

IN DEPTH

# Harmonization of the American College of Cardiology/American Heart Association and European Society of Cardiology/European Society of Hypertension Blood Pressure/Hypertension Guidelines

## Comparisons, Reflections, and Recommendations

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**ABSTRACT:** The 2017 American College of Cardiology/American Heart Association and 2018 European Society of Cardiology/European Society of Hypertension clinical practice guidelines for management of high blood pressure/hypertension are influential documents. Both guidelines are comprehensive, were developed using rigorous processes, and underwent extensive peer review. The most notable difference between the 2 guidelines is the blood pressure cut points recommended for the diagnosis of hypertension. There are also differences in the timing and intensity of treatment, with the American College of Cardiology/American Heart Association guideline recommending a somewhat more intensive approach. Overall, there is substantial concordance in the recommendations provided by the 2 guideline-writing committees, with greater congruity between them than their predecessors. Additional harmonization of future guidelines would help to underscore the commonality of their core recommendations and could serve to catalyze changes in practice that would lead to improved prevention, awareness, treatment, and control of hypertension, worldwide.

**Key Words:** antihypertensive agents ■ blood pressure ■ cardiovascular diseases ■ hypertension ■ life style ■ practice guideline ■ public health

Few areas are of greater importance for the health of the public and provide better opportunity for decisions based on sound scientific principles than the prevention and management of high blood pressure (BP)/hypertension. In partnership with 9 other professional societies, the American College of Cardiology (ACC) and American Heart Association (AHA) published 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<sup>1</sup> and 1 year later the European Society

of Cardiology (ESC) and European Society of Hypertension (ESH) published the 2018 ESC/ESH Guidelines for the Management of Arterial Hypertension.<sup>2</sup> The 2017 ACC/AHA and 2018 ESC/ESH guidelines are among the most influential and highly cited BP/hypertension clinical practice guidelines (CPGs) worldwide.

These 2 comprehensive guidelines have areas of difference but more often provide similar advice.<sup>3</sup> In this review, we provide a comparison of these 2 CPGs by contrasting the processes used to formulate the guidelines and by reviewing the recommendations provided

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## Nonstandard Abbreviations and Acronyms

|              |  |
|--------------|--|
| <b>ACC</b>   | American College of Cardiology         |
| <b>ACE</b>   | angiotensin-converting enzyme          |
| <b>AHA</b>   | American Heart Association             |
| <b>ARB</b>   | angiotensin receptor blocker           |
| <b>ASCVD</b> | atherosclerotic cardiovascular disease |
| <b>BP</b>    | blood pressure                         |
| <b>CCB</b>   | calcium channel blocker                |
| <b>CKD</b>   | chronic kidney disease                 |
| <b>CPG</b>   | clinical practice guideline            |
| <b>CVD</b>   | cardiovascular disease                 |
| <b>DBP</b>   | diastolic blood pressure               |
| <b>DM</b>    | diabetes mellitus                      |
| <b>ESC</b>   | European Society of Cardiology         |
| <b>ESH</b>   | European Society of Hypertension       |
| <b>HMOD</b>  | hypertension-mediated organ damage     |
| <b>SBP</b>   | systolic blood pressure                |
| <b>SCORE</b> | Systematic Coronary Risk Evaluation    |

for BP measurement and classification, patient evaluation, estimation of cardiovascular disease (CVD) risk, BP threshold for initiating antihypertensive drug therapy, BP goals of therapy, and the use of lifestyle modification and pharmacological therapy. We also provide reflections and recommendations to future guideline committees on ways to harmonize recommendations in US and European BP guidelines.

## PROCESS AND REPORT FORMAT

Both guidelines were based on a rigorous approach to the generation of recommendations, with some differences in the specifics of the process (Table 1 in the Data Supplement). The ACC/AHA guideline was developed by a 21-member writing committee composed of primary and specialty care physicians, epidemiologists, a nurse, a physician assistant, a pharmacist, and 2 lay/patient members. Members were chosen for their expertise and for their capacity to represent the 2 principal sponsors (ACC and AHA) and the 9 collaborating professional societies. The ESC/ESH report was developed by a 28-member committee of physician and nurse members, half selected by the ESC and half selected by the ESH, from 14 European countries, who had special expertise in the prevention and treatment of hypertension or the generation of CPGs. A requirement for participation in the ACC/AHA writing committee was absence of a relationship with BP-related commercial entities. The ESC/ESH writing committee required disclosure of any such relationships. Both guidelines followed a formal process for the development of their recommendations that was stipulated by their sponsor-

ing professional societies. Both writing committees conducted extensive reviews of the existing literature. The ACC/AHA process specified conduct of systematic reviews and meta-analyses by an independent Evidence Review Committee. The ESC/ESH guideline committee had the option to commission additional evidence reviews but concluded that published peer-reviewed systematic reviews and meta-analyses already provided sufficient evidence for decision-making. The ACC/AHA process also stipulated the generation of detailed evidence tables as a supplement to the guideline recommendations; a total of 448 such tables were published. Both guidelines underwent extensive peer review and required final approval by the governing boards of their sponsoring professional organizations.

The ACC/AHA guideline provides 106 formal recommendations and the ESC/ESH provides 122. In both guidelines, each recommendation is characterized by a class of recommendation that specifies the strength or importance of the recommendation and by a level-of-evidence designation. Both the ESC/ESH and ACC/AHA guideline committees voted on the wording and grading of each recommendation. Both guidelines provide comprehensive advice for prevention, diagnosis, evaluation, and management of high BP/hypertension. As a result, the 2 full reports are relatively long (103 pages for the ACC/AHA and 84 pages for the ESC/ESH). For ease of reading, however, the documents are divided into sections and subsections that use a similar presentation format. In addition, a variety of shorter executive summaries and brief synopses have been published. Guideline authors have published articles that expand on individual guideline topics, provide perspective for the evidence underpinning selected recommendations, and furnish quantitative estimates of potential impact based on universal application of guideline recommendations in their target populations. Last, both guidelines are complemented by publicly available slide sets, CVD risk estimation calculators, and other educational tools.

## BP MEASUREMENT AND CORRESPONDENCE OF OFFICE AND OUT-OF-OFFICE READINGS

Errors in BP measurement are a major source of BP misclassification. Both guidelines place strong emphasis on accurate measurement of BP by using validated devices and multiple readings for diagnosis and management of hypertension (Tables 1–3). The ACC/AHA recommends averaging office BP readings, using the same advice for  $\geq 2$  readings on  $\geq 2$  occasions provided in previous Joint National Committee reports, and recommends confirmation of office hypertension by means of out-of-office measurements. The ESC/ESH

**Table 1. BP Measurement**

| American College of Cardiology/American Heart Association                                     | European Society of Cardiology/ European Society of Hypertension  |
|---|---|
| Strong emphasis on measurement accuracy.  | Strong emphasis on measurement accuracy.  |
| Use of repeated office readings (≥2 readings on ≥2 occasions).                                | Use of repeated readings (3 readings, with additional readings when first 2 differ by ≥10 mmHg or BP unstable because of an arrhythmia). BP is recorded as the average of the last 2 BP readings. |
| Confirmation of office hypertension by means of out-of-office (HBPM or ABPM) BP measurements. | Confirmation of hypertension by means of repeated office, or out-of-office (ABPM or HBPM) BP measurements.  |
| Out-of-office measurements to recognize masked and white coat hypertension.                   | Out-of-office BP measurements to recognize masked and white coat hypertension.  |
|   | Heart rate should be also recorded during BP measurements.  |

ABPM indicates ambulatory blood pressure monitoring; BP, blood pressure; and HBPM, home blood pressure monitoring. Adapted from Whelton et al<sup>1</sup> with permission. Copyright © 2018, Elsevier; and Williams et al<sup>2</sup> with permission. Copyright © 2018, Oxford University Press.

recommends 3 readings for office BP measurement, with additional readings when the first 2 differ by >10 mmHg or BP is unstable because of an arrhythmia, and advises confirmation of office hypertension by means of either repeated office readings at several visits or by out-of-office BP measurements. Both guidelines recommend out-of-office BP measurements to recognize masked and white coat hypertension. They provide only slightly different treatment guidance for white coat and masked hypertension, while mentioning the uncertainty of such recommendations. The ACC/AHA CPG provides corresponding values for office and out-of-office measurements (home blood pressure monitoring, ambulatory blood pressure monitoring) in the range of 120/80 mmHg to 160/100 mmHg for office BP measurements, whereas the ESC/ESH provides only the corresponding cutoff values for the diagnosis of hypertension for home blood pressure monitoring and ambulatory blood pressure monitoring measurements. The latter are, however, concordant with the corresponding values in the ACC/AHA guideline (Tables 1–3).

**Table 2. American College of Cardiology/American Heart Association Table of Blood Pressure Equivalence for Clinic and Out-of-Office Readings**

| Clinic  | Home   | Ambulatory blood pressure monitoring |           |          |
|---------|--------|--------------------------------------|-----------|----------|
|         |        | Daytime                              | Nighttime | 24 hours |
| 120/80  | 120/80 | 120/80                               | 100/65    | 115/75   |
| 130/80  | 130/80 | 130/80                               | 110/65    | 125/75   |
| 140/90  | 135/85 | 135/85                               | 120/70    | 130/80   |
| 160/100 | 145/90 | 145/90                               | 140/85    | 145/90   |

All measurements are mmHg. Table adapted from Whelton et al<sup>1</sup> with permission. Copyright © 2018, Elsevier.

**Table 3. European Society of Cardiology/European Society of Hypertension Table of Out-of-Office Equivalence for an Office Systolic Blood Pressure/Diastolic Blood Pressure of 140/90 mmHg**

| Office | Home   | Ambulatory blood pressure monitoring |           |          |
|--------|--------|--------------------------------------|-----------|----------|
|        |        | Daytime                              | Nighttime | 24 hours |
| 140/90 | 135/85 | 135/85                               | 120/70    | 130/80   |

All measurements are mmHg. Table modified from Williams et al<sup>2</sup> with permission. Copyright © 2018, Oxford University Press to facilitate comparison.

## BP CLASSIFICATION

The most obvious difference between the 2 guidelines is their approach to BP classification and the BP cut points recommended for the identification of hypertension (Table 4). The ACC/AHA proposes categories for normal BP, elevated BP, and 2 stages of hypertension, with a cut point of systolic blood pressure (SBP) ≥130 mmHg and/or diastolic blood pressure (DBP) ≥80 mmHg for identification of hypertension. This is a change from the preceding 2003 Joint National Committee 7 CPG, which recommended use of an SBP and/or DBP cut point of 140 and/or 90 mmHg, except in adults with diabetes mellitus (DM) or chronic kidney disease (CKD), where an SBP and/or DBP cut point of 130 and/or 80 mmHg was recommended. The ESC/ESH classifies BP into optimal BP, normal BP, high normal BP, 3 grades of systolic/diastolic hypertension, and isolated systolic hypertension. It retains the same SBP ≥140 mmHg and/or DBP ≥90 mmHg cut points for diagnosis of hypertension recommended in the preceding 2013 ESH/ESC hypertension CPG.

The potential US population impact of the ACC/AHA guideline was estimated by an analysis of the 2011 to 2014 National Health and Nutrition Examination Survey. In this analysis, 24.1% of US adults ≥20 years of age reported that they were taking antihypertensive medication and were therefore considered to have hypertension. Of those not taking antihypertensive medication, 7.7% had an SBP ≥140 mmHg or DBP ≥90 mmHg, and 13.7% had an SBP 130 to 139 mmHg or DBP 80 to 89 mmHg, yielding a 46% prevalence of hypertension for adults using the SBP ≥130 mmHg and/or DBP ≥80 mmHg cut points, or taking antihypertensive medication definition of hypertension compared with a prevalence of 32% using the SBP ≥140 mmHg and/or DBP ≥90 mmHg, or taking antihypertensive medication definition.<sup>4</sup> Prevalence estimates using the 2 definitions of hypertension were more discrepant at younger age than at older age, and in men compared with women. Taken altogether, the ACC/AHA reclassification of BP resulted in an estimated population increase in hypertension prevalence of ≈14%. The National Health and Nutrition Examination Survey analyses, however, are likely to overestimate hypertension prevalence because participant BP was only measured on a single occasion and presumed hypertension was not confirmed by out-of-office BP readings.

**Table 4. Blood Pressure Classification**

| Categories  | Systolic blood pressure, mm Hg | And/or | Diastolic blood pressure, mm Hg |
|---|--------------------------------|--------|---------------------------------|
| American College of Cardiology/American Heart Association       |                                |        |                                 |
| Normal  | <120                           | and    | <80                             |
| Elevated  | 120–129                        | and    | <80                             |
| Hypertension, stage 1   | 130–139                        | or     | 80–89                           |
| Hypertension, stage 2   | ≥140                           | or     | ≥90                             |
| European Society of Cardiology/European Society of Hypertension |                                |        |                                 |
| Optimal   | <120                           | and    | <80                             |
| Normal  | 120–129                        | and/or | 80–84                           |
| High normal   | 130–139                        | and/or | 85–89                           |
| Hypertension, grade 1   | 140–159                        | and/or | 90–99                           |
| Hypertension, grade 2   | 160–179                        | and/or | 100–109                         |
| Hypertension, grade 3   | ≥180                           | and/or | ≥110                            |
| Isolated systolic hypertension                                  | ≥140                           | and    | <90                             |

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Overall, the ACC/AHA categorization is simpler and captures more of the BP-related risk for CVD. However, it results in a larger challenge for health care professionals compared with the ESC/ESH or preceding Joint National Committee 7 Report because (1) it designates hypertension in a higher percentage of adults and (2) there is need to assess underlying atherosclerotic CVD (ASCVD) risk for treatment decisions, especially in adults with ACC/AHA stage 1 hypertension (outlined in the CVD risk assessment section). The ESC/ESH classification system has more BP categories but provides a simpler approach to decisions for the administration of antihypertensive drug therapy, unchanged from the previous European guideline recommendations.

## PATIENT EVALUATION

Both guidelines recommend obtaining a personal and family history, performing a physical examination that includes measurement of BP, and obtaining basic laboratory testing (Table II in the Data Supplement). Although the specifics of the latter overlap in requiring a fasting blood glucose, blood/serum sodium and potassium, lipid profile, serum creatinine/estimated glomerular filtration rate, urinalysis, and ECG, there are discrepancies with the ACC/AHA (only) recommending a complete blood count, serum calcium, and thyroid stimulating hormone, and the ESC/ESH (only) recommending a hemoglobin/hematocrit, blood uric acid, glycosylated hemoglobin A1c, liver function tests, urine protein test or, ideally, urinary albumin-to-creatinine ratio. An echocardiogram, uric acid, and urinary albumin-to-creatinine ratio are optional tests in the ACC/AHA guideline. In the ESC/ESH, echocar-

diography, carotid ultrasound, pulse wave velocity, ankle-brachial index, cognitive function testing, and brain imaging are additional tests that can be used for recognition of hypertension-mediated organ damage (HMOD). Thus, the assessment of HMOD and its implementation in risk stratification was an important consideration for CVD risk prediction in the ESC/ESH CPG.

## CVD RISK ASSESSMENT

CVD risk assessment identifies individuals at increased risk for the major complications of hypertension, including target organ damage and death. Both guidelines recommend CVD risk assessment as a complement to the level of BP for antihypertensive treatment decisions, with the ESC/ESH guideline also emphasizing the importance of CVD risk prediction for consideration of concomitant interventions such as statin and antiplatelet therapies. The 2 guidelines differ in their methods for estimation of risk, and as outlined later, their use of the risk information in decision-making for antihypertensive drug treatment. The ACC/AHA prescribes a relatively simple approach in which the presence of CVD automatically indicates high risk (Table 5). In the absence of CVD, ASCVD risk in adults 40 to 79 years of age is estimated using the ACC/AHA Pooled Cohort Equations<sup>6</sup>, which have been validated in White and Black US adults. The ACC/AHA ASCVD Risk Estimator Plus<sup>7</sup> is based on age; levels of SBP, DBP; total, high-density, and low-density cholesterol; history of DM; current smoking; and treatment with antihypertensive drug therapy, statins, or aspirin. The ACC/AHA Guideline Writing Committee estimated a 10-year ASCVD risk of ≈10% in the landmark event-based antihypertensive drug treatment trials, leading to the choice of a higher and lower 10-year ASCVD risk of ≥10% and <10%, respectively. Hypertension in adults with DM, CKD, or age of ≥65 years is accepted as a surrogate disease marker for higher ASCVD risk. For adults <40 years of age, the ACC/AHA recommends estimation of lifetime CVD risk. The ESC/ESH uses 4 categories of CVD risk (Figure 1). Adults with existing CVD, including asymptomatic atheromatous disease on imaging, type 1 or 2 DM, very high levels of individual CVD risk factors, or CKD are considered to be at high or very high risk (10-year CVD mortality of 5%–10% and ≥10%, respectively). For all others, 10-year CVD mortality risk should be estimated using the Systematic Coronary Risk Evaluation (SCORE) risk estimator. The SCORE risk is estimated using a patient's age, sex, total cholesterol or total and high-density lipoprotein cholesterol, smoking status, and level of SBP. Although not included in SCORE, the ESC/ESH guidelines recommend that heart rate should also be recorded during BP measurements (Table 1–3) and a resting heart rate >80 beats/min should be considered as a cardiovascular risk factor. Validated SCORE risk charts are available for both high-risk and low-risk

**Table 5. CVD/ASCVD Risk Assessment**

| American College of Cardiology/American Heart Association  | European Society of Cardiology/European Society of Hypertension   |
|--|---|
| CVD risk based on history of CVD or 10-year ASCVD risk $\geq 10\%$ using the ACC/AHA Pooled Cohort Equations <sup>5</sup> in adults 40–79 years of age.  | Adults with existing CVD, type 1 or type 2 diabetes mellitus, very high levels of individual CVD risk factors (eg, grade 3 hypertension), or hypertension-mediated organ damage (eg, chronic kidney disease, stages 3–5) are considered to be at high or very high risk (10-year CVD mortality of 5%–10% and $\geq 10\%$ , respectively). |
| Higher-risk category*: CVD or 10-year ASCVD risk $\geq 10\%$   | For all others, 10-year CVD risk should be estimated using the Systematic Coronary Risk Evaluation system for prediction of a first fatal CVD event.  |
| Lower-risk category*: no CVD and 10-year ASCVD risk $< 10\%$   |   |
| Risk stratification recommended for all adults with hypertension but especially important for treatment decisions in adults with stage 1 hypertension (confirmed systolic blood pressure 130–139 mmHg or diastolic blood pressure 80–89 mmHg). |   |
| Lifetime risk assessment encouraged in younger adults.   |   |

ACC indicates American College of Cardiology; AHA, American Heart Association; ASCVD, atherosclerotic cardiovascular disease; CVD, cardiovascular disease. Table adapted from Whelton et al<sup>1</sup> with permission. Copyright © 2018, Elsevier; and Williams et al<sup>2</sup> with permission. Copyright © 2018, Oxford University Press.

\*Based on ACC/AHA Pooled Cohort Equations.<sup>5</sup>

European countries and 15 national or regional SCORE risk charts are also available.<sup>8</sup> The ESC/ESH places emphasis on the importance of considering HMOD in the assessment of CVD risk. Comorbidities such as CKD, left ventricular hypertrophy, and DM are included in the SCORE risk assessment tool (Table 5). The guideline also includes a table of SCORE risk calculation correction factors according to ethnicity. Last, the ESC/ESH guideline uses a classification system based on levels of BP, categories of HMOD, other CVD risk factors, and/or CVD, to illustrate the amplification of risk when risk factors aggregate. Both the ESC/ESH and ACC/AHA guidelines recognize challenges with the use and interpretation of CVD/ASCVD risk-estimating tools.

## LIFESTYLE INTERVENTION

In a high percentage of adults, high BP is related to an unhealthy diet, lack of physical activity, and/or use of alcohol. Therefore, both guidelines identify lifestyle modification as the cornerstone for prevention and treatment of hypertension (Table III in the Data Supplement). In the ACC/AHA, a healthy diet, especially the Dietary Approaches to Stop Hypertension diet, weight loss in adults who are overweight/obese, dietary sodium reduction, enhanced dietary potassium intake, physical activity, and moderation or abstinence from alcohol are recommended for prevention and management of hypertension. Similarly, in the ESC/ESH, a healthy diet, especially the Mediterranean diet, weight loss in adults who are overweight/obese, dietary sodium reduction, physical activity, and moderation in alcohol consumption are identified as the core strategy for prevention and management of hypertension. Both guidelines recommend smoking cessation for the prevention of CVD.

## THRESHOLD FOR INITIATION OF ANTIHYPERTENSIVE DRUG THERAPY

The addition of antihypertensive drug therapy to non-pharmacological lifestyle counseling is recommended for all adults with an SBP  $\geq 140$  mmHg or DBP  $\geq 90$  mmHg, irrespective of CVD/ASCVD risk, in the ACC/AHA guideline (Tables 6–8). For the same BP cut points, the ESC/ESH guideline recommends the immediate initiation of antihypertensive drug therapy in high-risk or very-high-risk patients with CVD, renal disease, or HMOD, and if BP is not controlled after 3 months of lifestyle intervention in patients at low or moderate risk for CVD. An exception is that adults  $> 80$  years of age who have untreated hypertension should only be considered for BP lowering when their office SBP is  $\geq 160$  mmHg. In the ACC/AHA guideline, drug therapy is also recommended for the  $\approx 30\%$  of adults with an SBP 130 to 139 mmHg or DBP 80 to 89 mmHg who are identified as being at higher risk for CVD/ASCVD. This has a particular effect on increased drug treatment for older patients, because age is such a strong and nonmodifiable determinant of risk.<sup>4</sup> In the ESC/ESH, drug therapy may only be considered for adults with an SBP 130 to 139 mmHg or DBP 85 to 89 mmHg in patients with CVD, especially those with coronary artery disease. Figure 2 provides 2 algorithms that highlight the recommended approaches to the management of adults with different categories of BP and CVD/ASCVD risk with nonpharmacological therapy/lifestyle advise and antihypertensive drug therapy. It is challenging to derive a precise quantitative estimate for the resulting difference in treatment rates with antihypertensive medication. Based on the previously mentioned National Health and Nutrition Examination Survey

|                       |   |
|-----------------------|---|
| <b>Very high risk</b> | <p><b>People with any of the following:</b></p> <p><b>Documented CVD, either clinical or unequivocal on imaging.</b></p> <ul style="list-style-type: none"> <li>• <b>Clinical CVD</b> includes acute myocardial infarction, acute coronary syndrome, coronary or other arterial revascularization, stroke, TIA, aortic aneurysm and PAD.</li> <li>• <b>Unequivocal documented CVD on imaging</b> includes significant plaque (i.e. <math>\geq 50\%</math> stenosis) on angiography or ultrasound. It does not include increase in carotid intima-media thickness.</li> <li>• <b>Diabetes mellitus with target organ damage</b>, e.g. proteinuria or a with a major risk factor such as grade 3 hypertension or hypercholesterolaemia</li> <li>• <b>Severe CKD</b> (eGFR <math>&lt; 30</math> mL/min/1.73 m<sup>2</sup>)</li> <li>• <b>A calculated 10-year SCORE of <math>\geq 10\%</math></b></li> </ul> |
| <b>High risk</b>      | <p><b>People with any of the following:</b></p> <ul style="list-style-type: none"> <li>• <b>Marked elevation of a single risk factor</b>, particularly cholesterol <math>&gt; 8</math> mmol/L (<math>&gt; 310</math> mg/dL) e.g. familial hypercholesterolaemia, grade 3 hypertension (BP <math>\geq 180/110</math> mmHg)</li> <li>• <b>Most other people with diabetes mellitus</b> (except some young people with type 1 diabetes mellitus and without major risk factors, that may be moderate risk)</li> <li>• <b>Hypertensive LVH</b></li> <li>• <b>Moderate CKD</b> (eGFR <math>30\text{--}59</math> mL/min/1.73 m<sup>2</sup>)</li> <li>• <b>A calculated 10-year SCORE of <math>5\text{--}10\%</math></b></li> </ul>  |
| <b>Moderate risk</b>  | <p><b>People with:</b></p> <ul style="list-style-type: none"> <li>• <b>A calculated 10-year SCORE of <math>1\%</math> to <math>&lt; 5\%</math></b></li> <li>• <b>Grade 2 hypertension</b></li> <li>• <b>Many middle-aged people</b> belong to this category</li> </ul>  |
| <b>Low risk</b>       | <p><b>People with:</b></p> <ul style="list-style-type: none"> <li>• <b>A calculated 10-year SCORE of <math>&lt; 1\%</math></b></li> </ul>   |

**Figure 1. Categories of cardiovascular disease risk in the 2018 ESC/ESH hypertension guideline.**

BP indicates blood pressure; CKD, chronic kidney disease; CVD, cardiovascular disease; eGFR, estimated glomerular filtration rate; ESC, European Society of Cardiology; ESH, European Society of Hypertension; HMOD, hypertension-mediated organ damage; LVH, left ventricular hypertrophy; PAD, peripheral artery disease; SCORE, Systematic Coronary Risk Evaluation; and TIA, transient ischemic attack. Reprinted from Williams et al<sup>2</sup> with permission. Copyright © 2018, Oxford University Press.

analysis, the difference between the prevalence of anti-hypertensive drug therapy recommendations using the 2017 ACC/AHA and Joint National Committee 7 BP guidelines was estimated to be 1.9%.<sup>4</sup> Whatever the absolute difference between the ACC/AHA and ESC/ESH guidelines, the ACC/AHA CPG recommends anti-hypertensive drug therapy in addition to lifestyle counseling in a higher percentage of adults with an SBP/DBP  $< 140/90$  mm Hg.

## ANTIHYPERTENSIVE DRUG TREATMENT STRATEGY

As outlined in Tables 6–8, both guidelines recommend use of agents from the following 4 drug classes: diuretics, calcium channel blockers (CCBs), angiotensin-converting enzyme (ACE) inhibitors, or angiotensin receptor blockers (ARBs) in adults with no compelling indication for selection of a specific BP-lowering medication.

The ACC/AHA indicates a preference for the longer-acting thiazide-type diuretic chlorthalidone compared with other diuretic agents because chlorthalidone was the diuretic used in many of the landmark event-based randomized clinical trials. Both guidelines advise combination therapy in most adults with hypertension (usually, an initial combination of ACE inhibitors or ARB, a

diuretic, and/or a CCB). The ACC/AHA specifically recommends combination therapy for Black patients and for adults with more severe hypertension (SBP  $\geq 140$  mm Hg or DBP  $\geq 90$  mm Hg and an average SBP/DBP  $> 20/10$  mm Hg above their target BP). In addition, the ACC/AHA guideline recommends that initial antihypertensive drug therapy in Black patients should include a thiazide-type diuretic or CCB. The ESC/ESH guideline also recommends that initial treatment in most Black patients should be with a 2-drug combination, comprising a diuretic and CCB, either in combination with each other or with an ACE inhibitor or ARB. The ACC/AHA notes that single-pill combinations improve treatment adherence but may contain lower-than-optimal doses of the thiazide diuretic component. The ESC/ESH recommends a core drug combination treatment strategy for most patients including patients with uncomplicated hypertension, patients with HMOD, cerebrovascular disease, diabetes, or peripheral artery disease. This strategy comprises initial dual combination therapy (ACE inhibitors or ARB and CCB or diuretic), preferably in a single-pill combination, followed, if still above target BP, by triple therapy (ACE inhibitors or ARB, CCB and diuretic) using a single-pill combination, followed if still above the target by the addition of spironolactone or other diuretic,  $\alpha$ -blocker, or  $\beta$ -blocker and consideration of referral to a specialist center. Both guidelines

**Table 6. Antihypertensive Drug Therapy for Management of Hypertension**

| American College of Cardiology/American Heart Association   | European Society of Cardiology/European Society of Hypertension   |
|---|---|
| Threshold for addition of antihypertensive drug therapy   |   |
| All adults with SBP $\geq$ 140 mmHg or DBP $\geq$ 90 mmHg.<br>Adults with SBP 130–139 or DBP 80–89 mmHg and CVD or a 10-year atherosclerotic CVD risk $\geq$ 10%, based on estimation using of the ACC/AHA Pooled Cohort Equations calculator. <sup>6</sup>   | All adults with SBP $\geq$ 140 mmHg or DBP $\geq$ 90 mmHg. Consider in adults with SBP 130–139 mmHg or DBP 85–89 mmHg who are at very high risk because of CVD, especially those with coronary heart disease.   |
| Treatment strategy  |   |
| If there is no compelling clinical indication for selection of a BP-lowering medication, treat with $\geq$ 1 drugs from the following classes: diuretics, CCBs, ACE inhibitors, or ARBs. Combination therapy is required in most patients and is specifically recommended in African Americans and in adults with a starting SBP/DBP $\geq$ 20/10 mmHg above the BP treatment target. Dual- and triple-drug therapy should include agents with complementary mechanisms of action. Single-pill combinations improve adherence but may contain lower-than-optimal doses of thiazide diuretic. Simultaneous use of an ACE inhibitors, ARB, and/or renin inhibitor is potentially harmful and not recommended. | If no compelling clinical indication for selection of a BP-lowering medication, treat with drugs from the following classes: ACE inhibitors, ARB, CCB, or diuretics. Initial combination therapy with ACE inhibitors or ARB plus CCB or diuretic recommended in most patients with hypertension, with the use of single-pill combinations strongly favored. If BP is still above goal, switch to single-pill combination therapy with ACE inhibitors or ARB plus CCB and diuretic. If BP still above goal, add spironolactone or other diuretic, $\alpha$ -blocker or $\beta$ -blocker and consider referral to a specialist center for further evaluation.<br><br>The combination of 2 renin-angiotensin system blockers is not recommended. |

ACE indicates angiotensin converting enzyme; ARB, angiotensin receptor blocker; BP, blood pressure; CCB, calcium channel blocker; CVD, cardiovascular disease; DBP, diastolic blood pressure; and SBP, systolic blood pressure. Table adapted from Whelton et al<sup>1</sup> with permission. Copyright © 2018, Elsevier; and Williams et al<sup>2</sup> with permission. Copyright © 2018, Oxford University Press.

recommend against simultaneous use of ACE inhibitors and ARB. Likewise, both guidelines provide specific advice on choice of BP-lowering medications in adults with hypertension and various comorbidities/conditions, and in special patient groups, as well. In the ESC/ESH guidelines,  $\beta$ -blockers are considered to be first-line antihypertensive drugs in patients with a specific indication for their use, because, in comparison with other BP-lowering drugs,  $\beta$ -blockers are usually equivalent in preventing major cardiovascular events with the exception of less efficacy for stroke prevention. Therefore, their use is primarily recommended in specific (most importantly cardiac) indications and in pregnant women or women planning pregnancy.

previous guidelines. The ACC/AHA recommends SBP/DBP <130/80 mmHg as a general treatment target, if tolerated (Tables 6–8). For older adults ( $\geq$ 65 years), who are noninstitutionalized, ambulatory, and community dwelling, the target is SBP <130 mmHg, if tolerated. For older adults with a high burden of comorbidity and limited life expectancy, treatment decisions should be based on clinical judgment, patient preference, and a team-based assessment of risk/benefit. The ESC/ESH recommends target ranges but recognizes that the optimal and tolerated targets for individuals will differ. The initial SBP/DBP target is <140/90 mmHg for all adults with hypertension. Provided the treatment is well tolerated, targeting to 130/80 mmHg is recommended, with subsequent efforts to achieve a lower BP in those 18 to 65 years of age. An exception to the general rule is that the SBP target in adults with hypertension and CKD should be <140 to 130 mmHg. The ESC/ESH advises against specifically targeting SBP to <120 mmHg for adults, but acknowledges that this may be achieved in some treated patients without adverse effects. A key emphasis, especially in older and frailer patients, is to tailor the treatment to achieve the best BP possible within the target range, while monitoring for adverse effects. The optimal DBP target is defined as 70 to 79 mmHg for all patients, but the emphasis is on controlling SBP, even when DBP is below these levels, provided the treatment is tolerated.

## OFFICE BP TREATMENT TARGETS

Both the ACC/AHA and ESC/ESH recommend lower BP treatment targets compared with the goals advised in

**Table 7. American College of Cardiology/American Heart Association Office Blood Pressure Treatment Targets for Antihypertensive Drug Therapy for Management of Hypertension**

A systolic blood pressure /diastolic blood pressure <130/80 mmHg target recommended for all adults with hypertension, with the exception that a systolic blood pressure <130 mmHg target is recommended for noninstitutionalized, ambulatory, community-living older adults ( $\geq$ 65 years). For older adults with hypertension and a high burden of comorbidity/limited life expectancy, it is reasonable to base treatment intensity and choice of drugs on clinical judgment, patient preference, and a team-based approach to assessing risk/benefit.

Table adapted from Whelton et al<sup>1</sup> with permission. Copyright © 2018, Elsevier; and Williams et al<sup>2</sup> with permission. Copyright © 2018, Oxford University Press.

## OTHER TOPICS

Both guidelines provide recommendations for follow-up intervals, with the ACC/AHA CPG suggesting 1 year for

**Table 8. European Society of Cardiology/European Society of Hypertension Office Blood Pressure Treatment Targets for Antihypertensive Drug Therapy for Management of Hypertension**

| Age, y | Systolic blood pressure, mm Hg          |           |                         |                                   |                           | Diastolic blood pressure, mm Hg |
|--------|---|-----------|-------------------------|-----------------------------------|---------------------------|---------------------------------|
|        | Hypertension                            | +Diabetes | +Coronary heart disease | +Stroke/transient ischemic attack | +Chronic kidney disease   |                                 |
| 18-65  | 130 or lower, if tolerated but not <120 |           |                         |                                   | <140 to 130, if tolerated | 70-79                           |
| ≥65    | 130-139, if tolerated                   |           |                         |                                   |                           | 70-79                           |

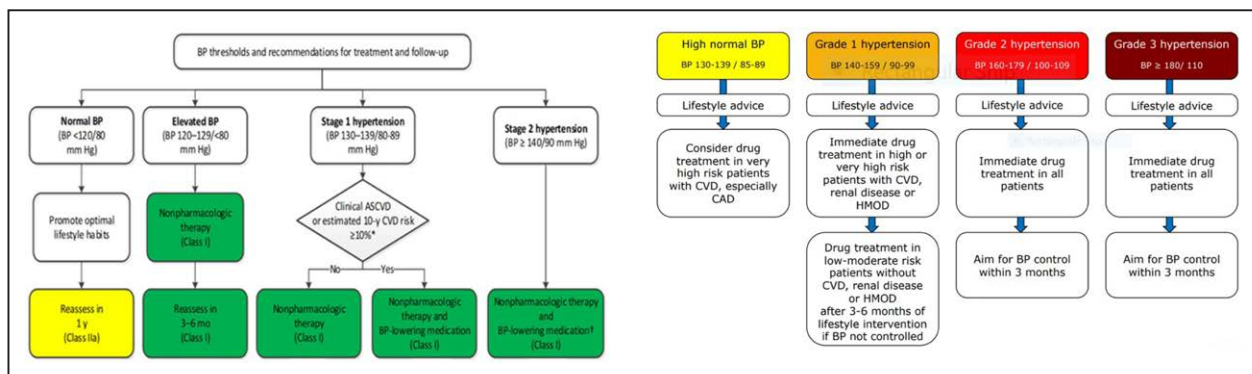
First target office systolic blood pressure/diastolic blood pressure <140/90 mm Hg, with final target range as shown in this table. Table adapted from Williams et al<sup>2</sup> with permission. Copyright © 2018, Oxford University Press.

reevaluation of adults with a normal BP, 3 to 6 months for those treated with nonpharmacological therapy, and 1 month after initiation of antihypertensive drug therapy followed by 3 to 6 months after meeting the BP goal. The ESC/ESH CPG suggests follow-up within the first 2 months after the initiation of antihypertensive drug therapy, with the caveat that the interval should depend on the severity of hypertension and urgency to achieve BP control. After the desired BP target has been achieved, an interval of a few months is suggested for BP monitoring and 2 years for reassessment of risk factors and evidence of asymptomatic target organ damage. The ESC/ESH CPG recommends achieving BP control within 3 months of initiating therapy, further emphasizing the need to consider initial therapy with combination drugs in most patients to achieve rapid BP control.

Both guidelines provide detailed guidance for detection and management of secondary hypertension, definition and management of resistant hypertension, hypertensive urgencies and emergencies, masked and white coat hypertension, hypertension in older adults, men and women, persons of different race/ethnicity, and patients with various comorbidities and conditions,

including heart disease, cerebrovascular disease, CKD, peripheral vascular disease, DM and metabolic syndrome, aortic disease, and pregnancy.

Both guidelines focus considerable attention on strategies to improve adherence to therapy, emphasizing the advantage of single-pill combinations to improve adherence and overcome therapeutic inertia, and team-based care. Both guidelines also focus on implementation, that is, models for delivery of care, use of health information technology, improving quality of care, health literacy, access to care, social and community services, and a patient-specific plan of care. The ESC/ESH provides recommendations for treatment of isolated systolic hypertension, and it recommends reserving device-based treatments of hypertension for research settings. The ESC/ESH provides recommendations for managing concomitant CVD risk with specific recommendations for the use of statins, antiplatelet drugs, and oral anticoagulation (in atrial fibrillation), whereas the ACC/AHA largely defers to other ACC/AHA guidelines that cover these topics. Last, both guidelines identify gaps in evidence and provide a summary key message (ESC/ESH) or BP treatment thresholds and goals (ACC/AHA).



**Figure 2. Blood pressure thresholds for initiation of blood pressure-lowering therapies in the 2017 ACC/AHA and 2018 ESC/ESH blood pressure guidelines.**

ACC indicates American College of Cardiology; AHA, American Heart Association; ASCVD, atherosclerotic cardiovascular disease; BP, blood pressure; CAD, coronary heart disease; CVD, cardiovascular disease; ESC, European Society of Cardiology; ESH, European Society of Hypertension; and HMOD, hypertension-mediated organ damage. Adapted from Whelton et al<sup>1</sup> with permission. Copyright © 2018, Elsevier; and Williams et al<sup>2</sup> with permission. Copyright © 2018, Oxford University Press.



## REFLECTIONS

Although differences in guidelines are invariably highlighted, it is notable that the core advice in the ACC/AHA and ESC/ESH guidelines is remarkably similar in most important areas of practice (Table 9). Even for the area of greatest difference, the definition of hypertension, there is still considerable overlap. In both guidelines, adults with an average SBP  $\geq 140$  mmHg or DBP  $\geq 90$  mmHg are designated as having hypertension and treatment with a combination of lifestyle counseling and antihypertensive drug therapy is recommended. Those with an average SBP 130 to 139 mmHg are designated as having stage 1 hypertension in the ACC/AHA and high normal BP in the ESC/ESH. However, both guidelines recommend lifestyle modification for most adults in this BP category, the addition of antihypertensive drugs only being recommended for the  $\approx 30\%$  of US adults with CVD or a 10-year ASCVD risk  $\geq 10\%$  in the ACC/AHA guideline and only to be considered in very-high-risk patients, especially those with coronary artery disease, in the ESC/ESH CPG. For many other treatment differences, the 2 guidelines provide overall advice that is similar but sometimes discrepant in the specifics. For example, both guidelines recommend combination antihypertensive drug therapy but the specific application for this advice is somewhat different. The ESC/ESH places great emphasis on single-pill combination drug therapy, whereas the ACC/AHA encourages single-

pill combinations when possible but notes that many of the combination pills available in the United States use hydrochlorothiazide rather than chlorthalidone and often use a diuretic dose that is lower than what has been used in the landmark treatment trials. Likewise, both guidelines recommend a lower BP target during treatment compared with what was advised in previous guidelines, including in older adults. Overall, the difference lies in the ESC/ESH taking a more stepped approach, first recommending achievement of an SBP/DBP  $< 140/90$  mmHg before targeting a lower BP, if tolerated, and identifying SBP 120 mmHg and DBP 70 mmHg as the lower safety boundary for BP reduction in adults 18 to 65 years of age (130 mmHg in those with CKD). The ACC/AHA recommends a single SBP/DBP target of  $< 130/80$  mmHg in most adults but SBP  $< 130$  mmHg in older well adults, if tolerated.

Some of the differences between the 2 guidelines reflect the CPG process requirements of the ACC/AHA and ESC/ESH. For example, the composition of the 2 writing committees, the approach to management of potential conflicts of interest, and the ACC/AHA use of an independent evidence review committee are all a direct result of ACC/AHA and ESC/ESH guideline process requirements. Other differences between the 2 guidelines reflect the fact that they were written for different populations/geographic regions. A good example of this is CVD/ASCVD risk estimation, where evidence suggests that risk-estimating tools that have been validated in 1 population may not

**Table 9. Similarities and Differences in the 2017 ACC/AHA and 2018 ESC/ESH Adult BP Guidelines**

| Similarities   | Differences  |
|--|--|
| Comprehensive guidelines based on rigorous development processes   | Lower SBP and DBP cut points for diagnosis of hypertension in ACC/AHA guideline  |
| Emphasis on accurate BP measurements and use of out-of-office readings   | ACC/AHA recommends antihypertensive drug therapy when SBP 130–139 mmHg or DBP 80–89 mmHg and CVD or 10-year atherosclerotic CVD risk $\geq 10\%$ , whereas ESC/ESH recommends drug therapy only be considered for SBP 130–139 mmHg or DBP 85–89 mmHg when CVD present, especially coronary heart disease |
| Use of CVD risk estimation to inform decision for initiation of antihypertensive drug therapy  | BP targets somewhat lower in ACC/AHA than in ESC/ESH, especially in older adults and those with chronic kidney disease.  |
| Similar lifestyle change recommendations for prevention and treatment of hypertension  | Treatment of other CVD risk factors recommended in both guidelines but ACC/AHA references other ACC/AHA guidelines for specific details, whereas ESC/ESH includes details for statin and aspirin therapy.  |
| Antihypertensive drug therapy recommended when SBP $\geq 140$ mmHg or DBP $\geq 90$ mmHg in both guidelines  |  |
| Similar core strategy for antihypertensive drug therapy<br>Combination therapy for most adults with hypertension<br>Single-pill combinations preferred<br>If no compelling indication for drug choice, consider initial 2-drug combination of diuretic or calcium channel blockers plus angiotensin converting enzyme inhibitors or angiotensin receptor blockers, followed by a 3-drug combination if necessary |  |
| Lower BP targets compared with previous guidelines   |  |
| Strategies to improve adherence and BP control   |  |

ACC indicates American College of Cardiology; AHA, American Heart Association; BP, blood pressure; CVD, cardiovascular disease; ESC, European Society of Cardiology; ESH, European Society of Hypertension; DBP, diastolic blood pressure; and SBP, systolic blood pressure.

perform as well in another practice setting. Some of the differences reflect different weighting and interpretation of the available research findings by the 2 writing committees. For example, the ESC/ESH placed less emphasis on the SPRINT (Systolic Blood Pressure Intervention Trial) findings, and on meta-analysis (especially network meta-analysis). Last, some of the differences probably reflect variations in practice culture and organization of the health care systems in the United States and Europe.

## RECOMMENDATIONS

Despite assertions to the contrary,<sup>9</sup> there is greater congruity between the 2017 ACC/AHA and 2018 ESC/ESH CPGs than previous BP guidelines on each side of the Atlantic. Additional harmonization of the 2 guidelines in the future would be helpful. Ways to achieve this goal could include the use of processes that better approximate each other, liaison membership from each writing committee to the other, temporal synchronization of guideline preparation allowing ongoing communication between writing committees, structured open discussion of the science underpinning recommendations by the writing committees and sharing systematic reviews related to key questions, peer review of each report by members of the other guideline writing committee, and joint presentations/publications, such as the one provided here, to compare the ACC/AHA and the ESC/ESH recommendations and to place them in the context of the populations and practice communities for which they are being written. Much of this is already happening to some extent, but it is informal and would likely benefit from a more structured approach. The ACC/AHA and ESC/ESH guidelines have a common purpose of assisting clinicians, the public health community, and the public in achieving the goal of better health. Current rates of treatment and control of hypertension, however defined, remain suboptimal in Europe and the United States. The more convergent the major American and European guideline recommendations are with each other, the more unified the message to patients, clinicians, professional societies, governmental agencies, and the public. Greater congruence would thus be expected to underscore a common purpose and command the attention necessary to catalyze changes in practice leading to improvement in hypertension awareness, treatment, and control in the future.

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### Supplemental Materials

Data Supplement Tables I–III

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