

Conclusions

In this paper, we examined five approaches developed by economists and health policy analysts to evaluate policy affecting health and safety: COI, WTP, cost-effectiveness analysis, risk-risk analysis, and health-health analysis. We examined what analysts measure when using each approach, determined the appropriate use for each approach, and examined the influence that assumptions embedded in each have on policy guidance. We also addressed measurement issues raised by available empirical methods.

Our analysis left us with four principal conclusions. First, the usefulness of each approach depends on the unit of account. The philosophical decision to eschew the monetization of health costs or benefits constrains the ability of the approach to rank policy options and to gauge the social desirability of policy. Second, all of the approaches except risk-risk analysis and one variation of cost-effectiveness analysis incorporate the effects of income and circumstance. As a result, policy guidance could be influenced by the distribution of income. Third, the approaches are not interchangeable: they measure different things. Even estimates using the same approach are often not comparable because, in practice, there is little consistency in the application of any approach. The fact that each approach measures something different suggests a need for some guidelines for its proper use. Fourth, the theory and practice of WTP estimation are in opposition. While it is now common practice for regulatory agencies to adopt the WTP approach to estimate health and safety benefits, they do so by ignoring the importance of individual preferences.

Unit of Account Affects Usefulness of Results

One of the first decisions that health-policy analysts must make when measuring the costs and benefits of health and safety intervention is the unit of measurement to use. In conventional cost-benefit analysis, such as WTP or COI, both the costs and benefits of policy are measured in dollars, requiring that health outcomes be translated into dollar amounts. Cost-effectiveness analysis uses dollars to measure costs but leaves benefits in physical terms, namely a count

of the adverse health outcomes averted. In risk-risk analysis or health-health analysis, both costs and benefits are expressed in terms of health outcomes.

The choice of a unit of measurement reveals the philosophical underpinnings of the approach. Approaches that monetize benefits and costs are built on the philosophical stance that, like other commodities, health and life can be valued in economic terms for comparison with other goods that people value. Approaches that do not use money as the unit of measurement reflect the stance that health and life are invaluable and cannot be measured with a finite amount of dollars.

Unfortunately, analysts who, for philosophical reasons, do not choose dollars as the unit of measurement, restrict the usefulness of their analyses for ranking policy options and for determining the social desirability of policy. Only COI and WTP, the two monetized approaches, provide a full ranking of policy options and a context for determining social desirability. Because COI and WTP translate health outcomes into a common unit of account, analysts using either of these approaches can rank dissimilar programs with different health outcomes (the costs and benefits of a kidney machine can be compared with those of a nutrition program). Because COI and WTP use money as the unit of measurement, analysts using either approach can comment on the net benefit of policy options. If the net benefits of a program were negative, the program would not be worthwhile, regardless of whether it was ranked higher than every other program. In addition, because money is already in common use in ranking choices and in conveying value, analyses based on a money scale allow us to compare values and make trade-offs among all goods, whether produced in the public or private sector. With a monetized account, we can compare the relative value of various public health programs and compare public health programs with alternative ways individuals might spend their money, like consumer goods. We can compare the value of programs with the value of goods and labor services that have to be used to carry out the program. And these comparisons can be easily accomplished. If dollar benefits exceed dollar costs, the program is worth the price.

The cost-effectiveness approach cannot be used to compare programs with different health outcomes, because it measures costs and benefits in different units of account. The costs and benefits of a kidney machine cannot be compared with those of a nutrition program. In addition, cost-effectiveness estimates do not, by themselves, indicate whether either program offers positive net benefits. Cost-effectiveness analysis reveals that a program that saves 5 lives for \$100 million is preferable to one that saves 2 lives for \$100 million, but it does not reveal whether either of the programs is socially desirable.

Like COI and WTP, health-health analysis has the advantage that costs and benefits are measured in a common unit. And, as with conventional cost-benefit analysis, comparisons can be drawn across diverse programs and net benefits can be shown to be either positive or negative. A kidney program that saves 10 lives is ranked above a nutrition program that saves 9, and the fact that both programs cost 11 lives means that both have negative net benefits and neither is socially desirable. A primary disadvantage of health-health analysis is, unlike conventional cost-benefit analysis, particularly WTP, which assigns values to morbidity and pain and suffering, health-health analysis is restricted to mortality risks.

It is interesting to note that when analyses of costs and benefits are denominated in lives, the calculated costs and benefits usually differ from conventional cost-benefit analysis in more than accounting definitions. For example, a health program with an estimated cost of \$1 million and benefits of \$5 million has a benefit-cost ratio of 5, and, all else equal, the project appears to be a good return on Federal expenditures. A similar risk-risk ratio is likely to generate less enthusiasm. A 5:1 ratio of deaths averted to deaths induced could be unacceptable—as in the case of front-right passenger airbags, where one life is lost (usually a child's) for every five lives saved. That a 5:1 ratio of benefits to costs derived from conventional benefit-cost analysis is viewed differently from a 5:1 ratio of benefits to costs derived from a risk-risk analysis shows that the two techniques reveal different information. The units of account are not the only difference. One could argue that dollar costs imposed on one group can be offset one-for-one by dollar benefits another group receives. However, it is difficult to argue that a life lost in one group can be offset one-for-one by a life saved in another group. The

issue of distribution of costs and benefits takes on more importance in the evaluation of health and life than in the evaluation of other goods and services.

The Influence of Income and Circumstance Is Impossible To Avoid

WTP, COI, and cost-effectiveness analysis share a surprising feature. When analysts attempt to make their calculations relevant to public health decisions, either accounting for individual preferences or accounting for social costs, policy guidance will be influenced by income and circumstance. In this regard, policy guidance offered by an analyst using cost-effectiveness is no different from guidance derived from conventional cost-benefit analysis where all benefits are monetized. All else equal, programs that offer benefits for the wealthy will show greater net benefits or greater cost-effectiveness than programs offering identical health benefits to the poor.

In health-health analysis, income effects are incorporated through costs rather than benefits. While conventional cost-benefit analysis might show relatively larger benefits when benefits accrue to the wealthy, health-health analysis might show relatively larger costs when costs accrue to the poor. That is, health-health analysis is more likely to guide policies away from programs that impose costs on the poor.

The Approaches Are Not Interchangeable: They Measure Different Things

One of the principal reasons that analyses are not comparable is that each approach embodies a different view of what a cost is. COI, cost-effectiveness analysis, and risk-risk analysis all measure costs in terms of *ex post* damages while WTP measures costs in terms of *ex ante* risk perception. WTP reflects expectations rather than realized damages.

There are also practical problems with drawing comparisons among results. There is no template for any of the approaches. Analysts must decide what counts as a cost or benefit and must choose among different tools and techniques to measure costs and benefits. For example, we examined four methods for measuring WTP. The four approaches are substantively dif-

ferent from one another and some measure preferences of different populations. In COI, analysts sometimes include defensive expenditures, and sometimes do not. Some include only those costs incurred by the individuals who benefit from programs, ignoring the spillover. Some use observed prices, and others attempt to modify prices to eliminate effects of cross-subsidization common in health care.

The fact that the methods measure different costs and benefits suggests that there are circumstances where one would be more appropriate than another.

- The COI approach is not a valid tool for welfare analysis because it does not provide adequate estimates of individual or social welfare. COI estimates are not reliable measures of disease severity. Only under very unusual conditions could COI estimates serve as a lower bound to WTP. However, despite these shortcomings, the COI approach is still a useful economic tool. The COI approach provides an *accounting* of the dollars spent on medical expenses and the wage dollars forgone as a result of illness, accident, or premature death. Such an accounting provides useful information to economists and policymakers in that it indicates the direction and magnitude of the economic flows resulting from health shocks to the economy.

- WTP measures provide the best estimate of *individual* welfare available to economists. It is a logical and consistent application of the primary tenets of standard applied welfare economics. While there is little reason to challenge WTP from a theoretical perspective, estimation raises practical problems because it depends on individual and idiosyncratic utility functions. With additional studies analysts may be able to estimate the demand for risk reduction throughout the population for a variety of different risks.

- Of the three variants of cost-effectiveness analysis in common use, the simplest, the ratio of program costs to a count of health benefits, may be the most useful. This variant of cost effectiveness may serve as a coarse filter, helping to screen out programs that more complex analyses would also show are not worthwhile. However, this use of cost-effectiveness has no theoretical appeal. It is not an individual welfare measure and does not fully account for costs avoided by programs. Cost-effectiveness analysis

may help minimize costs when an irrevocable decision has been made to take an action, but no decision has been made about technique or method.

- Risk-risk analysis is most useful in cases of all-or-nothing decisions. That is, only one program is offered and the decisionmaker must decide either to go forward with the program or accept the status quo. When there are more options, risk-risk analysis shifts most of the burden of analysis to the decisionmaker.

- Health-health analysis is an appropriate technique for comparing costs and benefits when analysts want to highlight both policy efficiency (net benefits) and the distribution of health (the extent to which one subpopulation might benefit at the expense of another). However, until the relationships between income and morbidity are better understood, health-health analysis is suitable only where benefits are denominated in the number of lives saved. Further, because analysts who use health-health analysis must translate dollars (income) into health, it may be easier to simply use standard cost-benefit analysis.

Theory and Practice Are in Opposition for WTP

In practice, regulatory agencies using WTP to estimate the value of lives saved have generally adopted a single value derived from compensating wage studies. Agencies apply this value to every health risk, regardless of the population likely to receive program benefits, the type of risk that might be mitigated, or the level of risk mitigated. This practice is in opposition to the reason for choosing WTP as a welfare measure and flies in the face of empirical evidence. There is no universal value that can be used in every situation. So far, no one has provided a compelling reason that labor market risk values are relevant for food safety risk assessment, where risks are especially large for the very young, the very old, and the infirm. Only with additional studies targeted specifically toward food safety risks will analysts be able to estimate relevant demands for risk reduction throughout the population. At that time, analysts will be faced with exactly the same problem facing those using COI. There will be a range of values that vary demographically. Cost-benefit analysts using WTP estimates will then be back in the awkward position of assigning different values to different individuals.