

those achieve a BP of 140/90 mm Hg or lower, according to National Health and Nutrition Examination Surveys (NHANES) in the United States and similar cohorts in Canada and Europe. Under the new US definition of hypertension (systolic pressure  $\geq 130$  mm Hg and/or a diastolic pressure  $\geq 80$  mm Hg), only 47% of individuals undergoing hypertensive therapy will achieve controlled BP. Unfortunately, for many patients in racial or ethnic minority groups, socioeconomic and lifestyle factors continue to be barriers to treatment.

## Classification of Blood Pressure and Diagnosis of Hypertension

In recent years, the classification and diagnosis of BP have been updated. The 2017 American College of Cardiology (ACC)/American Heart Association (AHA) guidelines defined “normal” blood pressure as  $<120/80$  mm Hg, while the 2018 European Society of Cardiology/European Society of Hypertension guidelines consider this level “optimal.” While there are some key differences between the recommendations of the US and European groups, there is also much overlap, as shown in Table 4-1. These classifications are based on the average of 2 or more properly measured seated BP readings during each of 2 or more office visits or other outpatient assessments such as ambulatory BP monitoring or home BP monitoring with an approved device.

Clinical trial data have demonstrated additional benefits of aggressive lowering of BP to  $<130$  mm Hg. Both US and European organizations recommend BP treatment targets of  $<130/80$  mm Hg, particularly for hypertensive patients with coexisting coronary artery disease, chronic kidney disease, diabetes, and cerebrovascular disease.

In 10%–15% of patients, BP increases only when they are in a physician’s office; these patients are said to have *white coat hypertension*. Home BP monitoring by self-measured BP (SMBP) or 24-hour ambulatory BP measurement (ABPM) is warranted in these individuals and in patients with labile hypertension, resistant hypertension, hypotensive episodes, or

**Table 4-1 Comparison of ACC/AHA and ESC/ESH Blood Pressure Classifications**

	ACC/AHA 2017 Guidelines	ESC/ESH 2018 Guidelines
Definition of hypertension (mm Hg)	$\geq 130/80$	$\geq 140/90$
Normal	Normal: $<120/80$ Elevated: $120\text{--}129/<80$	Optimal: $<120/80$ Normal: $120\text{--}129/80\text{--}84$ High normal: $130\text{--}139/85\text{--}89$
Stages	Stage 1: $130\text{--}139/80\text{--}89$ Stage 2: $\geq 140/90$	Grade 1: $140\text{--}159/90\text{--}99$ Grade 2: $160\text{--}179/100\text{--}109$ Grade 3: $\geq 180/110$
Age-specific blood pressure targets (mm Hg)	$<65$ : $<130/80$ $\geq 65$ : $<130/80$	$<65$ : $<120\text{--}129/70\text{--}79$ $\geq 65$ : $<130\text{--}139/70\text{--}79$

ACC=American College of Cardiology; AHA=American Heart Association; ESC=European Society of Cardiology; ESH=European Society of Hypertension.


postural hypotension, as well as in those with *masked hypertension* (normal BP in the office setting but abnormal readings at home). Other indications for obtaining out-of-office BP measurements include confirming a new diagnosis of hypertension, determining the effectiveness of therapy, and confirming elevated office BP in pregnant women when gestational hypertension or preeclampsia are suspected.

ABPM provides data on circadian variations of BP. ABPM readings are usually lower than measurements taken in a physician's office, and they correlate better with target-organ injury than do office measurements. BP in most individuals decreases by 10%–20% during sleep (*dipping pattern*); those without such a decrease (*nondipping pattern*) are at greater risk for cardiovascular and neurovascular events. Masked hypertension may occur in 10%–30% of patients and carries a worse prognosis than white coat hypertension with regard to the development of atherosclerosis. Thus, it is important to recognize that a normal office BP does not exclude hypertension, and home monitoring may identify patients with true hypertension.

Whelton PK, Carey RM, Aronow WS, et al. 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: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *Hypertension*. 2018;71(6):e13–e115.

Williams B, Mancia G, Spiering W, et al. 2018 ESC/ESH Guidelines for the management of arterial hypertension. *Eur Heart J*. 2018;39(33):3021–3104.

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 **Ophthalmic considerations** There is a link between nocturnal blood pressure and glaucomatous optic neuropathy, and ABPM may be useful in determining the cause of glaucoma that progresses despite normal intraocular pressure. Some studies suggest that this may be caused by increased fluctuation and dipping of BP, leading to fluctuations in ocular perfusion and transient optic nerve head ischemia. In these patients, a shorter-acting BP medication at bedtime may be needed, especially in older adults, in whom dehydration is also a common cause of hypotension.

Melgarejo JD, Lee JH, Petitto M, et al. Glaucomatous optic neuropathy associated with nocturnal dip in blood pressure: findings from the Maracaibo Aging Study. *Ophthalmology*. 2018;125(6):807–814.

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## Etiology and Pathogenesis of Hypertension

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Approximately 90% of cases of hypertension are *primary (essential)*, in which the etiology is unknown, and 10% are secondary to identifiable causes. Primary hypertension most likely results from a dysregulation of various renal, hormonal, and cellular processes in conjunction with environmental factors such as diet and exercise. These processes include abnormal sodium transport, increased sympathetic nervous system activity, abnormal vasodilation, excess amounts of transforming growth factors  $\beta$ , and abnormalities in the renin-angiotensin-aldosterone system (Fig 4-1).