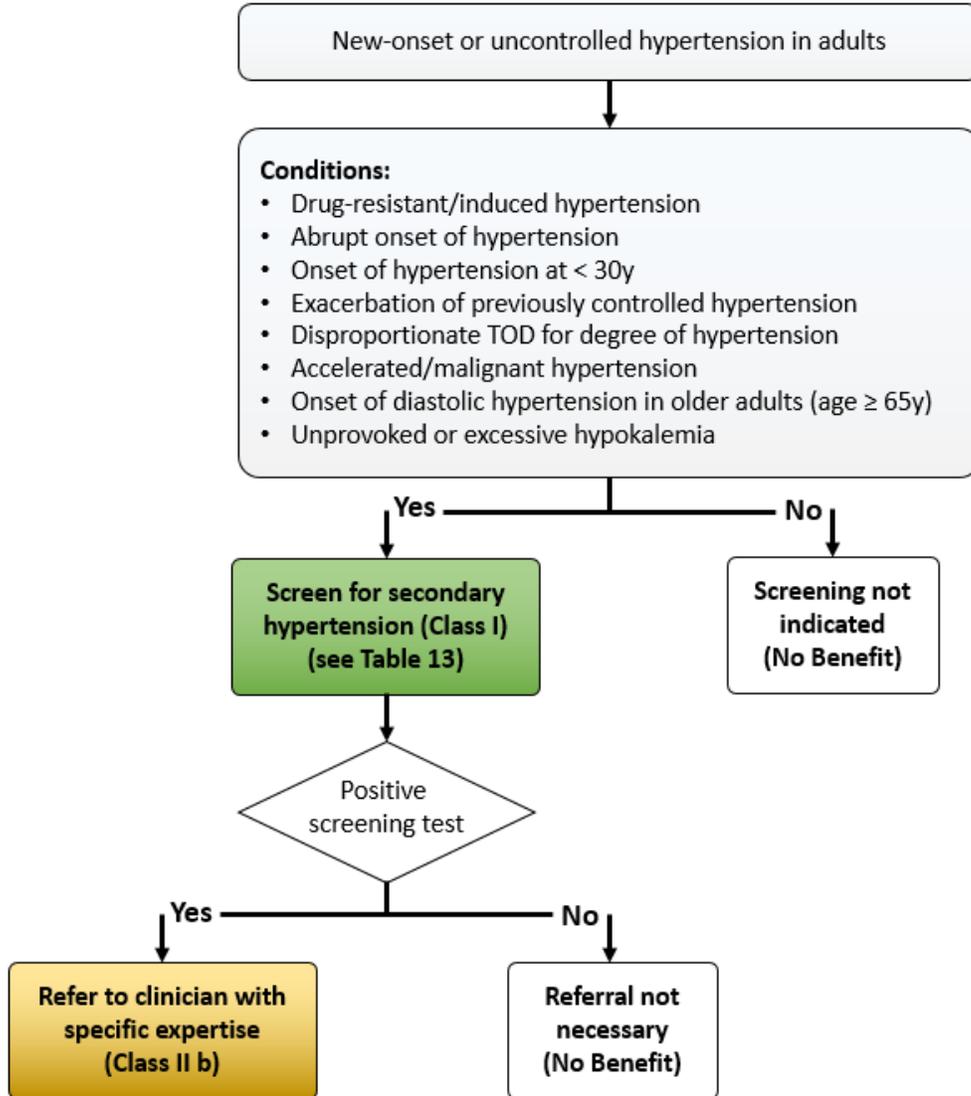
Colors correspond to Class of Recommendation in Table 1.

ABPM indicates ambulatory blood pressure monitoring; BP, blood pressure; and HBPM, home blood pressure monitoring.



Screening for Secondary Hypertension (Whelton PK, et al.)

(2017 AHA Guideline, Figure 3, for more detailed recommendations on screening, see Table 13, Pg. 45-48)

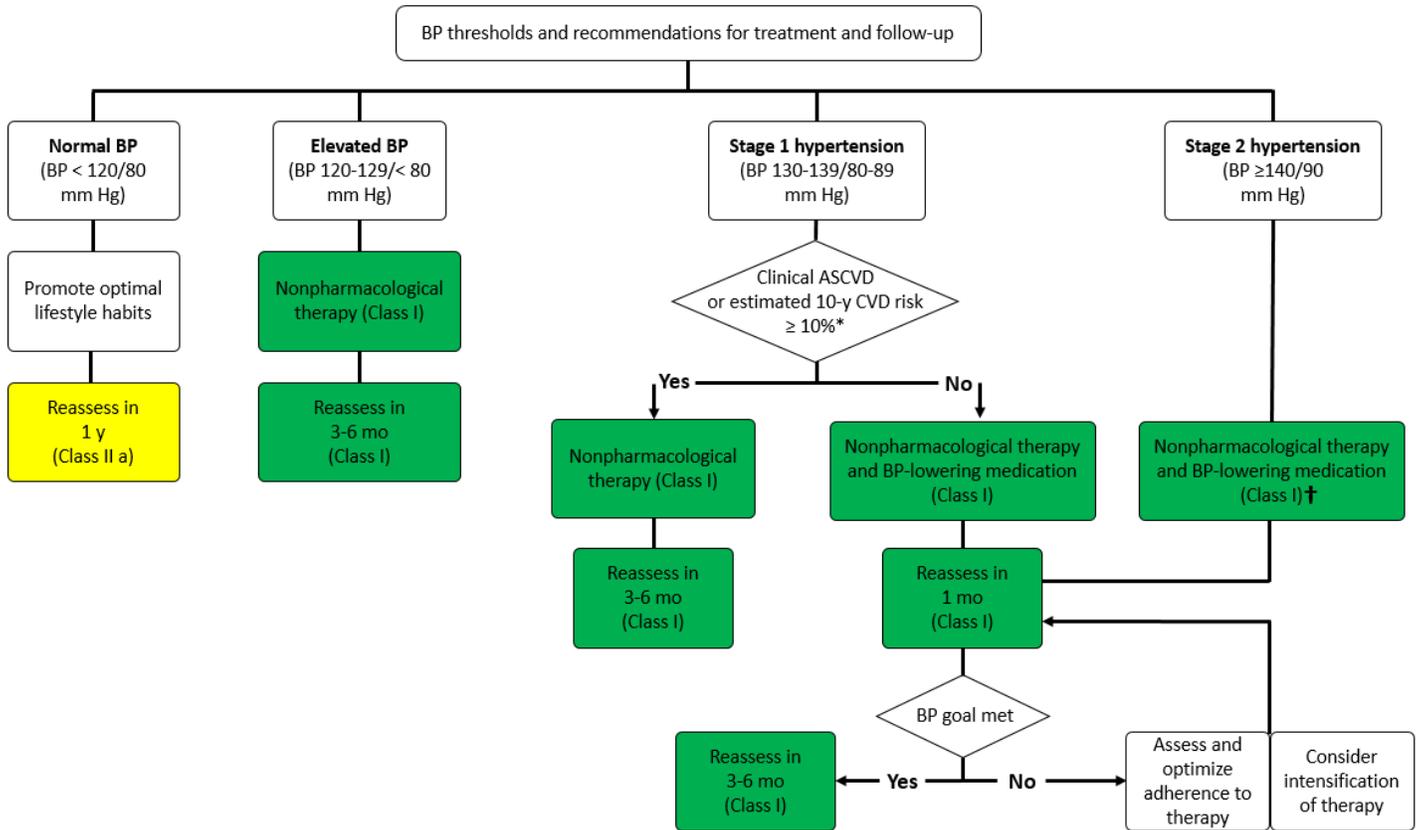




I. INITIAL MANAGEMENT

Blood Pressure Thresholds and Recommendations for Initial Treatment and Follow-up

(2017 AHA Guideline, Figure 4, Pg. 73)



*Using the ACC/AHA Pooled Cohort Equations (57). Note that patients with DM or CKD are automatically placed in the high-risk category. For initiation of RAS inhibitor or diuretic therapy, assess blood tests for electrolytes and renal function 2 to 4 weeks after initiating therapy.

† Consider initiation of pharmacological therapy for stage 2 hypertension with 2 antihypertensive agents of different classes. Patients with stage 2 hypertension and BP ≥160/100 mm Hg should be promptly treated, carefully monitored, and subject to upward medication dose adjustment as necessary to control BP. Reassessment includes BP measurement, detection of orthostatic hypotension in selected patients (e.g., older or with postural symptoms), identification of white coat hypertension or a white coat effect, documentation of adherence, monitoring of the response to therapy, reinforcement of the importance of adherence, reinforcement of the importance of treatment, and assistance with treatment to achieve BP target.



Nonpharmacological Interventions (2017 AHA Guideline, Section 6.2, Pg. 56)

Recommendations for Nonpharmacological Interventions		
References that support recommendations are summarized in Online Data Supplements 9-21.		
COR	LOE	Recommendations
I	A	1. Weight loss is recommended to reduce BP in adults with elevated BP or hypertension who are overweight or obese (1-4).
I	A	2. A heart-healthy diet, such as the DASH (Dietary Approaches to Stop Hypertension) diet, that facilitates achieving a desirable weight is recommended for adults with elevated BP or hypertension (5-7).
I	A	3. Sodium reduction is recommended for adults with elevated BP or hypertension (8-12).
I	A	4. Potassium supplementation, preferably in dietary modification, is recommended for adults with elevated BP or hypertension, unless contraindicated by the presence of CKD or use of drugs that reduce potassium excretion (13-17).
I	A	5. Increased physical activity with a structure exercise program is recommended for adults with elevated BP or hypertension (3, 4, 12, 18-22).
I	A	6. Adult men and women with elevated BP or hypertension who currently consume alcohol should be advised to drink no more than 2 and 1 standard drinks* per day, respectively (23-28).

*In the United States, 1 “standard” drink contains roughly 14 g of pure alcohol, which is typically found in 12 oz of regular beer (usually about 5% alcohol), 5 oz of wine (usually about 12% alcohol), and 1.5 oz of distilled spirits (usually about 40% alcohol) (29).

Choice of Initial Monotherapy Versus Initial Combination Drug Therapy

(2017 AHA Guideline, Section 8.1.6.1, Pg. 87)

Recommendations for Choice of Initial Monotherapy Versus Initial Combination Drug Therapy*		
COR	LOE	Recommendation
I	C-EO	1. Initiation of antihypertensive drug therapy with 2 first-line agents of different classes, either as separate agents or in a fixed-dose combination, is recommended in adults with stage 2 hypertension and an average BP more than 20/10 mm Hg above their BP target.
II a	C-EO	2. Initiation of antihypertensive drug therapy with a single antihypertensive drug is reasonable in adults with stage 1 hypertension and BP goal < 130/80 mm Hg with dosage titration and sequential addition of other agents to achieve the BP target.

*Fixed-dose combination antihypertensive medication are listed in Online Data Supplement D.



II. MANAGEMENT OF SELECTED SUB-POPULATIONS

Older Persons (2017 AHA Guideline, Section 10.3.1, Pg. 130)

Recommendations for Treatment of Hypertension in Older Persons		
References that support recommendations are summarized in Online Data Supplements 54.		
COR	LOE	Recommendations
I	A	1. Treatment of hypertension with a SBP treatment goal of less than 130 mm Hg is recommended for noninstitutionalized ambulatory community dwelling adults (≥ 65 years of age) with an average SBP of 130 mm Hg or higher (1).
II a	C-EO	2. For older adults (≥ 65 years of age) with hypertension and a high burden of comorbidity and a limited life expectancy, clinical judgement, patient preference, and a team-based approach to assess risk/benefit is reasonable for decisions regarding intensity of BP lowering and choice of antihypertensive drugs.

Note: BP thresholds and targets for treatment of hypertension in independent-living older adults without a high-burden of co-morbidities remain somewhat controversial. For example the ACP/AAFP guidelines recommend that:

- “clinicians initiate treatment in adults aged 60 years or older with systolic blood pressure persistently at or above 150 mm Hg to achieve a target systolic blood pressure of less than 150 mm Hg...”
- “consider initiating or intensifying pharmacologic treatment in adults aged 60 years or older with a history of stroke or transient ischemic attack to achieve a target systolic blood pressure of less than 140 mm Hg to reduce the risk for recurrent stroke”
- “consider initiating or intensifying pharmacologic treatment in some adults aged 60 years or older at high cardiovascular risk, based on individualized assessment, to achieve a target systolic blood pressure of less than 140 mm Hg.”
- The latter two recommendations are considered “weak.”

Despite these differences, it is clear that pharmacologic treatment significantly reduces the risk of major clinical outcomes. Thus, reluctance to treat simply based on age can be a missed opportunity to preserve the quality of life in older adults.

Heart Failure with Reduced/Preserved Ejection Fraction (HFrEF/HFpEF)

(2017 AHA Guideline, Sections 9.2.1 and 9.2.2, Pg. 96, 97)

Recommendations for Treatment of Hypertension in Patients With HFrEF		
COR	LOE	Recommendations
I	C-EO	1. Adults with HFrEF and hypertension should be prescribed Goal-Directed Medical Therapy GDMT (2) titrated to attain a BP of less than 130/80 mm Hg.
III: No Benefit	B-R	2. Nondihydropyridine CCBs are not recommended in the treatment of hypertension in adults with HFrEF (1).
Recommendations for Treatment of Hypertension in Patients With HFpEF		
I	C-EO	1. In adults with HFpEF who present with symptoms of volume overload, diuretics should be prescribed to control hypertension.
I	C-LD	2. Adults with HFpEF and persistent hypertension after management of volume overload should be prescribed ACE-inhibitors or ARBs and beta blockers titrated to attain SBP of less than 130mmHg (1-6).



Stable Ischemic Heart Disease (SIHD) (2017 AHA Guideline, Section 9.1, Pg. 91)

Recommendations for Treatment of Hypertension in Patients with Stable Ischemic Heart Disease		
References that support recommendations are summarized in Online Data Supplements 30-32.		
COR	LOE	Recommendations
I	SBP: B-R	1. In adults with SIHD and hypertension, a BP target of less than 130/80 mm Hg is recommended (1-5).
	DBP: C-EO	
I	SBP: B-R	2. Adults with SIHD and hypertension (BP ≥ 130/80 mm Hg) should be treated with medications (e.g., GDMT (6) beta blockers, ACE inhibitors, or ARBs) for compelling indications (e.g., previous MI, stable angina) as first-line therapy, with the addition of other drugs (e.g., dihydropyridine CCBs, thiazide, diuretics, and/or mineralocorticoid receptor antagonists) as needed to further control hypertension (7-10).
	DBP: C-EO	
I	B-NR	3. In adults with SIHD with angina and persistent uncontrolled hypertension, the addition of dihydropyridine CCBs to GDMT (6) beta blockers is recommended (8, 11, 12).
II a	B-NR	4. In adults who have had a MI or acute coronary syndrome, it is reasonable to continue GDMT (6) beta blockers beyond 3 years as long-term therapy for hypertension (13, 14).
II b	C-EO	5. Beta blockers and/or CCBs might be considered to control hypertension in patients with CAD (without HFrEF) who had an MI more than 3 years ago and have angina.

Chronic Kidney Disease (2017 AHA Guideline, Section 9.3, Pg. 100)

Recommendations for Treatment of Hypertension in Patients With CKD		
References that support recommendations are summarized in Online Data Supplements 37 and 38 and Systematic Review Report.		
COR	LOE	Recommendations
I	SBP: B-R ^{SR}	1. Adults with hypertension and CKD should be treated to a BP goal of less than 130/80 mm Hg (1-6).
	DBP: C-EO	
II a	B-R	2. In adults with hypertension and CKD (stage 3 or higher or stage 1 or 2 with albuminuria [≥ 300 mg/d, or ≥ 300 mg/g albumin-to-creatinine ratio or the equivalent in the first morning void]), treatment with an ACE inhibitor is reasonable to slow kidney disease progression (3, 7-12).
II b	C-EO	3. In adults with hypertension and CKD (stage 3 or higher or stage 1 or 2 with albuminuria [≥ 300 mg/d, or ≥ 300 mg/g albumin-to-creatinine ratio in the first morning void]), treatment with an ARB may be reasonable if an ACE inhibitor is not tolerated.

SR - indicates systematic review



Diabetes Mellitus (2017 AHA Guideline, Section 9.6, Pg. 116)

Recommendations for Treatment of Hypertension in Patients With DM		
References that support recommendations are summarized in Online Data Supplements 46 and 47 and Systematic Review Report.		
COR	LOE	Recommendations
I	SBP: B-R^{SR}	1. Adults with DM and hypertension, antihypertensive drug treatment should be initiated at a BP of 130/80 mm Hg or higher with a treatment goal of less than 130/80 mm Hg (1-8).
	DBP: C-EO	
I	A^{SR}	2. In adults with DM and hypertension, all first-line classes of antihypertensive agents (i.e., diuretics, ACE inhibitors, ARBs, and CCBs) are useful and effective (1, 9, 10).
II b	B-NR	3. In adults with DM and hypertension, ACE inhibitors or ARBs may be considered in the presence of albuminuria (11, 12).

SR - indicates systematic review

Racial and Ethnic Differences in Treatment (2017 AHA Guideline, Section 10.1.1, Pg. 125)

Recommendations for Race and Ethnicity		
References that support recommendations are summarized in Online Data Supplement 51.		
COR	LOE	Recommendations
I	B-R	1. In black adults with hypertension but without HF or CKD, including those with DM, initial antihypertensive treatment should include a thiazide-type diuretic or CCB (1-4).
I	C-LD	2. Two or more antihypertensive medication are recommended to achieve a BP target of less than 130/80 mm Hg in most adults with hypertension, especially in black adults with hypertension (5-7).



Table 1. Applying Class of Recommendation and Level of Evidence to Clinical Strategies, Interventions, Treatments, or Diagnostic Testing in Patient Care* (Updated August 2015)

CLASS (STRENGTH) OF RECOMMENDATION		LEVEL (QUALITY) OF EVIDENCE‡	
CLASS I (STRONG) Benefit >>> Risk		LEVEL A	
Suggested phrases for writing recommendations: <ul style="list-style-type: none"> Is recommended Is indicated/useful/effective/beneficial Should be performed/administered/other Comparative-Effectiveness Phrases†: <ul style="list-style-type: none"> Treatment/strategy A is recommended/indicated in preference to treatment B Treatment A should be chosen over treatment B 		<ul style="list-style-type: none"> High-quality evidence‡ from more than 1 RCT Meta-analyses of high-quality RCTs One or more RCTs corroborated by high-quality registry studies 	
CLASS IIa (MODERATE) Benefit >> Risk		LEVEL B-R (Randomized)	
Suggested phrases for writing recommendations: <ul style="list-style-type: none"> Is reasonable Can be useful/effective/beneficial Comparative-Effectiveness Phrases†: <ul style="list-style-type: none"> Treatment/strategy A is probably recommended/indicated in preference to treatment B It is reasonable to choose treatment A over treatment B 		<ul style="list-style-type: none"> Moderate-quality evidence‡ from 1 or more RCTs Meta-analyses of moderate-quality RCTs 	
CLASS IIb (WEAK) Benefit ≥ Risk		LEVEL B-NR (Nonrandomized)	
Suggested phrases for writing recommendations: <ul style="list-style-type: none"> May/might be reasonable May/might be considered Usefulness/effectiveness is unknown/unclear/uncertain or not well established 		<ul style="list-style-type: none"> Moderate-quality evidence‡ from 1 or more well-designed, well-executed nonrandomized studies, observational studies, or registry studies Meta-analyses of such studies 	
CLASS III: No Benefit (MODERATE) Benefit = Risk <i>(Generally, LOE A or B use only)</i>		LEVEL C-LD (Limited Data)	
Suggested phrases for writing recommendations: <ul style="list-style-type: none"> Is not recommended Is not indicated/useful/effective/beneficial Should not be performed/administered/other 		<ul style="list-style-type: none"> Randomized or nonrandomized observational or registry studies with limitations of design or execution Meta-analyses of such studies Physiological or mechanistic studies in human subjects 	
CLASS III: Harm (STRONG) Risk > Benefit		LEVEL C-EO (Expert Opinion)	
Suggested phrases for writing recommendations: <ul style="list-style-type: none"> Potentially harmful Causes harm Associated with excess morbidity/mortality Should not be performed/administered/other 		Consensus of expert opinion based on clinical experience	

COR and LOE are determined independently (any COR may be paired with any LOE).

A recommendation with LOE C does not imply that the recommendation is weak. Many important clinical questions addressed in guidelines do not lend themselves to clinical trials. Although RCTs are unavailable, there may be a very clear clinical consensus that a particular test or therapy is useful or effective.

* The outcome or result of the intervention should be specified (an improved clinical outcome or increased diagnostic accuracy or incremental prognostic information).

† For comparative-effectiveness recommendations (COR I and IIa; LOE A and B only), studies that support the use of comparator verbs should involve direct comparisons of the treatments or strategies being evaluated.

‡ The method of assessing quality is evolving, including the application of standardized, widely used, and preferably validated evidence grading tools; and for systematic reviews, the incorporation of an Evidence Review Committee.

COR indicates Class of Recommendation; EO, expert opinion; LD, limited data; LOE, Level of Evidence; NR, nonrandomized; R, randomized; and RCT, randomized controlled trial.