

Table 5. Summary of Recommendations for Lifestyle Management

Recommendations	NHLBI Grade	NHLBI Evidence Statements	ACC/AHA COR	ACC/AHA LOE
DIET				
LDL-C: Advise adults who would benefit from LDL-C lowering* to:				
1. Consume a dietary pattern that emphasizes intake of vegetables, fruits, and whole grains; includes low-fat dairy products, poultry, fish, legumes, nontropical vegetable oils, and nuts; and limits intake of sweets, sugar-sweetened beverages, and red meats. a. Adapt this dietary pattern to appropriate calorie requirements, personal and cultural food preferences, and nutrition therapy for other medical conditions (including diabetes). b. Achieve this pattern by following plans such as the DASH dietary pattern, the USDA Food Pattern, or the AHA Diet.	A (Strong)	CQ1: ES4 (high), ES6 (low), ES8 (moderate), ES9 (moderate)	I	A
2. Aim for a dietary pattern that achieves 5%–6% of calories from saturated fat.	A (Strong)	CQ1: ES11 (high)	I	A
3. Reduce percent of calories from saturated fat.	A (Strong)	CQ1: ES11 (high), ES12 (moderate), ES13 (moderate)	I	A
4. Reduce percent of calories from <i>trans</i> fat.	A (Strong)	CQ1: ES14 (moderate), ES15 (moderate)	I	A
BP: Advise adults who would benefit from BP lowering to:				
1. Consume a dietary pattern that emphasizes intake of vegetables, fruits, and whole grains; includes low-fat dairy products, poultry, fish, legumes, nontropical vegetable oils, and nuts; and limits intake of sweets, sugar-sweetened beverages, and red meats. a. Adapt this dietary pattern to appropriate calorie requirements, personal and cultural food preferences, and nutrition therapy for other medical conditions (including diabetes). b. Achieve this pattern by following plans such as the DASH dietary pattern, the USDA Food Pattern, or the AHA Diet.	A (Strong)	CQ1: ES1 (low) ES3 (high), ES5 (high), ES6 (low), ES7 (low), ES8 (moderate)	I	A
2. Lower sodium intake.	A (Strong)	CQ2: ES1 (high), ES2 (moderate), ES3 (high), ES4 (high), ES5 (high), ES8 (low), ES9 (low)	I	A
3. a. Consume no more than 2400 mg of sodium/d; b. Further reduction of sodium intake to 1500 mg/d can result in even greater reduction in BP; and c. Even without achieving these goals, reducing sodium intake by at least 1000 mg/d lowers BP.	B (Moderate)	CQ2: ES2 (moderate), ES3 (high)	Ila	B
4. Combine the DASH dietary pattern with lower sodium intake.	A (Strong)	CQ1: ES3 (high), ES5 (high), ES8 (moderate) CQ2: ES1 (high), ES2 (moderate), ES3 (high), ES4 (high), ES5 (high), ES6 (moderate)	I	A
PHYSICAL ACTIVITY				
Lipids				
1. In general, advise adults to engage in aerobic physical activity to reduce LDL-C and non-HDL-C: 3–4 sessions per wk, lasting on average 40 min per session, and involving moderate- to vigorous-intensity physical activity.	B (Moderate)	CQ3: ES1 (moderate), ES2 (moderate), ES5 (low)	Ila	A
BP				
1. In general, advise adults to engage in aerobic physical activity to lower BP: 3–4 sessions per wk, lasting on average 40 min per session, and involving moderate- to vigorous-intensity physical activity.	B (Moderate)	CQ3: ES1 (high)	Ila	A

*Refer to 2013 Blood Cholesterol Guideline for guidance on who would benefit from LDL-C lowering.⁴

ACC indicates American College of Cardiology; AHA, American Heart Association; BP, blood pressure; COR, Class of Recommendation; CQ, critical question; DASH, Dietary Approaches to Stop Hypertension; ES, evidence statement; HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol; LOE, Level of Evidence; NHLBI, National Heart, Lung, and Blood Institute; and USDA, US Department of Agriculture.

CLASSIFICATION OF BLOOD PRESSURE

Table 3 provides a classification of BP for adults 18 years and older. The classification is based on the average of two or more properly measured, seated, BP readings on each of two or more office visits.

Prehypertension is **not** a disease category. Rather, it is a designation chosen to identify individuals at high risk of developing hypertension, so that both patients and clinicians are alerted to this risk and encouraged to intervene and prevent or delay the disease from developing. Individuals who are prehypertensive are **not** candidates for drug therapy based on their level of BP and should be firmly and unambiguously advised to practice lifestyle modification in order to reduce their risk of developing hypertension in the future (see Lifestyle Modifications). Moreover, individuals with prehypertension, who **also** have diabetes or kidney disease, should be considered candidates for appropriate drug therapy if a trial of lifestyle modification fails to reduce their BP to 130/80 mmHg or less.

Table 3. Classification of blood pressure for adults

BLOOD PRESSURE CLASSIFICATION	SBP MMHG	DBP MMHG
NORMAL	<120	and <80
PREHYPERTENSION	120–139	or 80–89
STAGE 1 HYPERTENSION	140–159	or 90–99
STAGE 2 HYPERTENSION	≥160	or ≥100

SBP, systolic blood pressure; DBP, diastolic blood pressure

This classification does not stratify hypertensive individuals by the presence or absence of risk factors or target organ damage in order to make different treatment recommendations, should either or both be present. JNC 7 suggests that **all** people with hypertension (stages 1 and 2) be treated. The treatment goal for individuals with hypertension and no other compelling conditions is <140/90 mmHg (see Compelling Indications). The goal for individuals with prehypertension and no compelling indications is to lower BP to normal levels with lifestyle changes, and prevent the progressive rise in BP using the recommended lifestyle modifications (see Lifestyle Modifications).

Cardiovascular Disease Risk

The relationship between BP and risk of CVD events is continuous, consistent, and independent of other risk factors. The higher the BP, the greater the chance of heart attack, HF, stroke, and kidney diseases. The presence of each additional risk factor compounds the risk from hypertension as illustrated in figure 12.²⁰ The easy and rapid calculation of a Framingham CHD risk score using published tables²¹ may assist the clinician and patient in demonstrating the benefits of treatment. Management of these other risk factors is essential and should follow the established guidelines for controlling these coexisting problems that contribute to overall cardiovascular risk.

Barriers to prevention include cultural norms; insufficient attention to health education by health care practitioners; lack of reimbursement for health education services; lack of access to places to engage in physical activity; larger servings of food in restaurants; lack of availability of healthy food choices in many schools, worksites, and restaurants; lack of exercise programs in schools; large amounts of sodium added to foods by the food industry and restaurants; and the higher cost of food products that are lower in sodium and calories.¹⁰ Overcoming the barriers will require a multipronged approach directed not only to high-risk populations, but also to communities, schools, worksites, and the food industry. The recent recommendations by the American Public Health Association and the NHBPEP Coordinating Committee that the food industry, including manufacturers and restaurants, reduce sodium in the food supply by 50 percent over the next decade is the type of approach which, if implemented, would reduce BP in the population.^{39,40}

Community Programs

Healthy People 2010 has identified the community as a significant partner and vital point of intervention for attaining healthy goals and outcomes.⁴¹ Partnerships with community groups such as civic, philanthropic, religious, and senior

citizen organizations provide locally focused orientation to the health needs of diverse populations. The probability of success increases as interventional strategies more aptly address the diversity of racial, ethnic, cultural, linguistic, religious, and social factors in the delivery of medical services. Community service organizations can promote the prevention of hypertension by providing culturally sensitive educational messages and lifestyle support services and by establishing cardiovascular risk factor screening and referral programs. Community-based strategies and programs have been addressed in prior NHLBI publications and other documents (*Facts About the DASH Eating Plan*,⁴² *Your Guide to Lowering High Blood Pressure*,⁴³ National High Blood Pressure Education Month,⁴⁴ The Heart Truth: A National Awareness Campaign for Women About Heart Disease,⁴⁵ *Mobilizing African American Communities to Address Disparities in Cardiovascular Health: The Baltimore City Health Partnership Strategy Development Workshop Summary Report*,⁴⁶ NHLBI Healthy People 2010 Gateway,⁴⁷ Cardiovascular Disease Enhanced Dissemination and Utilization Centers [EDUCs] Awardees,⁴⁸ Hearts N' Parks,⁴⁹ Healthbeat Radio Network,⁵⁰ *Salud para su Corazón* [For the Health of Your Heart]⁵¹).

CALIBRATION, MAINTENANCE, AND USE OF BLOOD PRESSURE DEVICES

The potential of mercury spillage contaminating the environment has led to the decreased use or elimination of mercury in sphygmomanometers as well as in thermometers.⁵² However, concerns regarding the accuracy of nonmercury sphygmomanometers have created new challenges for accurate BP determination.^{53,54} When mercury sphygmomanometers are replaced, the new equipment, including all home BP measurement devices, must be appropriately validated and checked regularly for accuracy.⁵⁵

Accurate Blood Pressure Measurement in the Office

The accurate measurement of BP is the sine qua non for successful management. The equipment—whether aneroid, mercury, or electronic—should be regularly inspected and validated. The operator should be trained and regularly retrained in the standardized technique, and the patient must be properly prepared and positioned.^{4,56,57} The auscultatory method of BP measurement should be used.⁵⁸ Persons should be seated quietly for at least 5 minutes in a chair (rather than on an exam table), with feet on the floor, and arm supported at heart level. Caffeine, exercise, and smoking

should be avoided for at least 30 minutes prior to measurement. Measurement of BP in the standing position is indicated periodically, especially in those at risk for postural hypotension, prior to necessary drug dose or adding a drug, and in those who report symptoms consistent with reduced BP upon standing. An appropriately sized cuff (cuff bladder encircling at least 80 percent of the arm) should be used to ensure accuracy. At least two measurements should be made and the average recorded. For manual determinations, palpated radial pulse obliteration pressure should be used to estimate SBP—the cuff should then be inflated 20–30 mmHg above this level for the auscultatory determinations; the cuff deflation rate for auscultatory readings should be 2 mmHg per second. SBP is the point at which the first of two or more Korotkoff sounds is heard (onset of phase 1), and the disappearance of Korotkoff sound (onset of phase 5) is used to define DBP. Clinicians should provide to patients, verbally and in writing, their specific BP numbers and the BP goal of their treatment.

Followup of patients with various stages of hypertension is recommended as shown in table 4.

Table 4. Recommendations for followup based on initial blood pressure measurements for adults without acute end organ damage

INITIAL BLOOD PRESSURE (MMHG)*	FOLLOWUP RECOMMENDED†
Normal	Recheck in 2 years
Prehypertension	Recheck in 1 year‡
Stage 1 Hypertension	Confirm within 2 months‡
Stage 2 Hypertension	Evaluate or refer to source of care within 1 month. For those with higher pressures (e.g., >180/110 mmHg), evaluate and treat immediately or within 1 week depending on clinical situation and complications.

* If systolic and diastolic categories are different, follow recommendations for shorter time followup (e.g., 160/86 mmHg should be evaluated or referred to source of care within 1 month).

† Modify the scheduling of followup according to reliable information about past BP measurements, other cardiovascular risk factors, or target organ disease.

‡ Provide advice about lifestyle modifications (see Lifestyle Modifications).

Evaluation of hypertensive patients has three objectives: (1) to assess lifestyle and identify other cardiovascular risk factors or concomitant disorders that may affect prognosis and guide treatment (table 6); (2) to reveal identifiable causes of high BP (table 7); and (3) to assess the presence or absence of target organ damage and CVD.

Patient evaluation is made through medical history, physical examination, routine laboratory tests, and other diagnostic procedures. The physical examination should include: an appropriate measurement of BP, with verification in the contralateral arm; an examination of the optic fundi; a calculation of body mass index (BMI) (measurement of waist circumference is also very useful); an auscultation for carotid, abdominal, and femoral bruits; a palpation of the thyroid gland; a thorough examination of the heart and lungs; an examination of the abdomen for enlarged kidneys, masses, distended urinary bladder, and abnormal aortic pulsation; a palpation of the lower extremities for edema and pulses; and neurological assessment.

Data from epidemiological studies and clinical trials have demonstrated that elevations in resting heart rate and reduced heart-rate variability are associated with higher cardiovascular risk. In the Framingham Heart Study, an average resting heart rate of 83 beats per minute was associated with a substantially higher risk of death from a cardiovascular event than the risk associated with lower heart rate levels.⁶⁴ Moreover, reduced heart-rate variability was also associated with an increase in cardiovascular mortality.⁶⁵

No clinical trials have prospectively evaluated the impact of reduced heart rate on cardiovascular outcomes.

Table 6. Cardiovascular risk factors

MAJOR RISK FACTORS
Hypertension*
Age (older than 55 years for men, 65 years for women) [†]
Diabetes mellitus*
Elevated LDL (or total) cholesterol, or low HDL cholesterol*
Estimated GFR <60 mL/min
Family history of premature CVD (men <55 years of age or women <65 years of age)
Microalbuminuria
Obesity* (BMI ≥ 30 kg/m ²)
Physical inactivity
Tobacco usage, particularly cigarettes
TARGET ORGAN DAMAGE
Heart
LVH
Angina/prior MI
Prior coronary revascularization
Heart failure
Brain
Stroke or transient ischemic attack
Dementia
CKD
Peripheral arterial disease
Retinopathy

BMI, body mass index; CKD, chronic kidney disease; CVD, cardiovascular disease; GFR, glomerular filtration rate; HDL, high-density lipoprotein; LDL, low-density lipoprotein; LVH, left ventricular hypertrophy; MI, myocardial infarction

** Components of the metabolic syndrome. Reduced HDL and elevated triglycerides are components of the metabolic syndrome. Abdominal obesity also is a component of metabolic syndrome.*

[†] Increased risk begins at approximately 55 and 65 years of age for men and women, respectively. Adult Treatment Panel III used earlier age cut points to suggest the need for earlier action.