
A Critical Review of Adult Health Maintenance

Part 1: Prevention of Atherosclerotic Diseases

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This is the first paper in a four-part series that presents an updated protocol for selective longitudinal health maintenance of asymptomatic adults. Five conditions related to atherosclerotic diseases are reviewed with reference to six generally accepted screening criteria. A recommendation is made for each condition and is compared, when appropriate, with the recommendations of the Canadian Task Force on the Periodic Health Examination. In the fourth paper, the recommendations will be combined into a practical health maintenance flow sheet for use by primary care physicians.

Health maintenance and the prevention of disease is one of the most important tasks of the primary care physician. It is not always easy, however, for the physician to know what preventive measures are worthwhile and how often they should be done. In 1975 a critical review of the evidence to support screening for specific diseases in asymptomatic healthy adults was published.¹⁻⁴ Six specific criteria (outlined in the Methods section) were used, all of which had to be met before screening for a given disease was justified. Also specified were appropriate screening intervals for each disease throughout the patient's lifetime. The concept of a rational selective longitudinal health maintenance program was advocated as a replacement for the traditional annual complete physical examination.

Since then, selective longitudinal health maintenance has come to be accepted by the mainstream of medicine. In 1977 Breslow and Somers⁵ added the concept of health maintenance goals for each age group. In 1979 the Canadian Task Force on the Periodic Health Examination issued its comprehensive report, which specified the quality of evidence for each

recommendation.^{6,7} The Canadian Task Force continues to update its recommendations on an ongoing basis.⁸ In 1980 the American Cancer Society published recommendations for cancer screening.⁹ A United States preventive services task force convened by the Department of Health and Human Services is currently in the process of formulating yet another set of health maintenance recommendations. Concepts of selective longitudinal health maintenance have been endorsed by many organizations including the American Medical Association¹⁰ and the American College of Physicians.¹¹

It is necessary and proper that health maintenance recommendations be updated periodically in consideration of new research and evidence. The best health maintenance protocol, however, is worthless unless it is used on a day-to-day basis by primary care physicians on a large percentage of their patients.

Practicing physicians require a concise practical protocol that will tell them at a glance what tests need to be done on any given patient. Including marginal tests of uncertain benefit wastes precious time and money and make it less likely that physicians and patients will comply with the program.

The purpose of this series is to provide primary care physicians with an updated health maintenance protocol for asymptomatic adults that can be used in the day-to-day practice of medicine. The rationale for each recommendation is given as well as references, which allow the reader to investigate any topic in greater depth.

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METHODS

A list of 30 conditions was assembled for review, including five related to atherosclerotic diseases. Conditions were chosen from those discussed by previous authors¹⁻⁹ where there seemed to be significant evidence for inclusion in a health maintenance protocol or at least some controversy that they should be included. Each condition was reviewed to determine whether it fulfilled six criteria necessary for inclusion in a health maintenance protocol:

1. The condition must have a significant effect on the quality or quantity of life.
2. Acceptable methods of treatment must be available.
3. The condition must have an asymptomatic period during which detection and treatment significantly reduce morbidity or mortality.
4. Treatment in the asymptomatic phase must yield a therapeutic result superior to that obtained by delaying treatment until symptoms appear.
5. Tests that are acceptable to patients must be available at reasonable cost to detect the condition in the asymptomatic period.
6. The incidence of the condition must be sufficient to justify the cost of screening.

It is necessary for a disease to meet all six criteria before inclusion in the health maintenance plan. Failing a single criterion is adequate reason for exclusion.

The literature was searched for each condition with particular reference to (1) the incidence and prevalence of the disease, (2) progression of the disease both with and without treatment including the length of any asymptomatic period, (3) risk factors associated with the development of the disease, and (4) the availability, effectiveness, and cost of screening tests or preventive procedures.

The study considered only health maintenance for the hypothetical totally asymptomatic adult. Conditions affecting only minority groups or persons with specific chronic diseases were not reviewed. A number of conditions, including some reviewed in the 1975 articles,¹⁻⁴ were not formally reviewed if there was no substantial evidence they would fulfill the necessary criteria.

A brief discussion of the rationale for or against including each condition in a health maintenance program is presented and a specific recommendation is compared with the most recent recommendation of the Canadian Task Force on the Periodic Health Examination (CTF).^{6,8}

CORONARY HEART DISEASE

Recommendation. Screen for and reduce risk factors including tobacco use, elevated serum cholesterol, and hypertension. Routine electrocardiograms are not indicated.

Canadian Task Force. No screening is recommended for coronary heart disease. Treatment of hypertension is recommended for other reasons.

An estimated 4.6 million people in the United States (about 2 percent of the population) have coronary heart disease.¹² The death rate in 1976 was 272 per 100,000 men and 127 per 100,000 women.¹³ It is the most common cause of death in this country, accounting for one third of deaths from all causes.

Coronary heart disease is most common in middle age. The peak incidence occurs between ages 55 and 65 years. Risk factors include male sex, genetic predisposition, hypertension, cigarette smoking, elevated serum cholesterol, diabetes, lack of exercise, obesity, and psychosocial stress.

The natural history of coronary heart disease includes a long asymptomatic period during which atherosclerosis of the coronary arteries develops, followed by a clinical presentation of myocardial infarction (45 percent), angina pectoris (23 percent), sudden death (11 percent), or the incidental diagnosis while still asymptomatic (16 percent).¹⁴

Between 1963 and 1981 coronary heart disease mortality decreased 35 to 40 percent.¹⁵ This decrease in mortality is continuing to the present time. Goldman and Cook¹⁶ analyzed this trend and attribute 60 percent of the decrease to lifestyle changes in the general population, specifically, dietary changes producing lower serum cholesterol levels and decreased cigarette smoking. Forty percent of the decrease is estimated to be due to medical interventions, such as treatment of hypertension, and better medical and surgical treatment for the patient with symptoms of coronary heart disease.

Attempts to prevent coronary heart disease have focused on reducing amenable risk factors including hypertension, hyperlipidemia, cigarette smoking, sedentary lifestyle, obesity, and stress. The most important of these, hypertension, hyperlipidemia and smoking, are considered in separate sections of this paper.

Several large prospective studies have attempted to demonstrate reductions in coronary heart disease mortality by reducing multiple risk factors. The Multiple Risk Factor Intervention Trial (MRFIT)¹⁷ compared a study group of high-risk men receiving special treatment for hypertension, counseling regarding quitting smoking, and dietary therapy to reduce serum cholesterol with a control group of high-risk men receiving their usual care in the community. Both groups had a significant decrease in mortality overall and from coronary heart disease. Because significant risk factor reduction occurred in the control group, however, the differences in mortality between the two groups was not statistically significant. In both groups persons who quit smoking had significantly lower rates of coronary heart disease.

The Oslo study,¹⁸ a controlled study of reducing cholesterol and cigarette consumption in normotensive

men, had more dramatic and positive results. A 13 percent greater reduction in cholesterol levels was obtained in the study group compared with the control group, and tobacco use was 45 percent lower. The incidence of myocardial infarction and sudden death was 47 percent lower in the study group at the end of the five-year observation period.

In general, studies have shown a significant benefit from lowering cholesterol levels and tobacco use on mortality from coronary heart disease. With the exception of one major study,¹⁹ it has been difficult to show a beneficial effect on mortality from treating hypertension,^{15,20} despite hypertension being an established risk factor for coronary heart disease.²¹ Many experts feel the nationwide decrease in mortality from coronary heart disease correlated with concurrent dietary changes, less tobacco use, and better treatment of hypertension, provides the best proof that risk factor reduction is effective.

No trials of medical or surgical treatment for coronary heart disease in asymptomatic persons other than risk factor reduction have been reported. The electrocardiogram (ECG) is not recommended as a routine screening examination for coronary heart disease because of its low sensitivity for presymptomatic disease^{22,23} and the fact that finding an ECG abnormality in the asymptomatic individual does not lead to any further treatment other than risk factor reduction, which is already recommended. A baseline ECG for latter comparison if the patient presents with equivocal symptoms has been advocated²⁴ even though supporting evidence is lacking.²⁵ Rubenstein and Greenfield²⁶ showed that such a baseline ECG, if available, is useful in managing only a very small percentage of patients with chest pain.

Exercise ECGs are more sensitive for coronary heart disease than are resting ECGs. In a population that has a low prevalence for coronary heart disease, however, positive results are more likely to be false positives than true positives.²⁷ Furthermore, in the asymptomatic person risk factor reduction is still the only treatment. Exercise ECGs may be indicated in high-risk groups, especially those planning to engage in strenuous physical activity.

Regular exercise is commonly believed to prevent coronary heart disease. Population-based studies have given mixed results, but two thirds of studies reported show a positive association between habitual exercise and reduced rates of coronary heart disease.^{28,29} Prospective studies of prescribed exercise for prevention of coronary heart disease have not been done because of poor exercise compliance, the large number of patients required, and the difficulty of maintaining a nonexercising control group.²⁸

Prospective studies of exercise programs with patients who have suffered a myocardial infarction have not demonstrated a reduced rate of recurrent cardiovascular events or mortality.^{30,31}

It is prudent to encourage people to exercise. In

addition to probably preventing coronary heart disease, exercise is inversely related to obesity, hypertension, and total serum cholesterol. High-density lipoproteins are increased by exercise. It is unjustified, however, to claim that exercise, especially in patients with pre-existing coronary heart disease, will prevent further morbidity or mortality.

TOBACCO ABUSE

Recommendation. A history of tobacco use should be obtained when the patient is first seen and every ten years thereafter to the age of 40 years.

Canadian Task Force. Screening for tobacco use is not recommended.

Cigarette smoking may not be a disease itself, but it is clearly the largest single preventable cause of illness and premature death in the United States. Cigarette smokers have 1.7 times the risk of death from all causes as nonsmokers.³² Thirty percent of coronary heart disease is attributed to cigarette smoking.³³ Eighty percent of lung cancer is due to cigarette smoking.³⁴ Cigarette smoking is the major cause of emphysema. It is a significant risk factor for cerebrovascular and peripheral vascular disease as well as cancer of the larynx, esophagus, oral cavity, bladder, and pancreas.³²

Pipe and cigar smokers do not have the risk of vascular disease and emphysema that cigarette smokers have, but they do have an increased risk of cancer of the oral cavity and esophagus.³²

The great majority of smokers start smoking before the age of 21 years.³² In 1978, 36 percent of the US population smoked cigarettes. A significant reduction in cigarette smoking has occurred among men. Fifty-two percent of men smoked cigarettes in 1958, declining to 39 percent in 1978. During the same period the number of women smoking remained stable at 34 percent.³² Risk factors for smoking include male sex, lower socioeconomic class, urban locale, religious beliefs, and most important, the parents' smoking behavior.

Although smoking is unquestionably a major cause of much morbidity and mortality, some groups have been reluctant to recommend screening for tobacco use because of a belief that efforts to reduce smoking are not effective.⁶ Benfari and co-workers,³⁵ reviewing the many smoking cessation techniques that have been tried, report that any intervention can be effective. Short-term smoking cessation rates of 70 to 80 percent are not unusual, but long-term rates deteriorate to 20 to 40 percent. Smoking cessation may be the result of many stimuli of which the physician should be a part.

Not only can smokers quit, but most important, it has been shown that ex-smokers have decreased mortality. Rose and colleagues³⁶ report a ten-year con-

trolled trial of antismoking advice by physicians. At the end of ten years there was 53 percent less smoking in the study group compared with controls. Coronary heart disease mortality was 18 percent lower and lung cancer mortality was 23 percent lower in the study group. The MRFIT study¹⁷ found 47.8 percent fewer deaths among ex-smokers than predicted.

The detection of cigarette smoking requires only that the appropriate question be asked. Since most smokers start before the age of 21 years, the frequency with which questioning is done is arbitrary. Intervention can help smokers quit. Ex-smokers have decreased risk for coronary heart disease and lung cancer and probably for other diseases.

HYPERCHOLESTEROLEMIA

Recommendation. The total serum cholesterol level should be determined every four years in adults aged under 70 years.

Canadian Task Force. Screening for hypercholesterolemia is not recommended.

The blood lipids can be divided into several different components, including very low density lipoproteins (VLDL), low density lipoproteins (LDL), high density lipoproteins (HDL), and triglycerides.

Sixty to 80 percent of serum cholesterol is contained in the LDL fraction.³⁷ Many studies have shown that high levels of LDL and total serum cholesterol are strong risk factors for atherosclerosis at all sites and especially increase the risk of coronary heart disease.²¹ Total cholesterol is a mirror of LDL at all ages.³⁷ In contrast, VLDL and triglycerides have not been shown to be independent risk factors for atherosclerosis. HDL cholesterol is inversely related to coronary heart disease, but this finding does not negate the strong positive association between LDL total serum cholesterol and atherosclerosis.

For screening purposes in the general population, there is no reason to use any measure of blood lipids other than total cholesterol. All the major studies of coronary heart disease reduction have used total cholesterol as the basic reference measurement.

Abnormal cholesterol levels are usually defined with reference to the distribution of cholesterol levels in a given population. Cholesterol levels tend to increase with age. In the United States levels above either the 90th or 95th percentile for age are usually considered abnormal, which means over 250 mg/dL (90th percentile) or 270 mg/dL (95th percentile) is abnormal for persons aged between 40 and 50 years.³⁸ Mean serum cholesterol levels have decreased 6 to 8 mg/dL in the United States between 1959 and 1974.¹⁶ This decline is thought to be a major factor in the decreasing incidence of coronary heart disease.

The main reason to detect and treat hypercholes-

terolemia is the prevention of coronary heart disease. Although it has been well established that elevated cholesterol increases risk for coronary heart disease, it has been controversial whether meaningful reduction of cholesterol levels is possible and whether reducing cholesterol decreases mortality and morbidity from coronary heart disease.^{39,40} Two studies in the mid-1970s using the drug clofibrate produced disappointing results.^{41,42} In the World Health Organization cooperative study⁴² a 9 percent reduction in cholesterol was obtained, yet there was no difference in the rate of fatal myocardial infarctions between the study and control group, and the number of deaths from all causes was higher in the clofibrate group. The study group had a significant increase in gallbladder disease.

More recently, a number of studies have shown that cholesterol can be lowered and that lowering cholesterol decreases coronary heart disease mortality. The Western Electric study⁴³ showed a relation between a low cholesterol diet and lower serum cholesterol as well as decreased mortality from coronary heart disease. The Oslo¹⁸ and Finnish studies⁴⁴ showed dietary reduction of cholesterol and saturated fats to yield lower mortality from coronary heart disease.

The Lipid Research Clinics study⁴⁵ compared a study group using cholestyramine plus diet with a control group using diet alone to reduce cholesterol. The study group had a mean 23-mg/dL fall in serum cholesterol. They had a 24 percent decrease in death from coronary heart disease compared with the control group. No increase in gallbladder disease was noted in this study.

Thus in 1986 there is evidence both from prospective studies and the epidemiology of decreasing mortality from coronary heart disease in the population that lowering serum cholesterol by dietary change and possibly such drugs as cholestyramine is effective in preventing coronary heart disease.

HYPERTENSION

Recommendation. Blood pressure should be determined on all adults every two years.

Canadian Task Force. Blood pressure should be recorded on any visit to a physician, not just at periodic health examinations.

Hypertension is an established risk factor for atherosclerosis at all sites and is also a major cause of congestive heart failure, renal failure, and retinopathy of the eye.^{21,46}

The overall prevalence of hypertension, defined as a diastolic pressure greater than 95 mmHg, is 37 percent of blacks and 18 percent of whites aged 30 to 69 years.⁴⁷ Women and men are equally affected; however, hypertensive women are more likely to have

their blood pressure adequately controlled.

The classic Veterans Administration cooperative study⁴⁶ demonstrated a dramatic benefit from treating moderate and severe hypertension (diastolic blood pressure greater than 104 mmHg). The study showed a significant decrease in morbidity and mortality from congestive heart failure, stroke, hypertensive renal disease, and retinopathy. It did not demonstrate a reduction of complications from coronary heart disease.

Subsequent studies have confirmed these results.^{17,20,48} In particular most studies have not shown a reduction in coronary heart disease from treating mild hypertension (diastolic blood pressure less than 104 mmHg). In fact, in the MRFIT study¹⁷ there was a slight excess mortality among patients with mild hypertension treated with thiazide diuretics.

One major study, the hypertension detection and follow-up program,¹⁹ did show a major reduction of 20 percent fewer deaths from coronary heart disease in the study group compared with controls.

There is general agreement that hypertension should be screened for in a health maintenance program and that moderate and severe hypertension should be vigorously treated. There is considerable debate about whether mild hypertension should be treated with antihypertensive medications.⁴⁹⁻⁵¹

STROKE

Recommendation. The detection and treatment of hypertension is the best method of preventing stroke. Auscultation for carotid bruits is not indicated as a screening procedure.

Canadian Task Force. Same recommendation.

Stroke is the third leading cause of death after heart disease and cancer. The overall incidence in the United States is 140 per 100,000 population.⁵² The incidence rises with age from 3.3 per 100,000 persons aged under 35 years to 1,800 per 100,000 persons aged over 85 years. The vast majority of strokes (80 percent) are caused by thrombosis of the cerebral circulation, 12 percent are due to hemorrhage, and 5 percent are embolic. Thirty percent of stroke patients die within 30 days, and only 57 percent are alive six months after the stroke.⁵² Major risk factors for stroke include hypertension, diabetes, and heart disease, including coronary artery disease, rheumatic heart disease, and congestive heart failure.⁵³

There has been a 25 percent decrease in stroke mortality between 1969 and 1979.⁵³ This decrease is felt to be largely due to the better control of hypertension and the decline in coronary heart disease.

Detection of hypertension, which is discussed elsewhere in this paper, is the best method of preventing stroke.^{53,54} Control of hypercholesterolemia and

cigarette smoking, both risk factors for atherosclerosis, has not been shown to have much effect on preventing strokes except perhaps indirectly through the prevention of heart disease.⁵³

Other methods of preventing strokes in asymptomatic people involve the identification and treatment of carotid artery narrowing. About 4 percent of persons aged over 45 years have a carotid bruit.^{55,56} People with a carotid bruit have a 2 percent risk of stroke per year⁵⁵; however, many of the strokes in people with bruits do not occur in the area of the brain supplied by the vessel with the bruit.^{55,56} Persons with a carotid bruit have an increased incidence of myocardial infarction as well as stroke. Thus it is felt that carotid bruits are more often a nonspecific sign of generalized atherosclerosis than a specific cause of stroke.

Studies have not shown that treatment of persons with asymptomatic carotid bruits either medically with aspirin or by anticoagulation or surgically by carotid endarterectomy reduces morbidity or mortality.⁵⁷

Recently more sophisticated methods of measuring carotid artery obstruction, such as Doppler ultrasonography and digital subtraction angiography, have been developed. These tests are expensive and have not been tested as routine screening procedures. Roederer et al⁵⁸ reported following 167 patients with asymptomatic carotid bruits by duplex ultrasonography. Four percent of patients developed symptoms each year. Younger patients tended to have more progression than older patients. Persons with 80 percent or greater stenosis of the carotid artery had an especially high risk. Forty-six percent of these patients became symptomatic within one year. Carotid endarterectomy might potentially benefit asymptomatic patients in high-risk subgroups, but its efficacy must be carefully tested, since the procedure itself has a 2 to 16 percent complication rate.⁵⁷

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