

Cardiovascular disease is the most common cause of death among elderly (i.e., age 65 or older) Americans. In the general population, an elevated serum cholesterol level is associated with an increased risk of contracting and dying from cardiovascular disease. This paper reviews the evidence that elevation of serum cholesterol (hypercholesterolemia) is an independent risk factor for cardiovascular disease in the elderly and that the detection and treatment of hypercholesterolemia in an elderly individual who does not have clinically apparent heart disease will diminish overall morbidity or mortality. It also estimates health care expenditures associated with screening and treatment of hypercholesterolemia in the elderly.

Cholesterol and Heart Disease in the Elderly

Cholesterol is a fat, or lipid, that circulates in the bloodstream bound to proteins in complexes called lipoproteins. Cholesterol-containing lipoproteins are generally grouped into four categories, each containing different proportions of cholesterol, other lipids, and proteins. Low-density lipoproteins (LDLs) are 50 to 60 percent cholesterol; high-density lipoproteins (HDLs) are only 18 to 25 percent cholesterol; very low-density lipoproteins (VLDLs) contain between 20 and 30 percent cholesterol; and chylomicrons are only about 2 percent cholesterol (15). The serum cholesterol is the total amount of cholesterol circulating in all molecular forms.

Prolonged hyperlipoproteinemia or hyperlipidemia (elevated levels of lipids in the blood) has long been thought to contribute to the risk of heart disease. Hypercholesterolemia--long believed to be the most important form of hyperlipidemia--has been shown to be a major risk factor for coronary

heart disease (CHD) in middle-aged men. However, epidemiologic studies suggest that the cholesterol level does not have the same significance as a risk factor for cardiac disease in the elderly as in middle-aged and younger populations. Relatively few studies have addressed whether the cholesterol level at age 65 or older predicts CHD risk; the results of these are conflicting and vary with gender. Almost all studies of elderly men failed to find an association between cholesterol level and CHD incidence or mortality (4,5,8,22,44,115,126). The single exception was conducted on a population with a very low CHD mortality rate (13). In elderly women, cholesterol level was found to predict CHD or CHD mortality (13,51,115, 126). Although it is not certain why cholesterol might be a better predictor of CHD or CHD mortality in elderly women than in elderly men, women begin to develop symptoms of CHD at more advanced ages than men, so from the standpoint of cardiac disease, an elderly woman may bear risks similar to those of a middle-aged man. It is possible that future studies, conducted in populations with lower rates of CHD mortality, may confirm that cholesterol is a risk factor in both elderly men and women, but today the evidence that cholesterol is an important CHD risk factor at advanced ages remains equivocal.

Whatever its association with CHD incidence or mortality, the cholesterol level does not appear to be an independent predictor of overall survival in the elderly. The few studies that investigated this issue found either that the cholesterol level does not predict total mortality at all (5,8,13) or that it is a statistically significant predictor of lower mortality (115). Since the cholesterol level is not associated with mortality in the elderly, and since the development of CHD is only

weakly associated with the cholesterol level, the epidemiologic evidence does not confirm that detecting and treating hypercholesterolemia in the elderly will increase their longevity.

The HDL level may be a better predictor of cardiac risk in the elderly (higher levels indicating lower risk). However, HDL assays in routine clinical use are not well standardized. Because of the resulting inaccuracies, the HDL level may not predict cardiac risk as accurately as the well-standardized HDL assays used in the epidemiologic studies that have found an association between HDL and cardiac risk.

Treatment of High Cholesterol In the Elderly

The effects of cholesterol-lowering treatment in the elderly have not been studied extensively. In middle-aged men without evidence of heart disease, treatment of hypercholesterolemia lowers CHD incidence and CHD mortality but has not been shown to affect overall survival. In the elderly, the efficacy of cholesterol reduction has not been tested, and the adverse effects of treatment may be more frequent and more severe. Consequently, there is no firm evidence to suggest that cholesterol screening and subsequent treatment would prolong the lives of elderly individuals who have no evidence of heart disease.

Costs of Screening and Treatment

Recommendations for periodic cholesterol screening have recently been promulgated by the National Heart, Lung, and Blood Institute's National Cholesterol Education Program (NCEP) (116). These recommendations call for a total cholesterol determination at least every 5 years beginning at age 20. They also specify diagnostic followup and treatment regimens for individuals identified at screening with high cholesterol levels. OTA estimated the annual health care ex-

penditures implied by the NCEP protocol if the protocol were fully implemented in the elderly population. This model estimates the national health care expenditures associated with full compliance with the NCEP screening and treatment regimens.

The estimates of national health expenditures represent total incremental health expenditures associated with cholesterol screening and subsequent treatment of those requiring it in the asymptomatic elderly population compared to no screening or treatment in that population. Because many elderly people are presently screened and treated for high cholesterol, some of these costs are already incurred today. A Medicare cholesterol screening benefit would further increase cholesterol screening and treatment rates and the health care costs associated with them.

Expenditures for actual screening are relatively low compared to the costs of treating hypercholesterolemia; hence, total health care expenditures associated with the NCEP protocols are very sensitive to the costs of medications. Full compliance with NCEP screening and treatment protocols would result in treatment, either with diet or medication, of between 47 and 57 percent of the elderly population. In 1995, total health care expenditures associated with the NCEP protocols for cholesterol screening and treatment of the elderly would be between \$2.9 billion and \$14.3 billion (in 1988 prices) depending on the prevalence of certain risk factors in the elderly and the mix of medications prescribed by physicians treating elderly patients with hypercholesterolemia.

Whether the elderly would fully comply with cholesterol screening and treatment regimens even under full Medicare funding is questionable, so the actual impact of NCEP or Medicare coverage on health expenditures is probably substantially less than the estimates imply. For example, if only 25 percent of the elderly were to comply with the screening and treatment protocols specified by the NCEP, national health care

expenditures for cholesterol screening and treatment of the elderly would range between \$800 million and \$3.6 billion in 1995. It is worth noting, however, that the extent to which the actual costs of the NCEP protocol turn out to be lower than the costs estimated for full compliance is a reflection of the failure of the NCEP to achieve its stated goal of full participation in cholesterol screening.

Implications for Medicare

Medicare currently pays 80 percent of allowed charges after the beneficiary has met an annual deductible. Assuming that Medicare similarly were to pay 80 percent of screening expenditures, Medicare costs for screening only (not including treatment) would be roughly \$46 million in 1995. In addition, Medicare would pay 80 percent of allowed charges for physician services and diagnostic procedures necessary for monitoring drug therapy, which would range from

about \$250 to \$550 annually for each treated individual. If the entire elderly population were to comply fully with the NCEP guidelines, Medicare expenditures for testing and monitoring would range from \$1 billion to \$5.4 billion in 1995, depending on the frequency of risk factors and the monitoring required for prescribed medications. With a 25 percent compliance rate in the elderly, Medicare's expenditures (net of outpatient prescription drug benefits) would be reduced proportionately to between \$261 million and \$1.3 billion. Under the recently enacted Medicare Catastrophic Coverage Act of 1988 (Public Law 100-360), Medicare would also likely bear some portion of the cost of drugs used to treat hypercholesterolemia. Although some cholesterol-lowering drugs by themselves are unlikely to cause beneficiaries' drug expenses to exceed the required deductible, many elderly taking cholesterol-lowering drugs would qualify for the drug benefit because they use multiple prescription medications.