

Methods for Investigating Costs and Benefits of Prevention Interventions

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IMPORTANCE OF INVESTIGATING COSTS AND BENEFITS OF DRUG ABUSE PREVENTION

Adolescent drug use is a major public health problem because of the proportion of the population using drugs and because of the multiple effects of adolescent drug use on adolescents, their families, and their communities. In 1993 an estimated 87 percent of high school seniors reported use of alcohol, 35 percent had used marijuana, and 6 percent had used cocaine sometime in their lifetime (Johnston et al. 1994). High school senior data are considered lower bound prevalence data because the sample does not include an estimated 20 percent who dropped out of school, a subset with higher rates of drug use than the students surveyed (Johnston et al. 1994). Particularly disturbing is the proportion of drug users with preadolescent onset of use, with 24 percent of students reporting that they used alcohol by sixth grade (Gleaton and Adams 1990).

Drug use is linked to increases in the adolescent's health-related risk behaviors such as failure to use condoms, failure to use birth control, and sharing of intravenous needles (Cahalan 1991) and also increases in risk for a number of health conditions, including cancer, chronic liver disease, heart attack, stroke, and HIV/AIDS (Colliver and Malin 1986; U.S. Department of Health and Human Services (1991). Drug use has psychological and economic impacts on the adolescent's parents and siblings (Brook et al. 1990) and increases the risk of infant mortality and morbidity for the offspring of childbearing adolescents (Chasnoff 1988; Kleinman et al. 1988; Little et al. 1989). Community impacts stem from the association of drug use with motor vehicle accidents, suicide, homicide, rape, assault, and robbery (Inciardi and Pottieger 1991; Perrine et al. 1988). Current analyses estimate that the U.S.

economy absorbed \$70.3 billion in alcohol abuse costs and \$44.1 billion in other drug abuse costs (Rice et al. 1990). A 1987 report sponsored by the Boy Scouts of America, "Making the Grade: A Report on American Youth," estimated that drug use is a major determinant of school dropout for two-thirds of all dropouts, resulting in losses of \$228 billion in personal income and losses of \$68 billion in taxes.

To reduce the misuse of licit and illicit drugs, the U.S. Department of Health and Human Services (DHHS) has increased funding for drug abuse prevention demonstration projects. Over the past three decades, a wide range of prevention strategies has been implemented, directed at modifying characteristics of adolescents (e.g., increasing drug knowledge, changing attitudes about drugs, increasing social skills and resistance to social influence or peer pressure) and modifying the environmental context of adolescents (e.g., providing alternative opportunities for challenge, increasing parental influence on school policy, and increasing community influence).

With evidence that adolescent drug use has been rising in recent years, questions about the value of prevention programs are once again prominent in the public debate. Moreover, questions about program effectiveness are being increasingly linked with questions about program costs. Unfortunately, the literature on the cost-effectiveness and costs and benefits of prevention programs is relatively new and limited in scope.

In a review of the health literature from 1979 to 1990, Elixhauser and colleagues (1993) cited 3,206 studies that used either cost-benefit analysis (CBA) or cost-effectiveness analysis (CEA) to evaluate mostly clinical procedures. The authors classified 88 of the 3,206 articles as studies that focus on topics related to prevention. None of these 88 articles deals specifically with an evaluation of a drug abuse prevention program. Since 1990 more articles have been published that involve CBA and CEA of prevention programs; however, still no published studies exist that apply CEA or CBA to a drug abuse prevention program.

This chapter seeks to contribute to researchers' knowledge about the costs and benefits of drug abuse prevention by describing common methods of economic analysis, identifying critical challenges in measuring the costs and benefits of drug abuse prevention, and outlining a list of important steps to follow in an economic evaluation. Emphasis is placed on the practical

application of these methods to a drug abuse prevention program called ALPHA. The ALPHA program is operated by Operation PAR, in cooperation with the Pinellas County School Board in the State of Florida. The chapter concludes with recommendations on a process for progressive refinement and dissemination of economic evaluation methods for the drug abuse prevention research and service communities.

COMMON ECONOMIC ANALYSIS METHODS: DEFINITION OF TERMS

Policymakers in governmental bodies, schools, community-based organizations, and funding agencies increasingly are being asked to justify expenditures on complementary, but competing, programmatic efforts. They also are being asked to choose between programs that seek to achieve similar goals. While issues of costs generally are important to policymakers, they are particularly important in an era of fiscal constraints and declining resources.

Drummond and colleagues (1987) define economic evaluation as “the comparative analysis of alternative courses of action in terms of both their costs and consequences.” The heart of this process is the concept of opportunity cost, in which the true cost of a drug abuse prevention intervention is essentially the foregone benefits that could have been achieved had the resources been used for the next best alternative (Drummond et al. 1987). For example, the cost of a drug abuse prevention program that prevents a thousand children from using drugs may be a year of life of an elderly person, whose life could have been prolonged if the resources had been allocated toward an experimental therapy. When policymakers allocate funds for a particular program, they essentially are deciding that society will give up the benefits of some other program. Economic evaluation can help decisionmakers make these choices, while also attempting to ensure that limited funds are used efficiently.

This notion of an opportunity cost is particularly important when a health program is the focus of the analysis. Unlike other parts of the economy, many goods produced in the health sector are not explicitly bought and sold in markets. Normally, a market price reflects how much a society is willing to pay for a certain good or service. For example, according to economic theory, teachers’ salaries indicate how much society values the education of its

children. However, the amount society is willing to pay to prevent one child from using drugs is yet to be defined. It is difficult to answer this question because prevention cannot be bought and sold in a market. This problem makes it particularly important that the opportunity costs of health interventions be made explicit—otherwise, the lack of prices to guide decisionmakers impedes efficient resource allocation.

The most common economic methods used to evaluate programs are cost-effectiveness analysis and cost-benefit analysis. (Cost-utility analysis is another method of economic analysis, but it is not discussed in this chapter.) Both of these two methods are used to compare the costs and the outcomes of alternative, competing programs. CBA and CEA are similar in the methods used to collect data on costs. Both require documentation of the total value of resources consumed by the program under evaluation, as well as other alternative programs being investigated. The methods, however, diverge in their treatment of the consequences, or the benefits, of the program and its alternative(s).

CEA is implemented under the assumption that the program under evaluation and its alternative both produce the same type of outcomes. The value of these outcomes themselves is not questioned—instead, the evaluator is interested in the least expensive means of producing these outcomes. That is, CEA is used to compare alternative policy or program interventions in an effort to assess which alternative achieves the desired goal at the lowest overall cost. For example, CEA may compare two drug abuse prevention programs (a parent training program versus a family training program), or the analysis could compare a defined drug abuse prevention program, such as a school-based social skills intervention, with the school's "usual efforts" with high-risk youth. An example of usual efforts might be an after-school recreational program for high-risk youth.

In CEA, the question of interest is, Which of the available alternatives is the least expensive way to produce a unit of drug use prevention? Units of prevention can be measured in a variety of ways (e.g., life-years gained, hospital emergency room visits prevented, cases of adolescent drug use prevented), but they must be measured the same way across alternatives. Usually, alternatives are compared using cost-per-unit effectiveness (i.e., unit of prevention) ratios.

CBA theoretically can be used to assess whether a program or policy intervention is a worthwhile investment in and of itself, without comparison to other programs. It also can be used to compare interventions and policies. Traditionally, benefits as well as costs are valued in monetary terms—this feature distinguishes CBA from CEA, in which benefits are measured in their natural units. CBA is used to determine whether the benefits of a program measured in dollars outweigh its costs and thus justify the allocation of resources to that program. The most common indices in CBA are the cost-benefit ratio and net benefits.

The choice of approach in the valuation of costs and benefits in CBA reflects the assumptions and values of the researcher. The willingness-to-pay approach attempts to capture what individuals would be willing to pay for costs and benefits. For example, if an intervention reduces the probability of death or illness, willingness-to-pay methods would attempt to find what people would be willing to pay for a reduction in the probability of illness or death.

Willingness to pay for health outcomes is difficult to measure accurately for a number of reasons. For example, individuals' willingness to pay for a health improvement is heavily affected by income level (i.e., upper income families are able to pay more than poor families), and individuals are not accustomed to placing an explicit value on probability of illness or death. There is a growing literature on willingness-to-pay methods in the environmental economics literature. This growth is partly driven by the need to justify environmental regulations, which often impose hidden costs on businesses and, in turn, on consumers.

The human capital approach appears more appropriate for an assessment of the costs and benefits of drug abuse prevention because of current limitations in accurately measuring the willingness to pay for health outcomes. Under this approach, an individual's worth is measured by the discounted value of the individual's stream of productivity over time as measured by wages. The human capital approach assumes a societal perspective and, importantly, uses data that are more readily available and reliable. The human capital approach is appropriate for determining the economic cost of a disease or condition for a defined time period or for determining the cost savings of a specific procedure or intervention.

This approach, however, is limited when evaluating programs involving children or socially or economically disadvantaged

individuals, because society tends to value its members for reasons unrelated to their productive capacity. The human capital approach can undervalue lifetime earnings if current wages do not reflect future value or true abilities. Also, because of its dependence on market earnings, the human capital approach tends to undervalue certain other factors, such as pain and suffering (Rice et al. 1990).

Under the human capital approach, researchers may choose to estimate incidence or prevalence of an outcome. Prevalence estimates are used as the basis for evaluating the direct and indirect costs of an illness incurred during a defined time period such as a year. Incidence estimates are used to assess the lifetime costs of an illness (Rice et al. 1990). It is important to understand these assumptions that underlie the human capital method if the method will be used to value benefits in a cost-benefit evaluation.

Whether a researcher chooses to conduct a CEA or a CBA, there are a number of methodologic issues to be considered, such as whether the costs and benefits are direct or indirect, whether the costs and benefits are tangible, and whether the benefits can be expressed in monetary terms. The following discussion focuses on the definitions of these terms, which are commonly used in economic evaluation studies. Examples of these issues are highlighted in a later section.

Using the Rice and colleagues (1990) methodology, it is useful to classify the benefits of drug abuse prevention as “direct,” “indirect,” and “other related benefits.” In their work on the cost of drug abuse and mental illness, Rice and associates (1990) use this classification system for costs. Since the costs of drug abuse are avoided when abuse is prevented, these costs are actually the benefits of a drug abuse prevention program.

Direct and indirect benefits are classified under the more general category of core benefits. Core benefits are typically those that result directly from preventing the illness or condition itself. Core benefits include direct costs avoided such as dollar expenditures on health, mental health, and social services related to drug misuse and indirect costs avoided, which include the value of lost or reduced productivity. For example, if a patient participates in an inpatient drug abuse treatment program, the hospital expenses incurred are direct costs, while the wages lost by the patient are indirect costs. If this case of drug abuse had been prevented, the foregone hospital

expenses and lost wages could be classified respectively as the “direct and indirect benefits of drug abuse prevention.”

Other related costs are secondary to the condition under study, pertaining instead to the nonhealth effects of the illness. Like core benefits, other related benefits include direct costs avoided, for which monetary payments are actually made, and indirect costs avoided, which represent lost resources. Other related benefits include direct benefits, such as dollar expenditures avoided on drug abuse-related services (e.g., the avoidance of costs associated with the social welfare system), and indirect benefits, such as the value of delinquency or criminal activity avoided (e.g., avoidance of lost productivity due to incarceration) (Rice et al. 1990).

An important issue that arises in most economic evaluations is that some costs and benefits may be difficult to value in monetary terms, and other costs and benefits may be difficult to describe. For example, a treatment intervention may cause physical pain or anxiety. These factors are intangible costs of the intervention, and they may be difficult to describe and impossible to value accurately in dollars. This problem also arises in the context of benefits. For example, a school-based intervention may help children earn higher grades. This benefit may be easy to describe, but it is still difficult to value in dollars.

Researchers have attempted to quantify intangible costs and benefits using a variety of innovative methods. The “cost” of physical pain, for example, can be estimated by a patient’s expenditure on pain medication (Drummond et al. 1987). Questionnaires and experiments based on the willingness-to-pay approach can be used to elicit values for intangible costs and benefits. For example, a researcher might try to determine consumers’ willingness to pay for a reduction in pain by using a highly structured survey that elicits dollar values from individuals. Drummond and colleagues (1987) point out that it is important to assess whether using these relatively new methods to value intangible factors truly will aid decisionmaking. If not, it may be better to avoid this often difficult and expensive process.

CRITICAL CHALLENGES IN MEASURING THE COSTS AND BENEFITS OF PREVENTION

The application of CBA, CEA, and the other economic evaluation concepts described earlier presents the researcher with many challenges. These challenges have not yet been addressed in the context of a drug abuse prevention program, in part because the economic evaluation of these programs is still very new. Some issues, such as a lack of program-specific data, are not inherent in the methods outlined in the previous sections. Other problems, however, do result from methodologic limitations. Several critical challenges that arise in the application of economic evaluation techniques to drug abuse prevention programs are discussed in this section.

First, documenting prevention intervention program costs may not be as simple as expected. Since accounting records generally are not kept for billing purposes, and they tend to be of poorer quality than treatment records. Also, since many prevention programs are relatively new, they lack experience in cost accounting or they may not use an accounting system that sufficiently disaggregates costs as needed for cost-benefit analysis and cost-effectiveness analysis. This problem is magnified by the fact that a number of cost issues cross intervention and comparison conditions. When young people with multiple needs use multiple services, the problem of linking the service to one presenting problem versus another generally requires detailed information on the nature of the service use.

Requests for cost information, therefore, present an added burden for small programs with little or no institutional support or accounting infrastructure. Greater effort is generally required for documenting the costs of prevention services for youth in a comparison prevention program or who are engaged in efforts that could be considered the usual and customary efforts (i.e., the status quo).

Second, decisions must be made about handling one-time or shared administrative costs. For example, overhead costs and capital costs must be considered, especially when comparing established programs with new programs and their attendant capital costs. Volunteer contributions and other types of donations are also common in these types of programs. Donated goods and time represent a benefit to the program, but they can also be a hidden cost since volunteers often require training, facilities, office supplies, equipment (such as telephones and photocopiers), and other support in order to perform their jobs effectively.

Any assumption in the calculation and comparison must be made clear to decisionmakers in order to present a complete picture of the costs of a program. If the study is being conducted from a societal perspective, it is very important to include volunteer labor and donated goods and services as program costs. Even though the program itself does not pay for these goods and services, they are essential to the functioning of the program and represent resources that could have been used elsewhere. That is, the analysis should account for the opportunity costs of these donated inputs.

Finally, the impact of an intervention may take years to realize, but the average study is limited to 4 years or less—this time period may not be sufficient to assess the impact of the program. Many of the long-term benefits of prevention interventions, for example, may occur in the use of health/mental health services or in the labor market. These outcomes can be measured and, in some cases, valued. But very few projects last long enough to follow youth into their young adult years when health/mental health and labor market outcomes can be measured.

In addition to measuring an effect, it is important to make an assumption about how long an effect will last. For example, if a prevention program is designed to raise self-esteem in children in an effort to prevent drug use, two important questions about the outcome are (1) How long will it take for self-esteem to be raised to a level that is defined as success? and (2) Will the effects of the increase in self-esteem last through childhood? Into adolescence? Into adulthood? These issues have implications for benefits valuation. In order to link short-term, intangible outcomes such as improved self-esteem to long-term, measurable outcomes such as adult wage, it may be necessary to make assumptions about the durability of prevention program effects.

These two critical challenges—cost documentation and limited observation of benefits—are important to address in an economic evaluation of a drug abuse prevention program. Some problems may be difficult or impossible to remedy. Even so, it is important that these issues are made explicit in the analysis and that the implications of any limitations are analyzed.

STRATEGIES FOR ACCURATELY ASSESSING THE COSTS AND BENEFITS OF A DRUG ABUSE PREVENTION PROGRAM: THE ALPHA PREVENTION PROJECT

Although many contend that drug abuse prevention programs are more cost-effective than treatment, there is little evidence of the financial costs and benefits of these programs. As discussed in the previous section, the lack of research in this area reflects two critical challenges: difficulties in assigning costs to intervention and comparison conditions and problems in measuring outcomes that do not generally occur until many years after a program's completion. This section discusses strategies for resolving these two critical challenges in the context of the ALPHA Prevention Project, an ongoing NIDA-funded prevention research effort that includes an economic evaluation of a school-based drug prevention project for at-risk children.

The ALPHA Prevention Project is a NIDA-funded research effort to investigate whether an elementary school program for at-risk children has an impact on early adolescent drug use. The authors' research addresses this issue by linking together an existing drug abuse prevention program for at-risk children (the ALPHA program) with an existing annual survey (the Omnibus Survey). The ALPHA program is a school-based drug abuse prevention program targeting fourth and fifth graders with aggressive behavior, social withdrawal, learning problems, and low self-competence. The ALPHA program is operated by Operation PAR, in cooperation with the Pinellas County School Board. The semester-long "pullout" program intervenes with the targeted risk behaviors through behavior management strategies, social skills strategies, and curricular and instructional strategies.

The authors' sample is drawn from the Pinellas County School System Omnibus Project cohort. The Omnibus cohort is assessed annually using teachers and parents to report on a wide range of child and family characteristics from spring 1990 (when the children entered kindergarten) and continues through spring 2002 (when they will graduate from high school). The authors expect that collaboration with Omnibus will increase response rates because of the extra resources available to Omnibus for tracing the Omnibus cohort. Another advantage is access to prospectively gathered data from kindergarten through second grade, which enhances baseline information.

The authors' specific aims include investigating the impact of the ALPHA program on age of initiation of use, frequency of use, and

problem use; developing and implementing a protocol to assess the costs and benefits of the ALPHA program and producing a technical assistance manual for drug prevention costs and benefits research; and investigating the effectiveness of screening procedures, identifying perceived barriers to program participation, and characterizing the process of transition out of the program; these last three issues are critically important to the design of drug abuse prevention programs for at-risk children.

The authors' design is a field experiment with internal and external controls. At-risk children at four elementary schools feeding into the ALPHA program are randomly assigned to the ALPHA program or the internal comparison group, and at-risk children attending two similar schools constitute the external comparison group. The children in the internal comparison group at the four ALPHA feeder schools provide an important comparison for children enrolled in the ALPHA program because they are within the same school context. However, since children participating in the ALPHA program will return to classrooms and could potentially share information and skills learned in ALPHA with comparison children, a group of children in two other schools who are not likely to learn information and skills from returning ALPHA students is also needed.

All children were pretested at the end of third grade to obtain preintervention baseline data for checking the success of randomization, for modeling developmental trajectories, and for identifying subgroups that might respond differently to the intervention. Screenings were conducted at the end of third grade, beginning of fourth grade, end of fourth grade, and beginning of fifth grade to identify at-risk children. The screening consisted of an interview with the teacher, in which the teacher rated every child in the class, reviewed each child's recent grades, and conducted an interview with the child about self-esteem. Screening instruments were on op-scan forms so that scale scores could be rapidly obtained.

Children classified as being "at risk" (e.g., mild, moderate, or severe aggression; social withdrawal; learning problems; or perceived incompetence) at the ALPHA schools were randomly assigned to intervention (ALPHA) or control (internal control) conditions each semester during fourth and fifth grades. Assignments were made after consent was obtained to make the groups as comparable as possible. The intervention group, internal control group, and external control group will be assessed at the

end of fifth grade, end of sixth grade, end of seventh grade, and end of eighth grade (spring 1995 through spring 1998). Four posttests allow examination of the pattern of drug use as the child makes the transition to middle school.

To ensure that thoughtful consideration is given to the methodologic issues involved in this analysis, the Costs and Benefits Workgroup includes a multidisciplinary team consisting of two economists, a biostatistician, an accountant, and a health services researcher. To assess the cost-effectiveness of the ALPHA program, ALPHA program costs for attaining a particular level of outcome were compared with costs and outcomes of the usual and customary school system practices for at-risk youth. Costs for the ALPHA program and usual and customary school practices were retrieved from financial statements and other relevant source documents using a cost questionnaire completed by school system and Operation PAR budget officials. Accountants from both Operation PAR and the school system assisted the authors in this effort.

Primary impact variables are measured through annual child interviews and include whether drug use has started, age at first use, and frequency of use for each of the main drugs used by elementary school children (alcohol, tobacco, inhalants, and possibly marijuana and cocaine). Empirical work suggests that the age of initiation of use is an important outcome in drug abuse prevention research. Children who use drugs at an early age are more likely to have frequent drug use and greater involvement in deviant activities such as crime and drug sales than children who use drugs at later ages (Robins and Przybeck 1985). In addition, a number of researchers have suggested the importance of distinguishing frequency of use from problem use (Newcomb and Bentler 1989; White and Labouvie 1989). Problem use augments data about frequency and quantity of drug use with contextual characteristics of the drug use. For example, Hughes and colleagues (1992) identified patterns of drinking in adolescence by assessing frequency, quantity, and context of use (where, when, with whom, and how alcohol was obtained). The pattern of problem drinking that emerged from this enriched data was characterized by binge drinking, problems with the law or accidents, problems with friends or relatives, and problems in school.

In addition, benefits are expected to accrue from reduced use of the following services: (1) educational services such as special education, retention, remedial services, and total years of

schooling (K-12); (2) other services such as health and mental health; (3) educational achievement and employment measures such as number of years after high school and earnings; and (4) criminal behavior, such as victim costs and justice system costs. The authors are obtaining information about the benefits that are measurable during middle school (e.g., use of educational services, use of health and mental health services, school truancy, and school crime) from annual child and family interviews and school record retrieval. It is important to note that researchers will need to assess the extent to which benefits such as use of health and nonhealth services and school truancy should be attributed to drug use rather than academic or behavior problems unrelated to drug use.

To assess whether the benefits of the ALPHA program outweigh the costs, the authors' project is comparing the monetary costs of the intervention efforts with their expected benefits expressed in monetary terms. Costs for the ALPHA program and usual and customary school practices are obtained from the cost questionnaire mentioned earlier. Benefits will be estimated using a cost-of-illness methodology, where the cost of drug use among youth serves as the measure of the benefits to be derived from preventing drug use. Monetary values will be estimated for outcomes measurable during the middle-school period (e.g., use of educational services, use of health and mental health services, school truancy, and school crime).

In addition, the long-term economic consequences of early drug use will be estimated using the National Longitudinal Survey of Youth, a nationally representative longitudinal survey of a group of young people who were 14 to 21 years old when first interviewed in 1979. Although mainly a labor market survey, the National Longitudinal Survey of Youth also contains information on alcohol and other drug use. From this data set, estimates can be made of the long-term effects of adolescent drug use that appear later in adolescence (i.e., high-school dropout) and in adulthood (i.e., low wages).

TEN IMPORTANT STEPS IN AN ECONOMIC EVALUATION WITH EXAMPLES FROM THE ALPHA ECONOMIC EVALUATION

From the discussion in the previous section, it is clear that many of the solutions to economic evaluation problems require a thorough understanding of the intervention, its alternative(s), and the environment(s) in which they exist. In fact, CBA and CEA methods may appear to be ad hoc in the sense that they are often modified to conform to the situation at hand (D. Salkever, personal communication, January 1996). Nevertheless, the methods should be viewed as flexible rather than arbitrary. The principles that underlie CBA and CEA follow directly from economic theory and are not arbitrary. Even so, it is not possible or desirable to write a CBA/CEA “cookbook.” Every evaluation will present the researcher with different challenges and constraints that may require a unique methodologic approach to that particular problem.

It is important, however, to understand the widely accepted principles of CBA and CEA. The following guidelines, modified from outlines of Banta and Luce (1983) and Drummond and colleagues (1987), highlight the most important features of the process using examples from the ALPHA evaluation. The objective of the guidelines is to present the general steps in a CBA/CEA as well as to focus on special issues that arise in an evaluation of a prevention intervention. The 10 steps outlined below are intended to help both researchers planning to undertake a CBA or CEA and those who are interested in interpreting the results.

1. Define the Problem

An assessment of the problem motivating the study is important because it shapes the analytic agenda of the investigation. The definition of the problem has implications for the study objectives and the methods of analysis. Even when the problem has been identified by the study’s sponsor, restating the problem addressed by the intervention helps to ensure that the evaluator and the sponsor agree on the investigation’s focus. If the problem lends itself to being quantified, it is useful to describe the problem, as well as its causes and consequences, in measurable terms.

In the ALPHA intervention, the problem addressed is adolescent substance use (defined as use of alcohol, tobacco, and other drugs). The problem statement cites evidence of the prevalence of adolescent substance use by specific types of drugs and trends in substance use in the last 5 years. Also included in the evaluation

problem statement is knowledge about the health and societal consequences of adolescent substance use. For example, information is included on the risk of poorer school performance, involvement in juvenile crime, and the sale of drugs.

2. Formulate the Objective of the Study

Once the evaluator has explicitly stated the problem that has motivated the study, a specific objective must be formulated. This step will require considerable thought because the evaluator must consider not only what needs to be learned but also the time, money, and other constraints facing the evaluation. It is also essential to recognize the inherent strengths and weaknesses of the methods individually and in comparison with one another.

It is useful to formulate the objective of the study as a research question. It is not sufficient, however, to pose a vague research question such as, Is this particular family intervention program worth it? As Drummond and colleagues (1987) point out, this question can only be answered with more questions, such as, Worth it to whom? and Worth it compared with what? A better research question might be, From the viewpoint of society as a whole, is this new family intervention program preferable to the existing program? Another better-defined possibility is, From the viewpoint of the funding agency, do the benefits of this new family intervention program outweigh the costs?

These more specific questions clearly state the perspective of the study. It is important to specify whether costs and consequences are viewed as accruing to private firms and individuals or to society as a whole. Often, the private viewpoint is too restrictive. For example, a health program's costs might outweigh its benefits from the perspective of a single hospital that provides the program. But if societal benefits outweigh societal costs, efficiency would be enhanced if resources were allocated toward the program so that the hospital or some other institution was willing to provide the program (Drummond et al. 1987). (The term "efficiency" as used here refers to the concept of Pareto efficiency in economics. An allocation is Pareto efficient if no other allocation can make an individual better off without making at least one other individual worse off. If societal benefits are greater than societal costs and the program is not implemented, the current allocation is not Pareto efficient). In most cases, the societal viewpoint is most suitable, particularly for health care

evaluations that involve public dollars (Torrance 1986). Partly for this reason, the ALPHA program will be analyzed from the societal perspective.

The evaluator also must describe completely both the intervention under evaluation and its competing alternative(s). The objectives of the intervention and its alternative(s) should be clearly stated. This step is extremely important in part because it highlights the fact that resources used to implement the intervention under evaluation could have been used elsewhere. In fact, Banta and Luce (1983) state that “. . . the exercise of arraying all possible alternatives (including no action) may be the most important contribution of CEA/CBA.” CBA theoretically can be used to determine the worth of an intervention without explicit comparison to an alternative because the benefits and costs are both measured in dollars and can be compared. In most practical cases, however, alternatives exist, and even if the alternative is “do nothing,” it must be documented.

The competing alternative to the ALPHA program is the standard elementary school program. Since the at-risk children are randomly assigned to either the ALPHA program or their own school classrooms, the alternative to the intervention was easy to identify in this case. Both the intervention (the ALPHA program) and the alternative (the regular school program) have numerous objectives. Preventing drug use, however, is the main outcome of interest. For the purposes of this evaluation, the objective of the ALPHA program and the regular school program is to educate children so that they remain free of alcohol and other drugs.

At first glance, the regular school alternative may appear to be a do-nothing alternative since there is no program similar to ALPHA that is offered in the standard elementary school classroom. But individual schools and even individual teachers may offer substance use prevention materials and programs to their students—these prevention efforts must be documented to ensure a valid comparison between the intervention and its alternative. This detailed information, however, may not be readily available. In this case, school principals were asked to provide information since centralized school district records did not include data on some school-specific activities.

It is important to be knowledgeable about the alternative(s) early in the evaluation process for a number of reasons. First, the objective of the study cannot be formulated without answering the

question, “Compared with what?” Second, the objectives of the alternative(s) probably will affect the methods of analysis chosen (Drummond et al. 1987). For example, if a policymaker is seeking to make a decision between a school-based drug use prevention program and a school and family-based drug use prevention program, then CBA would have to be used instead of CEA because the intervention and the alternative produce different outcomes (Torrance 1986). Finally, users of the study results will need information about the alternatives to decide whether the results apply to their own allocation decisions (Drummond et al. 1987).

3. Research Past Efforts and Choose Methods of Analysis

The objective of the study may lead to a natural choice of a method. For example, if a health department wants to compare two programs with different outcomes, CEA will not be an option. But, in some cases, several methods of analysis may be possible, and the choice of method will depend on a variety of factors. One important factor to be considered is whether the objective of the evaluation is to compare the worth of the intervention’s objective with the worth of some other alternative(s)’ differing objectives (Drummond et al. 1987). If so, CBA will be more appropriate than CEA, which assumes from the start that the intervention’s objective is worth pursuing.

In many cases, practical considerations will dominate the choice of methods. For example, even if CBA is desirable, it may be impossible or very difficult to value all of the outcomes of a particular intervention in monetary terms. Usually, CEA is the “easier” choice when the outcomes are difficult to value in monetary terms. Whether the methods selected are a natural choice or a difficult decision, it is useful to review any existing literature that addresses problems similar to the one under evaluation. Often, the evaluator will be able to reassess and/or refine the choice of methods after reading about problems others have faced in conducting a CBA or a CEA with similar goals.

The economic evaluation of the ALPHA program includes both CEA and CBA. The CEA will allow a cost comparison between the attainment of the ALPHA and the common objectives of regular school programs. For example, final analysis might reveal that compared with participation in the regular school program, participation in the ALPHA program results in a larger reduction in the rate of drug use for the same cost. This finding would

suggest to school system officials that the ALPHA program is, from a purely economic viewpoint, a better investment than the regular school program for achieving the desired objective. In this way, CEA is a useful way to compare the costs of achieving certain goals through the ALPHA program and its alternative.

CBA will yield an answer to the question of whether society values the goals of the ALPHA program enough so that the benefits of the program outweigh its costs. Unlike CEA, CBA focuses on the value of the objective itself. Because the ALPHA program is partially funded by public dollars that could be allocated elsewhere, it is important to address this issue.

Very few, if any, researchers have attempted to conduct a CBA/CEA of a school-based substance use prevention program (Plotnick 1994). Even so, evaluations of other prevention programs were useful in refining the study. For example, the evaluation of the costs and benefits of the ALPHA program has been partly guided by strategies used to assess the cost-effectiveness of a chickenpox vaccine program, a back injury prevention program, and a bicycle safety helmets policy (Ginsberg and Silverberg 1994; Lieu et al. 1994; Shi 1993).

4. Review Evidence or Establish Methods of Evaluating Program Effectiveness

It is important to note that the effectiveness of an intervention should be established concurrently or prior to the assessment of how efficiently the intervention is operated. In other words, if they are misused, these economic techniques can uncover the most “. . . efficient provision of ineffective services, i.e., those services which have been shown to do no more good than harm” (Drummond et al. 1987). Obviously, this is an undesirable situation—evaluators do not want to attach the positive label of “cost effective” to ineffective programs and treatments. Ideally, one would like to be sure that the intervention(s) under analysis are effective. Particularly in the case of prevention interventions, this kind of indisputable evidence of efficacy may not be available.

In the case of the ALPHA program, the economic evaluation is a part of a broader effort to assess the effectiveness of the program. A major component of the evaluation is the collection of outcomes data on youth in the intervention and comparison schools. As described in an earlier section, teacher, parent, and child interviews are being conducted to measure the short-run

effects of program participation. These outcomes will be linked to a secondary data set to forecast the long-run benefits of the ALPHA program. In cases where the economic analysis is not accompanied by an effectiveness study, Drummond and colleagues (1987) suggest that at least some evidence of the efficacy of the intervention should be presented in the analysis.

5. Identify and Define Measurement Units for Costs and Benefits

At this point, the evaluator has defined a specific problem and objective and has selected the methods that will be used to conduct the analysis. The next logical step involves two parts. First, the evaluator must identify the following:

- All of the costs of the intervention and its alternative(s).
- All of the outcomes of the intervention and its alternative(s). (This information already may have been identified if an effectiveness evaluation is being conducted concurrently.)

Second, the evaluator should specify the units of measurement that will be used to describe these costs and outcomes (Drummond et al. 1987).

Identification of the costs of the intervention and its alternative(s) requires that all of the resources consumed by the programs are documented. As described earlier in this chapter, costs include direct costs, indirect costs, and intangible costs (Torrance 1986). Direct costs generally are the operating expenses—for example, the direct costs of the ALPHA program include teachers' salaries, supplies, and building rent, as well as financial indirect costs such as administrative overhead. Direct costs would also include any fees participants might incur (Drummond et al. 1987). Since the ALPHA and the regular school programs do not charge participants for their services, these direct costs were not documented.

Indirect costs refer to lost production that can be attributed to participation in the intervention or its alternative(s). For example, if a smoking cessation intervention required participants to attend an hour-long session each week, the cost of the participants' time must be included as a cost of the program. The opportunity cost

of an hour is the wage that the participant could have earned had he or she worked that hour. In the case of the ALPHA program, indirect costs do not seem relevant since children's time cannot be valued with a market wage.

Intangible costs include any emotional hardship that can be attributed to the program (Torrance 1986). For example, some interventions that target high-risk youth carry a stigma and may make it difficult for a participant to ultimately socialize with peers or colleagues. Although for some interventions this factor might be important, it is not expected to be a major issue with ALPHA participants because all high-risk youngsters have an opportunity to participate in ALPHA through random assignment. Furthermore, ALPHA is viewed as an enrichment program. It is unlikely, then, that intangible costs are a significant factor. Nevertheless, the ALPHA project incorporates this possible unintended consequence by questioning parents, teachers, and ALPHA participants about stigma during the transition period when students return to their regular classrooms. If stigma is found to exist, it will be included as an intangible cost of the ALPHA program. It is important to note that intangible costs are often difficult or impossible to value in monetary terms. Even so, if they are important, intangible costs should be included in an economic evaluation.

After the direct, indirect, and intangible costs have been identified, the outcomes must be addressed. For the intervention and its alternative(s), outcomes refer to the consequences or the effects that can be attributed to participation. Like costs, benefits can be divided into direct and indirect categories. Direct benefits are reductions in health care costs that can be attributed to the intervention (Drummond et al. 1987). For example, the direct benefits of the ALPHA program may include reduced mental health services utilization or fewer encounters with the juvenile justice system.

Indirect benefits are productivity gains—for example, a heart disease prevention program may prolong the working lives of its participants. Because ALPHA program participants are children, it is difficult to measure productivity gains through traditional labor market indicators such as the wage and hours worked. Currently, ALPHA project evaluators are working to substitute measures of school productivity for labor force productivity and to estimate long-run indirect benefits through use of a secondary data set. Nevertheless, at this point the issue of indirect benefits

remains very controversial in the literature (Drummond et al. 1987). Furthermore, the issue of indirect benefits of children’s prevention interventions has not been addressed in the literature.

So far, this chapter has addressed the issue of direct and indirect economic benefits. Many of the benefits of a prevention intervention, however, may not be economic—for example, the ALPHA program may improve quality of life for children and their families. These changes in quality of life, as well as other emotional and psychological benefits, should be documented.

Once the costs and the benefits of the intervention and its alternative(s) have been listed, the units of measurement for each item must be specified (Drummond et al. 1987). In some cases this task will be easy, but in other situations, finding a suitable unit of measurement may be challenging. It may be useful to list costs, benefits, and their units of measurement in a table form for easy reference. For the ALPHA program, this type of table might look like table 1 below.

TABLE 1. *ALPHA program.*

Direct Costs	Unit of Measurement
Teacher salaries	Yearly salary in dollars
Building	Yearly rent in dollars

6. Collect Necessary Data

The process of data collection will vary widely across evaluation projects. It is useful to develop (or adapt) a data collection instrument to ensure that comparable information is obtained from both the intervention and the alternative. Information on the costs of the ALPHA intervention and the alternative is collected using a data collection instrument that was modified from a Research Triangle Institute cost guide (Research Triangle Institute 1993). The main objective of the collection effort is to determine the costs per student in the ALPHA program and in the regular school program.

Initially, the authors thought it would be possible to obtain cost-per-student data from Florida School Reports, but it was found that the data did not sufficiently disaggregate costs for analysis. The

authors decided to develop a cost instrument that could better ensure the analysis of comparable information from the ALPHA intervention program and the school system's usual and customary practices with at-risk students. A survey instrument was designed based on a Research Triangle Institute questionnaire used to measure the costs of drug treatment programs. The instrument documents number of students, program revenue, expenditures, and in-kind contributions such as donated personnel, supplies, and facilities. Since many elementary schools also maintain internal budgets, the questionnaire includes sections that request information from the individual school as well as the centralized budget office.

A pretest was conducted of the cost instrument in a neighboring school system in Florida. After revising the cost instrument based on the comments and experience of the pretest, the authors are now collecting project cost data. A school budget official was asked to complete one questionnaire for each of the six project schools using centralized records. Each principal at a project school will complete a designated set of questions about information that is not available in centralized records. An Operation PAR budget official will fill out a single-cost questionnaire for the ALPHA program for each year. Information obtained from this process will be used to calculate a cost-per-student figure for the ALPHA program and for each of the six schools. The cost per student in the ALPHA program will be compared with the cost per student in the regular elementary school programs. As described in step 4 above, outcomes or benefits data will be obtained from the effectiveness portion of the evaluation.

7. Analyze Costs and Benefits for the Intervention and Its Alternative

Once the data have been collected, values must be assigned to costs and, in the case of CBA, to benefits. Normally, most costs already will be measured in dollar terms. Drummond and colleagues (1987) point out, however, that “. . . the objective in valuing costs is to obtain an estimate of the worth of resources depleted by the programme.”

Volunteer labor and donated goods, therefore, must be included as costs, even though they are free from the perspective of the program. These items must be assigned dollar values even if they are not recorded in this manner. For example, an intervention may utilize 100 volunteer hours. These hours can then be multiplied by the average wage the volunteers would have earned had they spent their time doing paid work. The product will

estimate the value of resources used. For some interventions, donated time and goods may be a large portion of costs.

At this point, the information collected can be summarized. In CEA, summary measures are usually cost in dollars per unit effectiveness ratios. Effectiveness measures are either final health outputs such as “life years gained” or intermediate health outputs such as “cases found” (Drummond et al. 1987). A summary statistic commonly used in CBA is net benefits. The net benefits of an alternative are the benefits minus the costs, both of which are measured in dollars.

8. Establish a Range of Values for Costs and Consequences

It is also very important to adjust future costs and benefits through a procedure called discounting. The purpose and process of discounting are best described with an example. Most people are familiar with the concept of gaining interest on an investment. Assume the rate of interest is 10 percent. After a year in the bank, a \$100 savings account will be worth \$110. Discounting reverses this relationship—this reversal implies that \$110 received a year from now is worth only \$100 today (Banta and Luce 1983). The present value of \$110 received next year is \$100.

In other words, discounting accounts for the fact that \$100 received now is worth more than \$100 received a year from now because money received now can earn interest in the bank for a year. In general, people prefer to receive benefits earlier rather than later and prefer to incur costs later rather than earlier. Although discounting is not difficult, an evaluator should consult one of the references or published studies to see more examples of the method.

Discounting should be performed if benefits and/or costs occur more than 1 or 2 years into the future (D. Salkever, personal communication, January 1996). For prevention interventions, benefits are often realized far into the future. Because these benefits are heavily discounted, they may appear to be worth very little.

The issue of discounting becomes controversial when the choice of interest rate is disputed. Usually, a rate of 2 to 10 percent is considered to be consistent with economic theory—5 percent is a commonly used rate (Drummond et al. 1987). Often, the evaluator will try a range of rates to assess the implications of “worst-case” and “best-case” scenarios (Banta and Luce 1983).

This process is called sensitivity analysis and is now considered to be an essential element of a cost-benefit or cost-effectiveness evaluation (Drummond et al. 1987).

Sensitivity analysis is not limited to analysis of the interest rate. Any uncertain assumptions or figures should be assigned different values to see whether these changes affect the results or the conclusions of the study. If the results or conclusions of the study are the same over a range of values and assumptions, the evaluator can make a recommendation with a degree of confidence. If not, the evaluator should list the range of values or assumptions that correspond to a specific result (Drummond et al. 1987).

For example, the evaluator might specify that project A is cost-effective compared with project B at interest rates between 0 and 7 percent. Another example might be a stipulation that project A is cost-effective compared with project B, assuming that indirect benefits are included in the analysis. This statement implies that the results or the conclusions of the study may be different if indirect benefits are not included.

9. Compare Intervention and Alternative

In a CEA, cost-per-unit effectiveness ratios can be compared across programs. For example, if project A has a ratio of \$10 per life-year gained, and project B has a ratio of \$15 per life-year gained, project A is the most cost-effective alternative. That is, compared with project B, project A achieves the same goal at a lower cost.

CBA results may be summarized by stating net benefits. The existence of positive net benefits implies that society values the benefits of the alternative more than it values the costs. Theoretically then, any alternative with positive net benefits should be implemented. Net benefits also can be compared across alternatives.

10. Address Ethical Issues, Scope, and Ramifications of the Study

It is important to recognize that every economic evaluation is based on assumptions that may have ethical implications. The evaluator should state explicitly all major assumptions made in the analysis and address the ethical ramifications of these assumptions. For example, the human capital approach described above essentially values human beings by their expected lifetime earnings.

One problem with this approach is that elderly people would be assigned low values since they may no longer work.

If this implication is not stated in the analysis, users of the study results might misinterpret the findings and make undesirable policy decisions. Banta and Luce (1983) point out that “. . . quantitative results are powerful and may overwhelm the policymaker with a false sense of security.” It is the evaluator’s responsibility to prevent this possibility by uncovering and discussing any implicit assumptions that may have been made in the analysis. This way, those who use results from CBA/CEA studies will understand the scope and ramifications of the ethical judgments that underlie the process of economic evaluation.

Although CBA and CEA can be very useful tools in decisionmaking, the methods are not without limitations. Economic evaluation focuses on efficiency rather than equity. Equity, however, might be one of the goals of an intervention. Other noneconomic factors will be important in making a decision on the worthiness of a particular program. Results from economic evaluations might have great impact on decisionmaking but should not be the only factors that are considered.

REFINEMENT AND DISSEMINATION OF COSTS AND BENEFITS METHODS FOR THE DRUG ABUSE PREVENTION RESEARCH AND SERVICE COMMUNITIES

The objective of the previous section was to clarify economic evaluation methods by outlining 10 major steps in the process. It is important that program evaluators as well as the users of CBA/CEA studies understand these steps for a number of reasons. First, there is a need in general for high-quality economic evaluations. Elixhauser and colleagues (1993) report that the number of cost-benefit and cost-effectiveness studies published yearly rose from 5 in 1966 to 251 in 1990. This rapid increase in the quantity of research done in this area has led to serious questions about the quality of the investigations. Some researchers estimate that about half of the published studies do not follow even the basic tenets of economic evaluation (Elixhauser et al. 1993). Concerns about quality and misinterpretation of results suggest that the basic principles of CBA and CEA are not widely understood.

Second, it is important that more drug abuse prevention programs undergo economic evaluation. Public policymakers are currently choosing to reduce funding for drug abuse prevention initiatives while maintaining dollars devoted to supply reduction efforts that largely rely on the use of law enforcement officials. The inability

to answer, with confidence, the perennial question of “what works” has attenuated policymakers’ support for even those drug abuse prevention efforts that have documented evidence of success.

Moreover, indications that adolescent drug use is increasing has made some policymakers question whether the benefits of investing in drug abuse prevention programs are worth the costs. With the fast pace of changes in Federal policy and the limited number of researchers skilled in conducting research in this area, there is a need to enhance the capacity of existing resources to respond to requests for information on the costs and benefits of drug abuse prevention policies and programs.

The authors propose a two-pronged approach to refining methods for documenting costs and estimating benefits of drug abuse prevention. The first would involve the research community. The research community would review existing costs and benefits methods, develop consensus about a core set of cost measures and a core set of short-term outcomes, and collaborate on estimating the long-term economic consequences of early drug use. The second approach would involve practitioners (e.g., drug abuse service providers and staff of key policymakers) who would contribute to the development of costs and benefits methods by providing input on the usefulness of the core set of cost and outcome measures for drug abuse prevention services. It is hoped that this chapter initiates progress toward these objectives and also stimulates the formation of a network of researchers and practitioners interested in the application of CBA and CEA to drug abuse prevention programs.

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