Cost-Effectiveness of Antihypertensive Treatment

General Considerations

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Cost-effectiveness analysis, a set of methods for estimating the costs and health effects of medical interventions, helps decision makers to compare alternative treatments and to decide which interventions are appropriate in which situations. This article outlines some fundamental principles of cost-effectiveness analysis and discusses the characteristics necessary if alternative therapies are to be more cost-effective than traditional drug treatment for hypertension. The discussion focuses primarily on the newer drugs like angiotensin converting enzyme inhibitors, α-adrenergic receptor blockers, and calcium antagonists. (Hypertension 1989;13(suppl I):I-141-I-144)

Cost-effectiveness analysis is a set of methods for answering the questions: What will this treatment cost? What effects—good and bad—will this treatment have on health? Cost-effectiveness analysis combines information about all these elements, and, by doing so, helps decision makers to weigh the elements, to compare alternative treatments, and to decide which treatments are appropriate in which situations. The methodology is thus well suited to address the issues before this workshop: the benefits, risks, and costs of alternative modalities of treating hypertension.

This article outlines some fundamental principles of cost-effectiveness analysis and discusses the characteristics necessary if alternative therapies are to be more cost-effective than traditional drug treatment for hypertension. The discussion focuses primarily on the newer drugs like the angiotensin converting enzyme inhibitors, the α-adrenergic receptor blockers, and the calcium antagonists. Because of space limitations, this article touches only briefly on a number of complex topics; a more complete description of cost-effectiveness analysis is presented in Is Prevention Better Than Cure?1

What Defines Cost-Effective Treatment?

Whether a particular treatment is cost-effective depends on the answers to three questions, the most important of which is the first: Is the treatment effective? When risks as well as benefits are considered, does the treatment actually improve health? If the answer is no, then the analysis need not proceed any further. There is no point in allocating time and money to those measures that do no good or that even do harm.

If the treatment is effective, the second question to be answered is: how much does the treatment cost? If it is effective and costs nothing or even saves money, then the treatment can be accepted at once because it is the best of all possible deals—an opportunity that brings some good and frees resources for other uses at the same time. However, most effective medical interventions add to costs. Medical interventions are thus standard economic choices, like so many others in life: the costs must be weighed against the gains to arrive at a decision.

The third question to be answered then is: How do the gains compare with the costs? Are the health benefits a reasonable return for the required expenditure? The decision is a comparative one because the answer depends on alternative treatments. If other treatments bring a better return for the money, they will be preferred. The decision also depends, fundamentally and inescapably, on values. The cost-effectiveness analysis shows the costs and effects, but it takes a personal human valuation of that information, a judgment, to decide whether the effects are worth the costs.

With society’s resources limited, it is essential to direct attention to those medical interventions that produce the best health with those resources. Cost-effectiveness analysis shows which interventions do this. Like the analyses in Consumer Reports, a cost-effectiveness analysis shows what we get and what we must pay to get it. But the choice is up to us.
Cost-Effectiveness Formulas

The distinctive feature of cost-effectiveness analysis is that, while costs are measured in dollars, health effects are measured in units more natural to them. The following formulas show the elements included in costs and effects:

Costs = costs of treating hypertension + costs of treating side effects of therapy - savings in (1) treatment because disease is prevented.

Traditionally, cost-effectiveness evaluations have expressed health effects in terms of the number of lives saved or the number of years of life gained. Neither measure takes into account the state of health during the additional years of life. An intervention that adds 10 years of good health to an individual's life is clearly preferable to one that adds 10 years of poor health, but the two interventions would appear equal unless some adjustment is made. The importance of adjusting for state of health is particularly evident in antihypertensive treatment, where side effects are such an important issue.

Methods have been developed that allow the number of years of life gained or lost through treatment to be translated into an equivalent number of years of good health.\(^1,2\) Simply stated, these methods value a year of good health at one, death at zero, and states of imperfect health at appropriate points between zero and one; valued this way, different states of health for different lengths of time can be added to compute the total number of healthy years. When these methods are used, changes in health during the years that would have been lived without antihypertensive treatment can be included among the health effects. The terms in the following formula are expressed as years of good health, and the sum of these terms is the total number of years of good health gained from treatment. In the literature, these years of good health are referred to as years of healthy life, well-years, or quality-adjusted life-years.

Health effects = years of life gained from treatment + better health (or - poorer health) (2) during the years that would have been lived without antihypertensive treatment - years of life lost to side effects.

The costs and health effects of antihypertensive treatment occur over a long period of time, perhaps 20 or 30 years for a specific patient. In cost-effectiveness analysis, costs and effects that occur in future years are discounted to reflect the fact that they are not valued as highly as those costs and effects that occur this year.\(^1\) These discounted costs and effects are then added to yield the totals shown by Formulas 1 and 2.

The results of a cost-effectiveness analysis are usually presented in two ways. The aggregate costs and health effects, including total expenditures, expenditures on particular items, and years of life gained for the study population or any of its subgroups, can be presented in detailed tables. For hypertension, costs and effects might be shown for people with mild hypertension, for 50-year-old men with mild hypertension, and so on.

The results can also be summarized in the form of cost-effectiveness ratios for the study population or its subgroups. A cost-effectiveness ratio shows the cost per unit of health effect, for example, the cost per year of good health gained by 50-year-old men with mild hypertension. A cost-effectiveness ratio is calculated by dividing the costs by the health effects:

Cost-effectiveness ratio = costs + health effects (3)

Cost-Effectiveness of Traditional Antihypertensive Drug Therapy

In 1976, Milton Weinstein and William Stason published a book, *Hypertension: A Policy Perspective,*\(^2\) in which they reported the results of a cost-effectiveness analysis of antihypertensive drugs. The use of these drugs was compared with the alternative of waiting until the consequences of hypertension developed and then treating them. I will not describe the results in detail, but I will point out several generalizations that emerged from the study because they highlight some important possibilities for alternative therapies.

The analysis showed that drug therapy for hypertension was neither a bargain nor too expensive to be worth considering. The cost per year of healthy life varied widely according to the age and sex of the patient and the severity of the patient's hypertension; treating moderate or severe hypertension was considerably more cost-effective than treating mild hypertension.

Two related phenomena, side effects and compliance, were found to be important factors in the cost-effectiveness of treatment. By reducing the health gains from treatment, side effects substantially raised the cost per year of healthy life.\(^3\) If the side effects are severe enough, the health gains are eliminated entirely. Failure to comply completely with the drug regimen also reduced the health gains and increased the cost of producing an additional year of healthy life.\(^3\)

When Will the New Antihypertensive Drugs Be More Cost-Effective Than the Old?

Throughout this discussion, I have assumed that each new drug is compared with the alternative of leaving hypertension untreated and treating its consequences when they occur, the same comparison that Weinstein and Stason\(^3\) used for traditional drug therapy. Thus, new and traditional drugs would be compared with the same alternative, which perhaps can be summarized without too much inaccuracy as the "do-nothing" alternative. The results of a series of cost-effectiveness calculations for this kind of comparison would show the costs, effects, and cost-effectiveness ratios for each drug compared...
with doing nothing; results would be calculated separately for each group of interest, for example, people over 65 or smokers. The results can be compared directly to answer the question: which drugs produce a year of healthy life at least cost for which people?

Simply stated, a new drug regimen will be more cost-effective than traditional drug therapy, that is, it will produce a year of healthy life at lower cost if the new drug regimen costs less, produces better health, or both. However, there are many ways to lower costs or increase health benefits, and some of these methods are not obvious at first glance. I will review the possibilities and note which of them seem likely on the basis of what is known about the new drugs. The point here is to provide a framework for thinking about cost-effectiveness analysis of new drugs by discussing the elements that should be included.

The new drugs could cost less if they are given less often, for shorter periods, or less continuously; new drugs could also cost less if they cost less per dose. In the regimens usually prescribed, the new drugs are considerably more expensive than the traditional ones, so new drugs will not prove more cost-effective on this basis. Stason has been quoted as estimating the cost of traditional drugs at $90–201/yr compared with $322–755 for the new drugs. However, this does not exclude the possibility that the new antihypertensive agents are less costly in the long run or at least not as expensive as they appear. It has been suggested that it may be unnecessary to take antihypertensive drugs continuously to control high blood pressure. At least some hypertensive subjects may be able to take drugs intermittently, without loss of hypertension control. If the new drugs permit this regimen more often than do the old, the cost of the new drugs will be reduced.

Costs could also be lower if the new drugs involve less expense for associated treatment, like diagnostic workups or treatment for side effects. There is no suggestion that the diagnostic workup would be less expensive with the new drugs. Indeed, as one writer suggested, if it becomes useful and possible to add tests to distinguish among hypertensive subjects according to characteristics that indicate different drug regimens, the workup may be more expensive. However, the cost of treating side effects may be less with the new drugs; this possibility will be discussed again when side effects are considered as part of health effects.

The new drugs could produce better health than do the traditional ones in several ways. For example, the new drugs may produce greater reductions in blood pressure and hence greater reductions in the incidence of stroke and heart attack. The new drugs may have beneficial effects on other diseases like cancer or osteoporosis, or they may produce better health because they have fewer side effects, and thus the subtraction from the positive benefits is smaller. Fewer objective side effects would reduce the number of years of good health lost to side effects and illnesses caused by them. Fewer subjective side effects would result in better health while patients were on drug therapy and could lead to better patient compliance, so that more people benefit and they benefit more; as noted previously, Weinstein and Stason showed that patient compliance has an important effect on the cost-effectiveness of antihypertensive drugs. Obviously, many of these gains can be represented only by a measure of health gain that allows for changes in the state of health as well as in the length of life.

The literature suggests that, if the new drugs prove to be more cost-effective than the old, the increased cost-effectiveness will be due to fewer adverse side effects. Zusman points out that the new drugs could, as a beneficial side effect, contribute to better cardiovascular health. For example, some of the new drugs are associated with a reduction in plasma cholesterol, while some of the old drugs are associated with an increase. Thus, one of these new drugs could produce a greater reduction in the incidence of heart attack for the same reduction in blood pressure.

Of course, fewer or less severe side effects imply that patients would suffer fewer problems while on drug therapy and would experience better health than with traditional drugs. As noted, fewer side effects would mean that the subtraction from health gains because of side effects, reflected in items 2 and 3 of Formula 2, would be smaller. Fewer side effects could also help reduce costs. When a patient experiences significant side effects, the physician often tries to adjust the drug regimen to avoid them. This situation can result in more frequent visits to the physician and wasted prescriptions when a drug is discarded in favor of another that is expected to produce better results. Additional treatment may also be necessary to counter the side effects. If the side effects can be avoided in the first place, these costs are avoided.

Fewer or less serious side effects could also improve compliance, which would result in greater health benefits for more people. Croog and others found better compliance with captopril, one of the new drugs, than with methyldopa or propranolol although only the difference between captopril and methyldopa was statistically significant. During the 6 months of the study, the percentage of men who withdrew because of side effects was 20% for methyldopa, 13% for propranolol, and 8% for captopril. Differences in compliance of this magnitude could make a substantial difference in health benefits.

The Croog study raises a second intriguing possibility. Weinstein and Stason, reflecting the medical knowledge of the time, assumed that antihypertensive drugs could make patients feel worse but could not make them feel better because hypertension was symptomless. However, Croog and his colleagues found improvements in various measures of functioning and well-being with the use of
captopril. If these benefits were counted, they would increase the cost-effectiveness of captopril.

Nonpharmacological Therapies

I have not specifically discussed nonpharmacological alternatives to drug therapy although the same type of discussion applies to them. Nonpharmacological treatments will be more cost-effective than traditional drug treatments if the nondrug therapies have lower costs or produce better health, and there are, in fact, many ways they can achieve these effects.

Two cautions are perhaps worth noting. The first is that these alternatives should not be assumed to be more cost-effective than drug therapy without analysis; there is a tendency to think of lifestyle changes as being without risk or cost when such changes usually involve both. The second aspect is that any therapy can be less health-effective than its alternative and still be more cost-effective if the costs of the therapy are small enough. Thus, if lifestyle changes or other therapies are less expensive than drugs, they can sometimes be the better choice even if they also produce less good health.

Estimating Cost-Effectiveness of the New Antihypertensive Drugs

If the new drugs neither produce better health nor cost less than the older ones, the new drugs should not be used. In this case, new drug treatments are simply a more expensive way to accomplish what can already be accomplished with traditional regimens. Nevertheless, it is possible that the new antihypertensive drugs do produce better health, and that their costs, if not lower than those of traditional drugs, may be lower than they appear at first. Thus, the analysis is worth pursuing. We cannot know the answers without doing the arithmetic.

Because the possible advantages of the new drugs have not been documented by large clinical trials, the current evidence on which to base cost-effectiveness analysis or medical decisions is not as solid as one would like. In the meantime, however, decisions are being made. Stason's article presents some cost-effectiveness estimates based on current knowledge about the new drugs.

References


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