The development of many strategies for the prevention of cardiovascular disease (CVD) presents an important policy question for society: do the benefits of these programs and interventions justify the investment in them? Preventive strategies may provide attractive opportunities to avoid or defer disease and disability, but they may have substantial costs and must often be applied to many subjects in order to reach the few in the group who will benefit the most. Whether and how limited health care dollars should be allocated to these activities is therefore an important area of inquiry for health care policy makers and practitioners.

Economic considerations now dominate the health care policy debate. Purchasers of health care have limited resources and thus must determine the “value” of the services of their spending decisions. The expanding array of CVD preventive options, including novel markers of risk, new imaging modalities, and innovative interventions, has drawn particular attention as the pressure on health care budgets increases. Currently, the U.S. uses almost 14% of its gross domestic product (GDP) on health care reaching more than $1.5 trillion per year (1). Health care inflation, initially stabilizing in the mid-1990s, is again increasing at a more rapid rate than the general consumer price index (2), leading to marked increases in health insurance premiums (3). In this economic environment, the failure of cardiologists to take economic issues seriously may place their patients at a distinct disadvantage in competing for scarce health care resources with patients who have, or are at risk for, other disease. Arguments in favor of the allocation of resources for CVD prevention will increasingly need to be supported by evidence of the value of the investment. Guideline committees need to consider the economic implications of their recommendations and appeal not only to evidence of the effectiveness of specific strategies but also to their value from a societal perspective. Policy will not be based on this information alone, but the information will be necessary to persuade care purchasers of the worthiness of these activities.

In this discussion, what is currently known about the value of selected preventive strategies for atherosclerotic disease is reviewed, referring to the extra dollars spent on a given program or intervention to produce extra health benefits. In this context, what extra benefits these strategies are producing, what they cost to produce these benefits, and the ratio of the cost to the benefit are examined. Controversies in this field that relate to valuing health care are also considered. A proposal for an integrated policy designed to determine the value of CVD prevention is presented in conclusion.

**COST-EFFECTIVENESS ANALYSIS OF PREVENTIVE STRATEGIES: BRIEF OVERVIEW**

A challenge for a society with finite resources is to determine which interventions and programs have the most value. An approach to measuring value is to determine which interventions yield the best extra or incremental benefits (e.g., most quality-adjusted life-years [QALYs], most years free from pain, and longest life in years) relative to the extra resources (costs) required to produce those benefits. Cost-effectiveness analysis is the most widely used approach for the economic analysis of medical strategies and interventions. It provides a way to compare incremental costs and benefits, typically summarized as a cost-effectiveness ratio (cost per unit of health outcomes achieved).

Interventions that improve outcomes and decrease, or do not change, costs are ideal yet all too rare. Strategies that increase costs and worsen outcomes are easy to reject. The challenge involves those strategies that improve outcomes but require extra resources. Cost-effectiveness analysis provides an approach for the ranking of the relative value of these options. When common definitions of health outcomes are employed, it is possible to compare the opportunity costs of various choices. “Opportunity costs” are the value forgone by devoting resources to a given activity rather than to their best alternative use.

For these ratios, no specific value ensures that a designation will be “cost-effective”—the distinction is relative and
depends largely on the amount of money available to spend on health care. For example, countries that spend a low proportion of their GDP on health care (such as the United Kingdom) would be expected to use a much lower threshold to define what is economically attractive or “cost-effective” than countries such as the U.S., that invest many more dollars in health care. Regardless of the absolute benchmarks used, the important concept is one of comparative value. With a certain, fixed amount of money allocated to health care, a policy maker is concerned with getting the greatest health return on the investment. Therefore, spending on health interventions that produce many benefits for a modest investment would always be preferred, in theory at least, over expensive interventions that produce modest benefits. Moreover, meaningful comparisons of value cannot be made against an absolute benchmark; rather, they must be measured in terms of alternative investment opportunities forgone. Thus, cost-effectiveness studies—when conducted correctly—are incremental in that they compare the added cost of achieving an additional unit of outcome by switching between therapeutic options. A judgment about what constitutes a reasonable return on investment depends on the total budget available and a person’s role (e.g., purchaser, patient, caregiver, patient family member).

Many studies have pursued economic analyses of CVD-preventive strategies. These studies have generally focused on the incremental cost of an intervention per incremental unit of health outcome and thus may be compared with other common medical interventions (4). To provide a survey of cost-effectiveness analyses performed for strategies to prevent CVD, articles were identified describing cost-effectiveness of lipid lowering, hypertension treatment, smoking cessation, diabetes treatment, and exercise using Medline covering the period from 1967 to 2001. The review of the bibliographies of retrieved articles was used to identify additional candidate articles. Studies of cost-effectiveness were included if they calculated an incremental cost-effectiveness ratio in terms of cost per year of life saved or QALY gained. All costs were converted to 2001 U.S. dollars using time-specific currency conversion rates and the U.S. GDP deflator inflation index.

Lipid lowering. Several economic analyses of randomized trial data have documented the economic attractiveness of drug treatment compared with placebo (Tables 1 and 2). The cost-effectiveness of the drug treatment is strongly associated with the underlying risk for the patients, the effectiveness of the drug and its cost. In general, pre–statin drug therapy studies showed very modest lipid lowering and equally modest reductions in major clinical events. In contrast, 3-hydroxy-3-methylglutaryl–coenzyme A reductase inhibitors (“statins”) are much more effective in reducing low-density lipoprotein (LDL)–cholesterol, with average reductions in the range of 20% to 25%. Corresponding relative reductions have been seen in clinical events. In economics, however, absolute rather than relative differences determine the results of cost-effectiveness analysis. Thus, a 20% reduction in mortality may save one life per thousand treated in a very low-risk population and five lives per hundred in a high-risk population. Granted that the cost of a year of statin therapy will be about the same in these two cases, it is clear that the 20% reduction in the high-risk patients will be much more economically attractive. In published studies, statins save lives at what is considered a reasonable cost (less than $50,000 per year of life saved) except for primary prevention in non–high-risk individuals. The cost of the drug is the other important factor, and the cost-effectiveness of this intervention will improve as less expensive generic drugs become available.

Non–pharmacological therapy has also been shown to be economically attractive. A low-cholesterol, low-fat diet has been shown to be an efficient first step in treatment for primary prevention for individuals with additional risk factors (5). An analysis of numerous combinations of risk factors by Prosser et al. (5) found that diet therapy was highly cost-effective compared with no therapy for elderly men age 75 to 84 with four risk factors (cost-effectiveness ratio $2,000/QALY) and moderately cost-effective for young women age 35 to 44 if they had three or more risk factors (smoking, elevated blood pressure, elevated LDL, low high-density lipoprotein [HDL]). However, the addition of a statin to a step 1 diet can be expensive. The cost-effectiveness ratio was less than $50,000/QALY only in patients with multiple risk factors, and in those without risk factors it was greater than $140,000/QALY.

The cost of lipid lowering used in these analyses was usually the wholesale price. However, the studies did not routinely examine the impact of a statin cost when the patent expires. A study using the Coronary Heart Disease Policy Model estimated that a 50% decrease in drug cost would reduce the cost-effectiveness ratio by 44% to 55% (5). Thus, the cost-effectiveness of statin treatment will be more favorable as generic drugs become available.

Smoking cessation. All published studies of smoking cessation interventions indicate that the cost per year of life saved is small compared with other accepted medical interventions (Table 3). Minimal physician counseling (4 min initially, then 3 to 6 min during follow-up at $2.40 per min), more intensive physician counseling (15 min), and nicotine replacement therapy (patch or gum) have all been shown to be relatively inexpensive per year of life saved. Lightwood and Glantz (6) estimated that over 98,000 hospitalizations (and over $3 billion of resource consumption) would be prevented in the U.S. over seven years with a 1% reduction in smoking. Krumholz et al. (7) found that the cost per year of life saved with a nurse-based educational program was less than $300.

Hypertension treatment. Numerous cost-effectiveness studies of hypertensive treatment and screening have been published (Table 4). However, different methodologies preclude direct comparisons of their results. Many studies were stated to be from a societal perspective, yet few studies...
Table 1. Lipid-Lowering: Primary Prevention Cost-Effectiveness Studies

<table>
<thead>
<tr>
<th>Study, Year</th>
<th>Age Group (Yrs)</th>
<th>Gender</th>
<th>Cholesterol (mg/dl)</th>
<th>Time Horizon</th>
<th>Treatment</th>
<th>Comparator</th>
<th>Cost-Effectiveness</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weinstein and Stason, 1985 (38)</td>
<td>45–50</td>
<td>Male</td>
<td>greater than 265</td>
<td>Unclear</td>
<td>Cholestyramine</td>
<td>No treatment</td>
<td>$190,000/LY</td>
<td>Based on Framingham risk data and LRC-CPPT protocol.</td>
</tr>
<tr>
<td>Oster and Epstein, 1987 (39)</td>
<td>55–59</td>
<td>Male</td>
<td>290</td>
<td>Lifetime</td>
<td>Cholestyramine</td>
<td>No treatment</td>
<td>$250,000/LY</td>
<td>Based on Framingham risk data and LRC-CPPT trial includes cost of prolonged survival.</td>
</tr>
<tr>
<td>Kinosian and Eisenberg, 1988 (40)</td>
<td>Adult</td>
<td>Male</td>
<td>greater than 265</td>
<td>7 years</td>
<td>Diet (oat bran)</td>
<td>No treatment</td>
<td>$25,400/LY</td>
<td>Based on Framingham risk data and LRC-CPPT trial.</td>
</tr>
<tr>
<td>Martens et al., 1989 (41)</td>
<td>Adult</td>
<td>Male</td>
<td>310</td>
<td>Lifetime</td>
<td>Simvastatin</td>
<td>No treatment</td>
<td>$36,000-83,000/LY</td>
<td>Based on Framingham risk data and LRC-CPPT trial and Dutch data.</td>
</tr>
<tr>
<td>Goldman et al., 1991 (42)</td>
<td>55–64</td>
<td>Male</td>
<td>greater than 300 mg/dl</td>
<td>Age 85</td>
<td>Lovastatin</td>
<td>No treatment</td>
<td>$75,000/LY</td>
<td>Based on Coronary Heart Disease Policy Model.</td>
</tr>
<tr>
<td></td>
<td>55–64</td>
<td>Female</td>
<td>greater than 300</td>
<td>Age 85</td>
<td>Lovastatin</td>
<td>20 mg/day</td>
<td>$169,000/LY</td>
<td></td>
</tr>
<tr>
<td></td>
<td>55–64</td>
<td>Male</td>
<td>250–299</td>
<td>Age 85</td>
<td>Lovastatin</td>
<td>20 mg/day</td>
<td>$121,000/LY</td>
<td></td>
</tr>
<tr>
<td>Pharoah and Hollingworth, 1996 (43)</td>
<td>45–64</td>
<td>Male</td>
<td>greater than 145</td>
<td>10 years</td>
<td>Pravastatin</td>
<td>No treatment</td>
<td>$239,000/LY</td>
<td>Assumptions from British Health Care System. Used lipid lowering but not economic data from WOSCOPS.</td>
</tr>
<tr>
<td>Tosteson et al., 1997 (44)</td>
<td>U.S. population</td>
<td></td>
<td></td>
<td></td>
<td>Education</td>
<td>Usual care</td>
<td>$3,700/LY</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$5.69 per person, 2% reduction in cholesterol, uses Coronary Heart Disease Policy Model.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WOSCOPS, 1997 (45)</td>
<td>45–64</td>
<td>Male</td>
<td>LDL &gt; 155</td>
<td>Lifetime</td>
<td>Pravastatin</td>
<td>Placebo</td>
<td>$34,000/LY</td>
<td>Did not include extra costs due to prolonged survival.</td>
</tr>
<tr>
<td>Pickin et al., 1999 (46)</td>
<td>Adult</td>
<td>Both</td>
<td>1.5% chance of coronary events/year</td>
<td>Lifetime</td>
<td>Simvastatin</td>
<td>No treatment</td>
<td>$22,000/LY</td>
<td>Effectiveness data based on WOSCOPS.</td>
</tr>
<tr>
<td>Prosser et al., 2000 (5)</td>
<td>35–44*</td>
<td>Male</td>
<td>greater than 160</td>
<td>30 years</td>
<td>Diet</td>
<td>No treatment</td>
<td>$87,000/QALY</td>
<td>Based on Coronary Heart Disease Policy Model, assumes 7.7% decrease in LDL with diet. Data provided for patients with no other risk factors.</td>
</tr>
<tr>
<td></td>
<td>35–44*</td>
<td>Female</td>
<td>greater than 160</td>
<td>30 years</td>
<td>Diet</td>
<td>No treatment</td>
<td>$251,000/QALY</td>
<td></td>
</tr>
<tr>
<td></td>
<td>65–74*</td>
<td>Male</td>
<td>greater than 160</td>
<td>30 years</td>
<td>Diet</td>
<td>No treatment</td>
<td>$39,000/QALY</td>
<td></td>
</tr>
<tr>
<td></td>
<td>75–84*</td>
<td>Female</td>
<td>greater than 160</td>
<td>30 years</td>
<td>Diet</td>
<td>No treatment</td>
<td>$40,000/QALY</td>
<td></td>
</tr>
<tr>
<td></td>
<td>35–44*</td>
<td>Male</td>
<td>greater than 160</td>
<td>30 years</td>
<td>Pravastatin</td>
<td>Diet</td>
<td>$271,000/QALY</td>
<td></td>
</tr>
<tr>
<td></td>
<td>35–44*</td>
<td>Female</td>
<td>greater than 160</td>
<td>30 years</td>
<td>Pravastatin</td>
<td>Diet</td>
<td>$775,000/QALY</td>
<td></td>
</tr>
<tr>
<td></td>
<td>65–74*</td>
<td>Male</td>
<td>greater than 160</td>
<td>30 years</td>
<td>Pravastatin</td>
<td>Diet</td>
<td>$148,000/QALY</td>
<td></td>
</tr>
<tr>
<td></td>
<td>65–74*</td>
<td>Female</td>
<td>greater than 160</td>
<td>30 years</td>
<td>Pravastatin</td>
<td>Diet</td>
<td>$159,000/QALY</td>
<td></td>
</tr>
<tr>
<td>Grover et al., 2000 (10)</td>
<td>Non-diabetic adult</td>
<td>Male</td>
<td>LDL 135 HDL 39</td>
<td>Lifetime</td>
<td>Pravastatin</td>
<td>No treatment</td>
<td>$26,000–43,000/LY</td>
<td>Based on pravastatin effects on lipids from the Cholesterol and Recurrent Events (CARE) trial.</td>
</tr>
<tr>
<td></td>
<td>Diabetic adult</td>
<td>Male</td>
<td>LDL 135 HDL 39</td>
<td>Lifetime</td>
<td>Pravastatin</td>
<td>No treatment</td>
<td>$8,000–16,000/LY</td>
<td></td>
</tr>
</tbody>
</table>

*Non-smoker, diastolic BP greater than 95 mm Hg. CVA = cerebrovascular accident; HDL = high-density lipoprotein; LDL = low-density lipoprotein; LY = life years gained; LRC-CPPT = Lipid Research Clinics Coronary Primary Prevention Trial; QALY = quality adjusted life years gained; WOSCOPS = West of Scotland Coronary Prevention Study.
Table 2. Lipid-Lowering: Secondary Prevention Cost-Effectiveness Studies

<table>
<thead>
<tr>
<th>Study, Year</th>
<th>Time Horizon</th>
<th>Treatment</th>
<th>Comparator</th>
<th>Cholesterol (mg/dl)</th>
<th>Gender</th>
<th>Age Group (Yrs)</th>
<th>Cost-Effectiveness</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task Force #2</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>$10,500/LY</td>
<td>—</td>
</tr>
<tr>
<td>Goldman et al., 1991 (42)</td>
<td>—</td>
<td>—</td>
<td>No treatment</td>
<td>Lovastatin 20 mg/day</td>
<td>Male</td>
<td>55-64</td>
<td>$22,000/LY</td>
<td>—</td>
</tr>
<tr>
<td>PLAC 1, 2, 1996 (47)</td>
<td>—</td>
<td>—</td>
<td>Pravastatin</td>
<td>Placebo</td>
<td>—</td>
<td>—</td>
<td>$7,800/LY</td>
<td>—</td>
</tr>
<tr>
<td>PLAC II, 1997 (48)</td>
<td>—</td>
<td>—</td>
<td>Simvastatin</td>
<td>Placebo</td>
<td>—</td>
<td>Age 59</td>
<td>$7,500/QALY</td>
<td>—</td>
</tr>
<tr>
<td>Grover et al., 1999 (49)</td>
<td>—</td>
<td>—</td>
<td>Simvastatin</td>
<td>Placebo</td>
<td>—</td>
<td>Median 59</td>
<td>$10,200/QALY</td>
<td>—</td>
</tr>
<tr>
<td>Prosser et al., 2000 (50)</td>
<td>—</td>
<td>—</td>
<td>Pravastatin</td>
<td>Placebo</td>
<td>—</td>
<td>Median 59</td>
<td>$42,500/QALY</td>
<td>—</td>
</tr>
</tbody>
</table>

*Non-smoker, diastolic BP greater than 95 mm Hg.*

Diabetes treatment. The cost-effectiveness analyses of diabetes treatment indicate that intensive glucose control improves outcome at a cost that is below other accepted health care interventions (Table 5). Because diabetic patients are at a high risk for coronary artery disease, treatment of hypertension and elevated lipids in these patients is particularly economically attractive (8–11). The study, based on the Diabetes Control and Complications Trial Research Group (DCCT) Study, found that including the extra cost of living longer with intensive therapy increased the cost-effectiveness ratio from $32,000 to $34,000 per year of life gained (12). If indirect costs are also accounted for, the cost-effectiveness ratio drops (treatment becomes more cost-effective) to $10,800 per year of life gained (13). Although it is not directed at glucose metabolism, treatment of middle-aged type II diabetics with angiotensin-converting enzyme inhibitors was found to be economically attractive (14).

Exercise programs. There is relatively little trial data on the long-term effects of exercise, and consequently, few studies have attempted to estimate the cost-effectiveness of exercise programs. Assuming that sedentary behavior increases the risk of heart disease by 1.9-fold, $6.4 billion would be saved if the entire U.S. sedentary population began a program of regular walking (15). Other studies estimate that exercise programs cost money, particularly when time lost to exercise is included, but that the benefits are large and the cost per year of life gained remains well below $20,000 (Table 6).

Little is known about the cost-effectiveness of simultaneous risk-factor modification. However, several studies have examined the cost-effectiveness of cardiac rehabilitation after acute myocardial infarction. These programs use a variety of interventions, including exercise, risk-factor management, and psychosocial counseling (16). A study from Sweden found cardiac rehabilitation to be cost-saving when indirect costs of work productivity were included (17). Studies from the U.S. have estimated that cardiac rehabilitation increases direct costs by $5,500 to $11,100 per life-year gained (18,19).
Table 3. Smoking Cessation Cost-Effectiveness Studies

<table>
<thead>
<tr>
<th>Study, Year</th>
<th>Population</th>
<th>Treatment</th>
<th>Comparator</th>
<th>Increased Cessation Rate</th>
<th>Cost-Effectiveness</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oster et al., 1986 (50)</td>
<td>Males ages 35–69</td>
<td>Nicotine gum plus counseling</td>
<td>Counseling</td>
<td>1.6%</td>
<td>$6,000–9,500/LY</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Females ages 35–69</td>
<td>Nicotine gum plus counseling</td>
<td>Counseling</td>
<td>1.6%</td>
<td>$10,000–13,900/LY</td>
<td></td>
</tr>
<tr>
<td>Cummings et al., 1989 (51)</td>
<td>Males ages 35–69</td>
<td>Physician counseling</td>
<td>Usual care</td>
<td>2.7%</td>
<td>$1,000–1,400/LY</td>
<td>Assumed 12 min of physician’s time.</td>
</tr>
<tr>
<td></td>
<td>Females ages 35–69</td>
<td>Physician counseling</td>
<td>Usual care</td>
<td>2.7%</td>
<td>$1,800–3,000/LY</td>
<td></td>
</tr>
<tr>
<td>Krumholz et al., 1993 (7)</td>
<td>Post MI</td>
<td>Nurse-mediated education leading to 2.6% reduction in smoking</td>
<td>Usual care</td>
<td>26%</td>
<td>$260/LY</td>
<td>Cost-effectiveness less than $24,000/LY even with program cost of $10,000 or success rate of only 0.3%.</td>
</tr>
<tr>
<td>Fiscella and Franks, 1996 (52)</td>
<td>Males ages 35–69</td>
<td>Nicotine patch plus counseling</td>
<td>Counseling</td>
<td>6.4%</td>
<td>$4,800–12,000/QALY</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Females ages 35–69</td>
<td>Nicotine patch plus counseling</td>
<td>Counseling</td>
<td>6.4%</td>
<td>$5,800–7,700/QALY</td>
<td></td>
</tr>
<tr>
<td>Lightwood and Glantz, 1997 (6)</td>
<td>U.S. smokers</td>
<td>Hypothetical program with 1% cessation rate</td>
<td>Usual care</td>
<td>1%</td>
<td>Program dominates*</td>
<td>3.32 billion saved and 13,000 deaths prevented over 7 years.</td>
</tr>
<tr>
<td>Cromwell et al., 1997 (53)</td>
<td>U.S. smokers</td>
<td>Minimal counseling</td>
<td>Usual care</td>
<td>1.2%</td>
<td>$4,400/QALY</td>
<td>Cost per minute of physician’s time: $2.40.</td>
</tr>
<tr>
<td></td>
<td>U.S. smokers</td>
<td>Full counseling</td>
<td>Usual care</td>
<td>9.3%</td>
<td>$1,700/QALY</td>
<td></td>
</tr>
<tr>
<td></td>
<td>U.S. smokers</td>
<td>Transdermal nicotine and minimal counseling</td>
<td>Usual care</td>
<td>21%</td>
<td>$2,600/QALY</td>
<td></td>
</tr>
<tr>
<td></td>
<td>U.S. smokers</td>
<td>Transdermal nicotine and full counseling</td>
<td>Usual care</td>
<td>60%</td>
<td>$1,500/QALY</td>
<td></td>
</tr>
<tr>
<td></td>
<td>U.S. smokers</td>
<td>Nicotine gum and minimal counseling</td>
<td>Usual care</td>
<td>2.3%</td>
<td>$5,000/QALY</td>
<td></td>
</tr>
<tr>
<td></td>
<td>U.S. smokers</td>
<td>Nicotine gum and intensive counseling</td>
<td>Usual care</td>
<td>12%</td>
<td>$2,300/QALY</td>
<td></td>
</tr>
<tr>
<td>Croghan et al., 1997 (54)</td>
<td>Adults</td>
<td>Program including nicotine replacement</td>
<td>Usual care</td>
<td>22.2%</td>
<td>$7,900/LY</td>
<td></td>
</tr>
<tr>
<td>Meenan et al., 1998 (55)</td>
<td>Hospitalized patients</td>
<td>In-hospital cessation and relapse prevention</td>
<td>Usual care</td>
<td>8%</td>
<td>$1,900/LY</td>
<td>Intervention data from a Kaiser-based randomized trial.</td>
</tr>
<tr>
<td>Stapleton et al., 1999 (56)</td>
<td>Adults</td>
<td>Nicotine patch plus counseling</td>
<td>Counseling</td>
<td>5.1%</td>
<td>$600–1,400/LY</td>
<td>Based on United Kingdom costs.</td>
</tr>
</tbody>
</table>

*Less expensive and more effective.  
LY = life years; MI = myocardial infarction; QALY = quality adjusted life years.
<table>
<thead>
<tr>
<th>Study, Year</th>
<th>Population</th>
<th>Time Horizon (yrs)</th>
<th>Treatment Duration (yrs)</th>
<th>Indirect Costs</th>
<th>Treatment (Comparator)*</th>
<th>Cost-Effectiveness</th>
<th>Comments</th>
</tr>
</thead>
</table>
| Stason and Weinstein, 1977 (57) | 20-year-old male, diastolic BP 100 mm Hg 
60-year-old female, diastolic BP 100 mm Hg | Lifetime | Lifetime | No | Drug treatment | $71,300/QALY | Assumed treatment of elderly is less beneficial than treatment of young, estimates based on Framingham Heart Study. |
| Stevens et al., 1984 (58) | 35-year-old male | Lifetime | Lifetime | No | Screening and treatment | $38,000/QALY | Used Stason model with local costs and effectiveness. |
| Nissinen et al., 1986 (59) | Based on North Karelia Hypertension program (Finland) | 5 | 5 | Yes | Screening and treatment | $8,500/QALY | Estimates based on trial data, results highly sensitive to costs of anti-hypertensives. |
| Littenberg et al., 1990 (60) | 40-year-old female | Lifetime | Lifetime | No | Screening and treatment | $30,000/QALY | |
| | 60-year-old male | Lifetime | Lifetime | No | Screening and treatment | $10,900/QALY | |
| Edelson et al., 1990 (61) | Patients 35–64 yrs with diastolic blood pressure greater than or equal to 95 mm Hg | 20 | 20 | No | Propranolol | $13,600/QALY | Based on the Coronary Heart Disease Policy Model. |
| | Patients 35–64 yrs with diastolic blood pressure greater than or equal to 95 mm Hg | 20 | 20 | No | HCTZ | $20,500/QALY | |
| | Patients 35–64 yrs with diastolic blood pressure greater than or equal to 95 mm Hg | 20 | 20 | No | Nifedipine | $39,500/QALY | |
| | Patients 35–64 yrs with diastolic blood pressure greater than or equal to 95 mm Hg | 20 | 20 | No | Captopril | $90,200/QALY | |
| Lasser and Wenzel, 1990 (62) | German hypertensive men age 55–64 yrs | Lifetime | Lifetime | No | Drug treatment | $39,200/LY | |
| Kawachi and Malcolm, 1991 (63) | 40-year-old men with diastolic blood pressure 100 mm Hg | Age 64 | Age 64 | No | Drug treatment | $64,200/QALY | Assumed no effect of treatment on coronary heart disease. |
| Johannesson and Jonsson, 1991 (64) | 35-year-old male | Lifetime | Lifetime | Yes | Drug treatment | $23,000/LY | Based on Framingham risk data and Swedish cost data. |
| Johannesson et al., 1993 (65) | Swedish Trial in Old Patients with Hypertension (STOP) Men aged 70–84 yrs | Lifetime | 2 | Yes | Diuretics, Beta-blockers | $980/LY | |
| | Swedish Trial in Old Patients with Hypertension (STOP) | Lifetime | 2 | Yes | Diuretics, Beta-blockers | $3,100/LY | |
| Johannesson et al., 1993 (66) | Metoprolol Atherosclerosis Prevention in Hypertensives (MAPHY) study Men aged 70–84 yrs | Lifetime | 5 | Yes | Metoprolol (thiazides) | Metoprolol dominant | |
| Johannesson, 1995 (67) | Male 45–70 yrs diastolic BP 95–99 | Lifetime | 1 | Yes | Drug treatment | $142/LY | Meta-analysis of trial data used to determine treatment benefit; Framingham data used for risk of stroke and CHD. |
| | Female 45–70 yrs diastolic BP 95–99 | Lifetime | 1 | Yes | Drug treatment | $190/LY | |

*Comparator is no treatment unless otherwise indicated.

Costs adjusted to 2001 U.S. dollars using the GDP deflator.

BP = blood pressure; CHD = coronary heart disease; HCTZ = hydrochlorothiazide; LY = life years; QALY = quality adjusted life years.
Several methodological issues in cost-effectiveness analyses are relevant to the assessment of preventive programs and can affect how these programs are rated relative to alternative uses of funds. In this section, the issues of discounting, the perspective of the analysis, the choice of effectiveness measures, and the use of indirect costs are briefly reviewed.

Discounting of future benefit. Discounting is employed in economic analysis to take into account the time value of costs and benefits. In general, people prefer to receive desirable benefits as soon as possible and to delay costs indefinitely. Discounting quantitatively incorporates these preferences into economic analyses by weighing costs and benefits less heavily the further into the future they occur. Thus, a benefit in the future is not as attractive as an immediate benefit, and a cost in the future does not weigh as heavily as an immediate outlay.

To illustrate the crucial role of time preferences, consider the case of two hypothetical means of achieving the same health objective: Program A involves an immediate outlay of $25,000, whereas alternative Program B requires no investment today but a $50,000 outlay 20 years from now (Table 7). Assuming that the two interventions are otherwise identical, the decision as to which program is most attractive depends solely upon the decision maker’s time preference. A decision maker who is indifferent to the timing of events would clearly prefer Program A, because $25,000 is less than $50,000. To the contrary, a decision maker who discounts future income streams at a 5% annual rate would find Program B more attractive. To see why this is so, consider an investor who can earn a 5% annual return on savings.

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### Table 5. Diabetes Treatment and Screening: Cost-Effectiveness Studies

<table>
<thead>
<tr>
<th>Study, Year</th>
<th>Population</th>
<th>Time Horizon (yrs)</th>
<th>Treatment</th>
<th>Comparator</th>
<th>Cost-Effectiveness</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>DCCT, 1996 (12)</td>
<td>Candidates for the DCCT trial 17% of diabetics on insulin</td>
<td>Lifetime</td>
<td>Intensive therapy</td>
<td>Conventional therapy</td>
<td>$31,600/LY</td>
<td></td>
</tr>
<tr>
<td>Golan et al., 1999 (14)</td>
<td>50-year-old patients with new type II diabetes</td>
<td>Lifetime</td>
<td>ACE inhibitors for all</td>
<td>Screening for microalbuminuria</td>
<td>$7,700/QALY</td>
<td></td>
</tr>
<tr>
<td>Gray et al., 2000 (68)</td>
<td>Type II diabetics</td>
<td>10</td>
<td>Intensive therapy</td>
<td>Conventional therapy</td>
<td>$2,000/event-free LY</td>
<td>Cost estimates from United Kingdom.</td>
</tr>
<tr>
<td>Almbrand et al., 2000 (69)</td>
<td>Diabetics with acute MI</td>
<td>Lifetime</td>
<td>Glucose-insulin infusion followed by SQ insulin</td>
<td>Conventional therapy</td>
<td>$18,300/QALY</td>
<td>Based on DIGAMI trial. Included indirect and future costs.</td>
</tr>
<tr>
<td>Clarke et al., 2001 (11)</td>
<td>Type II diabetics greater than 120% of ideal body weight</td>
<td>Lifetime</td>
<td>Metformin</td>
<td>Conventional therapy</td>
<td>Metformin dominates*</td>
<td>Cost estimates from United Kingdom. Effectiveness from randomized trial data. Metformin saved 258 pounds (1997) over 10.8 years.</td>
</tr>
</tbody>
</table>

*Less expensive and more effective.

**ACE** = angiotensin converting enzyme; **DCCT** = Diabetes Control and Complications Trial Research Group; **DIGAMI** = Diabetes Mellitus Insulin Glucose Infusion in Acute Myocardial Infarction; **LY** = life years; **MI** = myocardial infarction; **QALY** = quality adjusted life years; **SQ** = subcutaneous.

### ISSUES IN COST-EFFECTIVENESS ANALYSES

Several methodological issues in cost-effectiveness analyses are relevant to the assessment of preventive programs and can affect how these programs are rated relative to alternative uses of funds. In this section, the issues of discounting, the perspective of the analysis, the choice of effectiveness measures, and the use of indirect costs are briefly reviewed. The approach with regard to these issues may slant economic analyses away from preventive interventions relative to more acute care.

Discounting of future benefit. Discounting is employed in economic analysis to take into account the time value of costs and benefits. In general, people prefer to receive desirable benefits as soon as possible and to delay costs indefinitely. Discounting quantitatively incorporates these preferences into economic analyses by weighing costs and benefits less heavily the further into the future they occur.

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### Table 6. Exercise Programs: Cost-Effectiveness Studies

<table>
<thead>
<tr>
<th>Study, Year</th>
<th>Population</th>
<th>Time Horizon (yrs)</th>
<th>Treatment</th>
<th>Comparator</th>
<th>Cost-Effectiveness</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hatziandreu et al., 1988 (70)</td>
<td>Men age 35</td>
<td>30</td>
<td>Jogging</td>
<td>No exercise</td>
<td>$15,400/QALY</td>
<td>Includes indirect costs from time lost due to exercising.</td>
</tr>
<tr>
<td>Munro et al., 1997 (71)</td>
<td>Men and women over age 65</td>
<td>Lifetime</td>
<td>Supervised exercise twice weekly</td>
<td>No exercise</td>
<td>$533/LY</td>
<td></td>
</tr>
<tr>
<td>Lowenstein et al., 2000 (72)</td>
<td>U.S. population</td>
<td>Lifetime</td>
<td>Unsupervised exercise</td>
<td>No exercise</td>
<td>less than $13,000/LY</td>
<td>Based on the Cardiovascular Disease Life Expectancy Model.</td>
</tr>
<tr>
<td></td>
<td>Men with cardiovascular disease</td>
<td>Lifetime</td>
<td>Supervised exercise</td>
<td>No exercise</td>
<td>less than $16,000/LY</td>
<td></td>
</tr>
</tbody>
</table>

**LY** = life years; **QALY** = Quality adjusted life years.
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perspective of the analysis.
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splurge” (22).

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phenomenon of “policy paralysis” or the “infinitely delayed
splurge” also emerges when any discount rate lower than
those benefits may arise too far into the future.

Some experts advocate discounting costs but not benefits
(20,21). However, a practical problem emerges in this
situation. Discounting costs but not benefits can lead to the
peculiar result of improving the cost-effectiveness of many
programs by the indefinite delay of their implementation.
That is, discounting costs but not benefits suggests that any
program would be better implemented “next year.” This
phenomenon of “policy paralysis” or the “infinitely delayed
splurge” also emerges when any discount rate lower than
that applied to resource costs is applied to the health
benefits (22).

Using the approach of discounting future costs and
benefits, can it ever be more efficient to invest today’s dollars
in the uncertain hope of a benefit some time in the future?
The answer is mixed. Some preventive interventions are
highly cost-effective; others are less so. Some immediate
treatment interventions compare favorably with prevention;
others do not. A 1995 analysis of 500 different life-saving
interventions found that neither form of health investment
dominates the other (4). Nevertheless, the issue of whether
to value future benefits less than current benefits, which may
place preventive programs at a relative disadvantage com-
pared with acute interventions, results in some serious
tension in the economic analysis of preventive interventions.

Perspective of the analysis. Preventive interventions affect
patients, families, providers, developers of new drugs and
other medical technologies, insurers, managed care organi-
zations, governments, taxpayers, and society. More often
than not, the implementation of a new medical technology
or intervention—or its inclusion in a health maintenance
organization formulary—serves to redistribute costs and
benefits among these groups. Assessments of any interven-
tion’s appropriateness and cost-effectiveness may differ dra-
matically depending on a group’s perspective. For example,
an intervention designed to reduce hospital lengths of stay
may benefit health care institutions and payers by lowering
inpatient hospital costs, while simultaneously imposing
additional time and productivity burdens on patients and
their families. Depending on the perspective of the analysis,
assessments of the program’s attractiveness may differ not
only in magnitude but even in direction.

Published academic evaluations typically focus on public
health and global resource allocation decisions. For this
reason, the U.S. Panel on Cost-effectiveness Analysis in
Health and Medicine recommends that analysts adopt a
societal perspective in which all costs and benefits are taken
into account, regardless of whom they affect (23). The
societal perspective is the only one that does not require
some party in the treatment decision to lose in order that
someone else might gain. The hospital perspective, for
example, focuses on short-term cost and benefits. What
happens to patients after being discharged is irrelevant to
this perspective. The managed care company’s perspective
takes into account the fact that an individual patient is likely
to keep health insurance with that company for only two to
three years on average. Paying for interventions that might
yield benefits a decade or more in the future is of no value
from this perspective. Thus, while individuals in health care
rarely look at the societal perspective, it is in the public
interest to keep this perspective in the forefront of the
discussion while other perspectives are considered. One
issue that often evolves in this context is that the societal
perspective ignores important transfer payments (such as the
cost shift from health care purchasers to patients in the
length-of-stay example) from one member of society to
another: although such redistributions are irrelevant from a
societal viewpoint, they may be of paramount importance to
the parties affected. Given the fragmented nature of the
U.S. health care system and the painful transfers that must
inevitably result from any re-allocation of scarce resources, it
is unlikely that cost-effectiveness criteria, administered from
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fits are taken
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the parties affected. Given the fragmented nature of the
U.S. health care system and the painful transfers that must
inevitably result from any re-allocation of scarce resources, it
is unlikely that cost-effectiveness criteria, administered from
the societal perspective, will emerge any time soon as
blueprints for public decision making. Nevertheless, an
efficiency-based analysis can help to illuminate the clinical
and economic costs that society incurs by failing to apport-
ion its health care resources where they will do the greatest
good. Such an approach can add support to the develop-
ment of more ethically defensible prevention policies.

Deciding on the effectiveness measure. An advantage of
economic analysis is that expectations about the effective-
ness of a given strategy must be explicitly stated. If evidence
about the effectiveness of a given intervention is weak (or
non-existent), then it will be revealed in the methods and
exposed for the knowledgeable reader.

Table 7. Impact of Time Value on Preferences

<table>
<thead>
<tr>
<th>Year</th>
<th>Program A</th>
<th>Program B</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>$25,000</td>
<td>$0</td>
</tr>
<tr>
<td>20</td>
<td>$0</td>
<td>$50,000</td>
</tr>
<tr>
<td>Total outlay</td>
<td>$25,000</td>
<td>$50,000</td>
</tr>
<tr>
<td>NPV at 3%</td>
<td>$25,000</td>
<td>$27,684</td>
</tr>
<tr>
<td>NPV at 5%</td>
<td>$25,000</td>
<td>$18,844</td>
</tr>
</tbody>
</table>

NPV = net present value.

This investor could take the $25,000 that he might other-
wise invest in Program A and place it in an interest-bearing
bank account. In 20 years, the original $25,000 would have
grown to $66,332 ($66,332 equals the sum of $25,000 times
1.05^20), thus permitting the investor to invest in Program B
while pocketing the remaining $16,332. Indeed, Program B
is preferred to Program A by any decision maker whose
discount rate is in excess of roughly 3.5%, because at any
discount rate above 3.5%, the discounted value of $50,000 in
20 years is less than $25,000.

The fact that individuals and society value the present
more highly than the future significantly affects decisions
regarding preventive interventions. If a program incurs costs
immediately but its health effects accrue in the future, the
positive effects of the program are significantly smaller when
discounting is taken into account, whereas the full effect of
the current costs is felt. Thus, many programs that incur
substantial benefits may not be cost-effective, because those
benefits may arise too far into the future.

Some experts advocate discounting costs but not benefits
(20,21). However, a practical problem emerges in this
situation. Discounting costs but not benefits can lead to the
peculiar result of improving the cost-effectiveness of many
programs by the indefinite delay of their implementation.
That is, discounting costs but not benefits suggests that any
program would be better implemented “next year.” This
phenomenon of “policy paralysis” or the “infinitely delayed
splurge” also emerges when any discount rate lower than
that applied to resource costs is applied to the health
benefits (22).

Using the approach of discounting future costs and
benefits, can it ever be more efficient to invest today’s dollars
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tension in the economic analysis of preventive interventions.

Deciding on the effectiveness measure. An advantage of
economic analysis is that expectations about the effective-
ness of a given strategy must be explicitly stated. If evidence
about the effectiveness of a given intervention is weak (or
non-existent), then it will be revealed in the methods and
exposed for the knowledgeable reader.
The choice of measure of benefit on an intervention may determine its implementation. The prevention of death due to one disease may not be a valuable outcome if overall life expectancy is unchanged because of competing risks due to other illnesses. Preventing sudden death so that people instead die of cancer, without a significant net gain in quantity or quality of life, is not an economically attractive investment, even if the intervention is efficient in reducing sudden death. As a result, many analyses favor more global estimates of benefit that go beyond disease-specific metrics.

In addition, patients may value quality of life more than survival. Economic analyses have attempted to incorporate patient preferences (also called utilities)—or how patients value different states of disease and disability—in their evaluations of preventive or other interventions. These preferences allow the calculation of QALYs and arithmetically incorporate both quality and quantity of life. Unfortunately, the methods available to assess patient preferences are still rudimentary. In the evaluation of preventive services, it is particularly important to value appropriately the transition from being well to being ill. Much of the value of preventive programs consists in preventing this transition and in allowing individuals to avoid disability. Underestimating the preference for wellness is another challenge to the proper evaluation of preventive services.

Measuring indirect costs. Another challenge in performing these economic analyses is fully accounting for indirect costs, those resources expended that are not directly related to medical care. These costs include days lost from work, time diverted from other (non-work) productive activity, dollars devoted to caregiving activities, the value of caregiver time when provided outside the labor force (e.g., by family caregivers), or lost enjoyment associated with the intervention (e.g., losing the pleasure associated with smoking as a result of adherence to a smoking cessation regime). These costs can be considerable and may offset much of the investment in the preventive intervention. Despite the importance of these costs, they are often not included in cost-effectiveness analyses and are mostly invisible to those who purchase care. However, there are economic analyses that have measured many of these, and there are economic methodologies to measure all of them. From a societal perspective, they may account for the greatest recovery of costs from investments in prevention.

**COST EFFECTIVENESS VERSUS PUBLIC POLICY**

Health policy decisions often appear inconsistent with economic analyses for at least three reasons. First, the assumptions underlying economic analysis are that decision makers will behave in a rational fashion. Specifically, they will always choose to do the most efficient thing regardless of who gains and who loses. This is clearly not the case. Americans frequently support expensive programs that promise little health benefit while, at the same time, forgoing opportunities to invest in much more cost-effective strategies for health improvement (24). To cite just a few examples, the U.S. spends approximately $115 million per year on benzene emission control to save an estimated five years of life (25). If this same amount were instead spent on collapsible automobile steering columns, the nation could save an additional 1,684 years of life (26). Similarly, adhering to the 1990 amendments to the Clean Air Act will cost more than $5 million for each year of life that is saved as a result of reduced emission of toxic pollutants.

These inconsistencies can have important consequences both for the public health and for the public purse. Tengs and Graham (27) performed an analysis of 287 lifesaving interventions for which information on both cost-effectiveness and current levels of implementation was available. They determined that a simple redistribution of resources among those programs could prevent 60,000 premature deaths (resulting in a long-run gain of over 600,000 life-years) each year in the U.S., with no net increase in resource consumption. Viewed another way, these findings suggest that a re-allocation of lifesaving resources to the most cost-effective activities would free up $31 billion per year in the U.S., with no net loss of life.

What explains this inefficiency in the public prioritization of health risks? Part of the answer lies in the diffusion of authority. Lifesaving resources are not easily transferred from one domain of intervention (such as occupational safety, environmental health, or infectious disease control) to another. A single policy maker rarely has the authority to shift funds from pollution abatement to childhood immunization or from mammography for pre-menopausal women to automobile airbag installation. Indeed, entirely different funding mechanisms operate from one domain to the next; the compliance costs of many environmental interventions, for example, are borne by private businesses and their customers, whereas other health programs (such as epidemiological outbreak investigations) are funded directly with tax dollars. In addition, while some public health measures can be implemented at the behest of individual decision makers, many others (such as treatment of hyperlipidemia) rely on the participation of millions of independent decision makers with widely varying priorities, information, and resources.

A second reason why results of economic analysis often do not drive public policy is the lack of adequate data to perform credible economic analyses. In the state of Oregon, for example, policy makers undertook—and then more or less ignored—an ambitious, formal evaluation in 1989 to guide them in rationing the state's Medicaid services. A draft priority list, derived on the basis of the cost-effectiveness criterion, was revealed in May 1990. In the presence of overwhelming criticism and ridicule, it was almost immediately withdrawn. Commissioners went back to the drawing board and began work on a revised ranking scheme. By March 1993, the commission members had virtually abandoned the priorities suggested by the formal analysis in favor of a softer, intuitive apportionment process.
The effort in this case was well intentioned, but the available data were simply not adequate to support a global ranking of medical interventions. The third reason why economic analysis does not determine public policy has been called “the rule of rescue” (29). Simply put, medical professionals are unable to stand by while an identifiable person’s life is threatened if some possibly effective therapy is available to treat that person. The concept that “we did everything we could” is not rational from a decision-making point of view, but it is very human. Policy makers are not immune to this effect. Political lobbies and special interests can greatly influence resource allocation decisions. Good cases in point include the creation of the federally funded Acquired Immune Deficiency Syndrome Drug Assistance Programs, the federal government’s decision to finance dialysis therapy for all U.S. end-stage renal failure patients, and the broad political support of mammograms for women between the ages of 40 and 49 years.

Clearly, the principles of cost-effective resource allocation do not capture all the essential elements that influence policy decisions. The recognition of the various issues that are important in influencing perceptions of the value of preventive programs is essential in understanding the barriers to making decisions about programs solely by using cost-effectiveness ratios. It is these issues that make it difficult to answer directly whether we can afford prevention programs and what role they should play in our portfolio of health care expenditures. In the following section, selected issues that influence the debate and perceptions about the value of these interventions are reviewed.

COST EFFECTIVENESS VERSUS TOTAL SYSTEM COSTS

Despite the opportunity to make an economically attractive investment, society may resist devoting a large, disproportionate pool of resources to one condition or group of individuals. For example, the use of statins is an economically attractive intervention for many people with, or at risk for, CVD. In May 2001, the National Cholesterol Education Program published a report outlining revised guidelines for cholesterol control. In addition to many dietary and behavioral changes, the panel recommended a significant increase in the number of people who take lipid-lowering drugs (32). Applying the panel’s recommendations to the population of the U.S., it is estimated that 36 million Americans should be taking a lipid-lowering agent. The report, however, did not consider the system cost of implementing the recommendation. Taking the monthly retail price of an inexpensive statin as an example, and assuming a 5% rate of discounting costs in future years, this recommendation would cost society more than $500 billion in direct drug costs over the next 20 years. This allocation of resources would cost nearly $1,200 per person per year; that is, 29% of the current annual per capita (average) spending on health care in total (33). The allocation of these resources is expected to result in a lower rate of vascular disease and possibly other disease conditions, but it will almost certainly be at the expense of other potential medical investments. Finding that a therapy is economically attractive is not enough to ensure that it will be widely adopted. There must also be enough money in the budget to pay for it.

The American Heart Association (AHA), in concert with the Centers for Disease Control, has committed itself to achieve a 25% reduction in CVD by 2010. The AHA has not explicitly considered what the country should be willing to spend to achieve this goal, what it will cost to reach this target, or what other investments would be passed over as a result. Is it presumed that the country should meet this goal at any cost? If the most efficient use of prevention dollars (assuming that a finite amount is available) is to devote them to the prevention of CVD, should it be done at the expense of efforts to prevent other conditions? Pure economic analysis would favor the efficiency of that approach; however, politics and human nature would not.

Issues of blame and controllability. The attribution of death to a voluntary, controllable cause or behavior (like smoking) appears to play an important role in determining the degree of social sympathy that is likely to be provoked and, correspondingly, the level of difficulty experienced in securing financial support for prevention and treatment programs (34). Public funding for programs to prevent the spread of human immunodeficiency virus (widely perceived to be a voluntary, controllable risk) generally meets a great deal of opposition despite overwhelming evidence that many such programs actually save society money as well as lives. By contrast, even the specter of cancers from involuntary, uncontrollable sources (such as air pollution, second-hand tobacco smoke, and electromagnetic fields) provokes widespread calls for greater research and funding.

The human propensity to feel less charitable toward those perceived to be taking on voluntary or controllable risks is particularly pertinent in view of findings by psychological researchers that people almost universally underestimate the importance of situational (or environmental) factors, as opposed to personal qualities, in determining the behavior of individuals. Indeed, this tendency appears to be so deep-rooted and so widespread that psychologists have termed it the fundamental attribution error (35). Studies also show that the proclivity to over-assign blame to the individual when considering other peoples’ behavior does not extend to the evaluation of one’s own behavior; one usually takes credit for successes while blaming failures on the surrounding environment. With these findings in mind, it is perhaps not surprising that people feel less sympathy for cigarette smokers (a distinct minority of the population) who contract lung cancer than for inactive people with poor dietary habits who fall victim to coronary heart disease.

A perverse sense of fairness seems to exist. There is less sympathy for lives in peril when the individuals at risk are judged to have “brought it on themselves.” The problem, once again, is that what is perceived as fair from the point of
view of causation need not be fair—or efficient—with regard to final outcomes and the efficient allocation of scarce societal resources.

Expectations of budget neutrality. Another obstacle conspiring against increased investment in prevention programs is the public expectation that such interventions should pay for themselves. This is a view that is expressed with growing frequency in public discussions on health, social programs, and the environment. Well-intentioned prevention advocates are fond of arguing that a dollar invested today in a particular program produces more than a dollar’s worth of savings later. Recently, public figures have taken up the call, insisting that health, social, and environmental programs should “pay for themselves.” Terms such as “budget-neutrality” and “pay as you go” appear frequently in lawmakers’ discussions of Medicare and Medicaid financing. Indeed, the idea that new health initiatives should pay for themselves has the force of law. According to the Balanced Budget Act of 1997, no Medicaid waivers under Section 1115 of the Social Security Act may be granted unless states can demonstrate the “budget neutrality” of their proposed initiatives. This same law requires that all base-year Prospective Payment Service Medicare outlays be “budget-neutral” in their impact. The phrase “budget-neutral” appears 18 times in the text of the recently enacted congressional budget appropriations law concerning Medicare, Medicaid, and the Children’s Health Insurance Program.

The idea that “an ounce of prevention is worth a pound of cure” is well entrenched in the human psyche, makes an excellent media sound bite, yet is rarely true. A recent compilation of 500 economic evaluations of lifesaving interventions found only a small fraction of instances in which a medical prevention program paid for itself (4). In the large majority of situations, increased survival carried with it new long-term competing risks and additional resource costs that wiped out any short-term savings attributable to the prevention program.

To a cost-effectiveness analyst, budget neutrality is not a reasonable expectation nor is it good policy. When it comes to most public—and virtually all private—expenditures, people recognize that they must sometimes draw down their wealth to pay for the things they most desire. Nobody objects to spending good money when the benefits are believed to exceed the costs. People understand the idea of return on investment. Budget neutrality, however, demands return without investment (i.e., a free lunch). It is the search for a money-making program disguised as a health intervention, which if used as a public-policy hurdle, will force individuals to cast aside many sound investments in health promotion and disease prevention (36,37). For instance, suppose that a new therapy is shown to safely and reliably decrease cigarette smoking at a cost of $10,000 per QALY gained. With budget neutrality, either the therapy could not be adopted or some other health care service would have to be cut back or eliminated.

CONCLUSIONS

In summary, this task force has reviewed the major evidence on the value of preventive therapies. As in other areas of medicine, prevention is a complex mix of different strategies and technologies with widely varying economic attractiveness. Although primary prevention is more attractive on an emotional level, economic analysis usually finds secondary prevention to be more efficient. This is due to the rather simple fact that patients who have clinical disease are at higher risk, and therefore more likely to benefit, than a group of lower-risk subjects, only a few of whom will ever develop disease. The number needed to treat to save a life is much smaller in secondary prevention, and hence the cost to save a life is also smaller (more favorable). The decision to implement a preventive strategy on a widespread scale depends not only on the economic attractiveness but also on the cost of the whole program to the health system. The purchasers’ perspective may also “tilt” a decision because benefits of a long-term prevention strategy may not accrue to the organization required to make the initial investment. Also, an economically attractive intervention is no bargain if there is no money in the budget to pay for it or if it diverts money away from other important social priorities such as housing and education. Finally, economic analysis is just one part of the complex equation of clinical and policy decision making and often is trumped by other considerations. Policy makers do not display the “steely” rationality implicit in economic theory, and physicians cannot sit by and do nothing if a patient’s life is threatened, even if all they can do is very expensive and may have only potential for benefit.

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TASK FORCE 2 REFERENCE LIST

The provision of preventive cardiology services in the U.S. will require a combination of the medical model of care and of community preventive health programs. These approaches are complementary, synergistic, and each essential, with a goal of “getting results” in the broadest possible population. Organizations such as the American Heart Association (AHA) and the National Heart, Lung, and Blood Institute (NHLBI) have outlined algorithms for the primary and secondary prevention of coronary heart disease (CHD) (1–3), but it is a combination of medical-model and community program approaches that will deliver preventive care. In that the mortality from heart disease has dropped by 40% since 1970, the present approach is not without positive results (4). The goal of this discussion is to describe the types of clinical, community, and media programs that have been effective in decreasing coronary risk in the general public. Because an understanding of the principles of media and communication are crucial to the success of any health promotion program, the principles of effective media and communication are briefly reviewed.

Physicians are generally well trained in defining the presence of coronary risk factors and in the medical management of hyperlipidemia, hypertension, and diabetes. Further training of cardiovascular (CV) specialists as leaders in prevention (see Task Force Report #5) will assist in this effort. Physicians are, however, far less capable of managing and influencing lifestyle-related risk factors such as tobacco use, diet, physical inactivity, and the consequences of obesity. In addition, a brief office encounter does not lend itself to the counseling and follow-up necessary to initiate a change in unhealthy lifestyles. Broadening the physician encounter to include non-physician personnel and community resources will yield a greater impact in reducing coronary risk. Furthermore, a high percentage of young adults do not regularly visit physicians until the presence of lifestyle-related conditions such as CHD or type II diabetes are detected; thus, the role of public policy, school and worksite programs, and mass-media should be emphasized. Physicians, as role models and opinion setters, play a crucial role in supporting the design and development of community programs.

Numerous documents and position statements define treatment goals for the prevention of CHD (2,5). Less clear are the processes by which Americans might reach these goals. It is only through a combination of community programs, medical referral and treatment, and mass media approaches to screening and therapy that the majority of Americans will attain appropriate risk factor levels to significantly reduce the incidence of CHD.

**PROGRAMS OF GOVERNMENTAL AND NON-GOVERNMENTAL ORGANIZATIONS**

**National Cholesterol Education Program.** The National Heart, Lung, and Blood Institute (NHLBI) of the National Institutes of Health (NIH) launched the National Cholesterol Education Program (NCEP) in November 1985 (5).