TABLE 3. Primary Prevention in Coronary Asymptomatic Patients at High Short-Term Risk (CHD Risk Equivalents)

<table>
<thead>
<tr>
<th>Patient selection (CHD risk equivalents)</th>
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<tbody>
<tr>
<td>Symptomatic peripheral arterial disease</td>
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<tr>
<td>Abdominal aortic aneurysm</td>
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<tr>
<td>Symptomatic carotid artery disease</td>
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<tr>
<td>Type 2 diabetes*</td>
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<tr>
<td>Multiple risk factors (Framingham risk for hard CHD &gt;20%/10 years)†</td>
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<tr>
<td>Smoking goal: complete cessation</td>
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<tr>
<td>Blood pressure goal: ≤140/90 mm Hg (≤130/85 mm Hg in type 2 diabetes)</td>
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<tr>
<td>Primary lipid goal: LDL cholesterol ≤100 mg/dL</td>
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<tr>
<td>Glucose goal: near normal glucose and near normal hemoglobin A1c (&lt;7%)</td>
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<tr>
<td>Antiplatelet therapy: aspirin 300 mg/d if not contraindicated</td>
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<tr>
<td>Life habits: NCEP/AHA Step II diet, weight loss in overweight patients (goal body mass index 21–25 kg/m²), moderate-intensity exercise (30–60 minutes) 3 or 4 times weekly</td>
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*Includes Americans of white, Hispanic, black, and South Asian origin. May not include Americans of East Asian origin.
†Accuracy of absolute risk enhanced by substitution of noninvasive estimates of coronary plaque burden for age as a risk factor.
‡Most patients with baseline LDL cholesterol levels >130 mg/dL will require cholesterol-lowering drugs to achieve the target of therapy. When on-treatment serum LDL cholesterol is in the range of 100 to 129 mg/dL, several therapeutic options are available: increase the drug dose (or to combine with another cholesterol-lowering drug) to achieve an LDL cholesterol <100 mg/dL. To add another lipid-lowering drug to improve triglyceride and HDL cholesterol levels, or to aggressively modify other risk factors. Clinical judgment is required whether to start (or to increase the dose of) cholesterol-lowering drugs in patients >65 years old.

of CHD equivalents can be extended to other coronary asymptomatic patients at high short-term risk who also have a likelihood of experiencing a major coronary event equal to that of patients with established CHD.

One group of patients at very high risk appears to be those with type 2 diabetes. There is a growing consensus that type 2 diabetes represents a CHD risk equivalent. Not only are patients with diabetes at high risk for CHD, but once they develop CHD, their prognosis is poor. Conferring CHD risk equivalency to patients with type 2 diabetes probably holds for Americans of non-Hispanic white, black, Hispanic, and South Asian origin.

Other asymptomatic patients can be designated as having a CHD equivalent if their absolute risk for developing hard CHD is >20% in 10 years. One conceptual advance of recent European joint-society guidelines was the logic of applying similar risk reduction therapies to patients with similar risk, whether or not they manifest CHD. Application of Framingham scoring provides a method for estimating absolute risk and for defining patients who have CHD risk equivalents. The present document suggests that risk assessment can be enhanced by substituting noninvasive estimates of coronary plaque burden for age as a risk factor.

For asymptomatic patients with a CHD risk equivalent, general therapeutic recommendations for secondary prevention can be used (Table 3). Smoking cessation has a high priority. Blood pressure should be normalized, by medication if necessary. Low-dose aspirin is warranted for high short-term risk. Glucose levels and hemoglobin A1c levels should be reduced to near normal in patients with type 2 diabetes. Life habits should be modified to minimize risk. Finally, the LDL cholesterol goal is a level ≥100 mg/dL. This is the goal designated by NCEP for patients with established CHD. This goal was equated to NCEP's assessment of the optimal LDL cholesterol level as it relates to CHD risk. This assessment was based on evidence derived from epidemiological studies, coronary angiographic studies, and randomized clinical trials. Most patients with baseline LDL cholesterol levels >130 mg/dL will require cholesterol-lowering drugs to achieve the optimal LDL cholesterol. The favored drugs are the statins; the usefulness of statins has been demonstrated both for patients with established CHD and for those at high short-term risk without CHD. When LDL cholesterol levels have been reduced to the range of 100 to 129 mg/dL on standard doses of statins, several clinical options are open: to increase the statin dose (or to add a different cholesterol-lowering drug) to achieve an LDL cholesterol level of ≤100 mg/dL, to add another lipid-lowering drug (e.g., niacin acid or fibrate), to reduce triglycerides, and to raise HDL cholesterol levels or aggressively modify the nonlipid risk factors. NCEP favors the first option: some investigators opt for the latter 2.

A recurring theme of uncertainty pertains to risk assessment and risk management in elderly patients (i.e., patients >65 years old). Most investigators agree that patients in the age range of 65 to 75 years deserve management of categorical risk factors as would be done in middle age. Above age 75 years, however, decisions about choices in management depend increasingly on clinical judgment, although control of systolic hypertension in the elderly is considered essential. Framingham scoring confers a high short-term risk on a large portion of the male population between ages 65 and 75 years. These risk estimates nonetheless contain considerable uncertainty because of use of soft CHD end points and because age is a poor indicator of plaque burden for individuals. Particularly for decisions about institution of cholesterol-lowering drugs and low-dose aspirin, noninvasive estimates of plaque burden may be valuable as a replacement for age as a risk factor in global risk assessment in the elderly population.

Long-Term Primary Prevention in the Clinical Setting

A high long-term risk can be conferred either by multiple marginal risk factors or by a single categorical risk factor. As previously indicated, all categorical risk factors should be treated regardless of absolute risk status. Patients with a high risk in the long term deserve attention and intervention by physicians. One possible limitation of the current guidelines of European joint societies is failure to pay sufficient clinical attention to patients at long-term risk. These guidelines nonetheless reflect a widely held view in the cardiovascular field, a view based on 2 postulates. First is the belief that most risk can be reversed by modifying risk factors later in life; second is the belief that intervention in patients who are not at high short-term risk is not cost effective. The first idea
TABLE 4. Long-Term Primary Prevention in the Clinical Setting

<table>
<thead>
<tr>
<th>Category</th>
<th>Goal</th>
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<tbody>
<tr>
<td>Smoking</td>
<td>smoking cessation</td>
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<tr>
<td>Blood pressure</td>
<td>&lt;140/90 mm Hg</td>
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<tr>
<td>Serum cholesterol and lipids</td>
<td></td>
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<tr>
<td>Desirable LDL cholesterol</td>
<td>&lt;130 mg/dL</td>
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<tr>
<td>Very high LDL cholesterol (≥190 mg/dL)</td>
<td></td>
</tr>
<tr>
<td>Most patients will require cholesterol-lowering drugs</td>
<td></td>
</tr>
<tr>
<td>Two or more risk factors</td>
<td>(absolute risk &lt;20%/10 years for hard CHD)</td>
</tr>
<tr>
<td>LDL cholesterol goal</td>
<td>&lt;130 mg/dL</td>
</tr>
<tr>
<td>Zero to 1 risk factor</td>
<td></td>
</tr>
<tr>
<td>Acceptable LDL cholesterol</td>
<td>130 to 159 mg/dL</td>
</tr>
<tr>
<td>Elevated triglycerides (&gt;200 mg/dL) or low HDL cholesterol (&lt;35 mg/dL)</td>
<td></td>
</tr>
<tr>
<td>Emphasize weight reduction and increased physical activity</td>
<td></td>
</tr>
<tr>
<td>Consider nicoic acid or fibric acid only after LDL cholesterol goal of &lt;130 mg/dL is achieved (limited clinical trial evidence of efficacy)</td>
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Life habits: NCEP/AHA Step I diet, weight loss in overweight patients (goal: body mass index 21–25 kg/m²), moderate-intensity exercise (30–60 minutes) 3 or 4 times weekly

*Includes risk factors other than LDL cholesterol >160 mg/dL, i.e., cigarette smoking, hypertension, low HDL cholesterol (<35 mg/dL), family history of premature CHD, age (men ≥45 years, women ≥55 years or postmenopausal).*

absolute risk to the level of low-risk, younger persons; once a person has acquired a substantial burden of coronary plaque, absolute risk will remain relatively high even if risk factors are reduced. Moreover, including only patients at high risk in the short term under any circumstances has only a limited potential for reducing the burden of CHD in our society; if only the small fraction of the whole population at recognizable short-term risk is treated, the benefit to the overall population will be relatively small. Conversely, physicians have an opportunity to broaden their impact by lending their authority and expertise to long-term prevention. The second belief fails to recognize the relatively low cost of early clinical intervention for patients at risk in the long term. Long-term intervention will require some modification of the healthcare system to encourage clinicians to give more priority to primary prevention. Philosophical and institutional opposition couched in economic terms is inappropriate. The issue relates more to allocation of resources than to their availability. The health of the nation requires a broader commitment to preventive strategies.

AHA recommendations for primary prevention generally apply to patients at long-term risk (Table 4). Most important, all categorical risk factors should be managed under the care of a professional, regardless of a patient's absolute risk estimate. Efforts to achieve smoking cessation deserve highest priority. Categorical hypertension must be treated in all patients, according to current JNC reports. Healthy eating and exercise habits should be encouraged. Low-dose aspirin therapy is more difficult to justify in patients who are at high risk in the long term than in those who are in danger of developing CHD in the next few years; its side effects may

The issue of cholesterol management for long-term clinical prevention has become critical. The NCEP defines a desirable LDL cholesterol for primary prevention as a level <130 mg/dL. Thus, all persons without established CHD ideally should have an LDL cholesterol level <130 mg/dL. The recent AFCAPS/TexCAPS study demonstrated the benefit in risk reduction that would accrue from such low levels. However, because for many persons diet alone cannot achieve this target, widespread use of cholesterol-lowering drugs would be required to obtain this goal universally. NCEP therefore mandated this target for LDL cholesterol only for patients considered to be at high risk from multiple risk factors. Essentially, 2 major risk factors (excluding elevated LDL cholesterol but including advancing age) are selected as the level of risk that warrants medical intervention to achieve an LDL cholesterol of <130 mg/dL. For patients with <2 risk factors, an LDL cholesterol level reduced to the range of 130 to 159 mg/dL was considered acceptable although not desirable. Most patients with an LDL cholesterol level >190 mg/dL will require a cholesterol-lowering drug to achieve NCEP's goal. If a patient has an elevated serum triglyceride (>200 mg/dL) or a low HDL cholesterol (<35 mg/dL), weight reduction (in overweight patients) and increased physical activity should be encouraged. Triglyceride-lowering drugs should be used for long-term primary prevention only after an LDL cholesterol of <130 mg/dL has been achieved. Clinical trial support for triglyceride-lowering therapy in primary prevention is limited.

Some authorities essentially equate clinical management with pharmacological therapy. This oversimplification should be resisted for primary prevention. The physician can play an important role in the application of nondrug therapy in prevention. Physicians and ancillary personnel (nurses, physician assistants, and dietitians) can and should facilitate and support patients in their efforts to favorably modify lifestyle habits. Importantly, the borderline between drug therapy and nondrug therapy is becoming increasingly blurred. Use of antihypertensive agents and cholesterol-lowering drugs at low doses, along with novel approaches to risk-factor reduction, promise to bridge the gap between drug and nondrug therapies. Physician involvement in the application of these measures offers the greatest assurance that this combination of approaches will be used appropriately.

**Lifetime Primary Prevention**

The success of recent secondary prevention trials of statin therapy mandates more emphasis on high-risk primary prevention. The selection of patients for intensive risk-reducing therapy has become a prime issue and is the major focus of the present article. The fact remains, however, that reduction of the clinical burden of CHD in the United States and other high-risk populations requires broad application of risk-reduction strategies. These include 4 categories of life habits: cigarette smoking, diet composition, body weight, and physical activity. Each deserves a major public health commitment and can be examined briefly.

**Cigarette Smoking**

Smoking remains a major cause of CHD. It promotes the
plaque rupture and coronary thrombosis. It accelerates the development of peripheral arterial disease. Efforts to achieve smoking cessation by physicians are worthwhile. Aggressive urging by physicians will convince some patients to give up the smoking habit. Although clinical efforts for smoking cessation are important, the public health approach nevertheless holds greater promise overall. Involvement by government at every level and by health-related organizations is necessary and has reduced the proportion of the American population that smokes. However, not all the news is good. The apparent increase in smoking among American teenagers and women is alarming and a reminder of the necessity to sustain and expand public health efforts. Finally, the export of American tobacco to other nations and the tobacco industry's promotion of smoking worldwide are a national scandal.

Diet Composition
The American diet is far from ideal for CHD prevention. Advances nonetheless have been made in reducing intakes of dietary cholesterol and cholesterol-raising fatty acids. The latter include saturated fatty acids and trans-fatty acids. Decline in population intake of cholesterol-raising nutrients has decreased average serum cholesterol levels in the United States and probably has contributed to the age-adjusted fall in CHD. Current intakes of saturated plus trans-fatty acids account for ~14% of total energy in the US diet. If this intake could be cut in half, serum cholesterol levels would fall by another 10%, reducing lifetime risk of CHD by another 25%. Recent research suggests that dietary adjuncts may facilitate serum cholesterol lowering beyond what can be achieved by modifying diet composition; most promising are the stanols esters, which reduce absorption of cholesterol entering the intestine. Other changes in diet composition may help to prevent CHD. Many investigators believe that lower intakes of salt and increased consumption of fruits, vegetables, fiber, ω-3 fatty acids, and antioxidants will protect against CHD. This belief is supported by prospective epidemiological studies, but so far, it lacks verification from large controlled clinical trials.

Obesity
The prevalence of obesity in the United States is high and increasing. Obesity is the major factor underlying insulin resistance and the metabolic syndrome. It must be considered the foremost predisposing risk factor for CHD in the American population. The public health challenge to control body weight rivals that for prevention and cessation of smoking. The leading cause of obesity is an excessive intake of energy, but sedentary life habits contribute as well. Multiple factors underlie obesity, and multiple changes in American culture will be required to bring it under control.

Physical Inactivity
Most Americans practice sedentary life habits and suffer the consequences: obesity, increased insulin resistance, metabolic risk factors, earlier onset of type 2 diabetes, poor cardiovascular fitness, and impaired body function. Several prospective studies reveal physical inactivity to be a regular activity appear to protect against CHD. Changing American society to promote physical activity is a priority for the public health prevention of CHD.

In summary, the time is ripe to integrate high-risk primary prevention into standard clinical practice. The tools for risk assessment and for management of the high-risk patient are available. However, the issue of high-risk primary prevention should not divert attention from lifetime prevention; population-wide, lifetime prevention is the larger challenge and promises more in return.

References
Grundy

Primary Prevention of Coronary Heart Disease


37. Stroebel G, Engle E, Kristensen JS, Thulow E. Natural history of coronary


**Key Words:** coronary disease ■ risk factors ■ prevention