

Overview of Methods: Cost-Effectiveness, Cost-Benefits, and Cost-Offsets of Prevention

Albert Woodward

INTRODUCTION

A review of the health services literature reveals that there are relatively few cost-effectiveness studies of substance abuse prevention. In contrast, a large number of cost-effectiveness studies of medical treatment have been published over the last two decades (e.g., Hurley 1990). In the field of substance abuse treatment there are a number of studies evaluating the cost-effectiveness of treatment (Cartwright and Kaple 1991). The field of substance abuse prevention research is a relatively new field (Clayton and Cattarello 1991). Also, there may be a perception among prevention researchers and prevention program administrators that prevention programs are cost-effective. These reasons may help explain the relative paucity of prevention cost-effectiveness literature in substance abuse. This suggests that more work needs to be done if researchers are to provide decisionmakers with the arguments that prevention interventions are worth their cost.

This overview suggests that cost-effectiveness analysis is an adjunct to the decisionmaking process. Such analysis may prove useful in comparing costs of two or more programs, or costs of doing a program versus not doing it, but such analysis alone cannot be used for making a decision. Its importance arises because, in a world where choice among alternatives constantly has to be made, it is a useful tool in comparing programs.

DEFINITIONS AND CONCEPTS

The definition of cost-effectiveness is relatively simple as economic concepts go, but it is frequently confused with cost-benefit and cost-

savings definitions. It is useful to define these terms so that they can be differentiated. Once the definitions are clear, the basic concepts of measuring costs and the issues in their measurement are presented.

- **Cost-effectiveness:** Cost-effectiveness measures outcome against cost—usually the prevention effect of a program versus no program or, in a more sophisticated context, the prevention effects of two programs against one another, with the dollar costs of the programs being held constant. In other words, a prevention program is cost-effective if it yields more health benefits (or outcomes) than do alternative uses of healthcare resources (Weinstein 1990). The outcomes are hard to define, let alone measure. One widely used outcome is “years of life gained or quality adjusted years of life gained” (Hurley 1990). Outcomes can also be expressed as prevention of adverse behaviors and consequences of substance abuse as well as the increase in desired positive behaviors (Hser and Anglin 1991).
- **Cost-benefit:** Costs and benefits, unlike cost-effectiveness, are expressed in terms of dollars. They are expressed as a ratio with both the benefits (the numerator) and the costs (the denominator) in monetary terms. The benefits often have to be assigned or imputed in quantitative money amounts; they are hard to define and hard to measure. A recent article provides systematic guidelines in conducting cost-benefit analysis (Plotnick 1994).
- **Cost-offset:** Cost-offset has not been used in prevention research literature. It has been used in a context of treatment costs reduced following treatment intervention. That is, it is known that persons with substance abuse problems cost more to treat than healthy individuals, not just for the treatment of the particular substance abuse problem but also because they have other costly medical problems.¹ As a result of the substance abuse treatment, the reduction in the costs of substance abusers’ care over time is less than the cost of the intervention itself. This implies that researchers have to measure costs of not treating the problem—not that easy to do. In the realm of prevention this is of critical importance and has to be done, e.g., estimating the costs of prevention intervention versus cost-savings from reduced illness or premature death.

By use of the term “substance abuse,” alcohol is not considered independently of other drugs. Alcoholic beverages can be bought and drunk in the United States by persons 21 years or older, whereas other drugs cannot. The raising of the drinking age from 18 to 21 is a

legislated prevention that has had a large, measurable impact on curbing underage drinking (Wagenaar et al. 1994). Preventing the sale of alcoholic beverages to underage drinkers is quite different from preventing the use of illicit drugs. The research into this aspect of prevention is subsequently different (Hilton and Bloss 1993). However, other aspects of alcohol consumption, such as binge drinking or use by pregnant women, require the same types of prevention efforts as other drugs. In this way, alcohol is a part of substance abuse prevention.

CONSIDERATIONS IN COST-EFFECTIVENESS ANALYSIS

Many considerations go into the measurements in cost-effectiveness analysis (or cost-benefits or savings of a prevention program or intervention). Such considerations make measurement of costs and outcomes difficult, but they must be addressed if the intervention is to be evaluated competently. These considerations focus on costs, obviously, and they should be viewed as a supplement to the methodological considerations in undertaking prevention research studies (see, for example, National Institute on Drug Abuse [NIDA] Research Monographs 107 [Leukefeld and Bukoski 1991], 139 [Cazares and Beatty 1994], and 142 [Collins and Seitz 1994], cited in the reference section at the end of the chapter).

There may be a perception in the substance abuse prevention field that prevention programs are cost-effective or produce cost-savings for society. One recent study, however, suggests that there is no a priori reason to think so. This study by the Institute of Medicine, titled *Reducing Risks for Mental Disorders*, points out that the costs of prevention are not necessarily less than the costs of treatment (Mrazek and Haggerty 1994). In part, this is due to the costs of reaching a wide population in prevention, whereas treatment is focused on individuals.

This study builds on the work of Russell, then at the Brookings Institution (Russell 1986). Russell's first consideration was the link between the target population and the risk of what was being prevented. That is, the total costs of a prevention program depend on the size of the targeted population relative to the number in the target population who are at risk. The more focused the targeting to the group perceived to be at risk, the more the prevention intervention will be cost-effective or produce cost-savings. Thus, information about the population at risk was paramount to any

prevention strategy. Also, it was important to be able to describe on a per-dollar program basis the impact on behavior and how this varied among different populations (Hueston et al. 1994).

Russell's second consideration was that the cost and frequency of intervention should account for startup costs, frequency of contact with the population and contact duration per person, and the type of prevention program (for example, an innovation to a school curriculum was much less intensive and expensive than individual interventions).

Russell's third consideration was the potency of the intervention: the program design must link the proportion of persons at risk with the size of the effect of an intervention. This link will affect costs of the prevention program. As an example, one study in England (Tolley and Rowland 1991) examined the cost-effectiveness of adding a specialist-worker in a hospital to screen admissions to determine potential alcohol problems as a prevention measure. The study found that the more intensive effort of intervention by the specialist-worker identified more cases for prevention, but at a greater cost. Even the brief advice about smoking from a physician during an office visit has been shown to be cost-effective (Cummings et al. 1989).

The fourth consideration was the uncertainty of risk: if the risk of developing an alcohol, tobacco, or other drug-related disorder was not well known, then measuring the costs of risk was difficult. Also, the costs of prevention intervention among the general population were not easy to measure. This situation offered a potential for uncontrolled program costs.

Russell's fifth consideration was time. The perceived benefits were much greater for interventions that produced effects promptly than for those with delayed results. The timing of intervention effects was an important part of any cost-effectiveness study.

Another caveat was that the costs of intervention may not be uniform among the general or target populations. Some in a target population may be more amenable to an intervention than others. The target population may be distinguishable by certain characteristics that might make an intervention easier or harder to achieve; for example, homelessness or being at risk for human immunodeficiency virus (HIV) or acquired immunodeficiency syndrome (AIDS).

Another analytic concern is to make sure to include more than program costs, i.e., costs incurred by the target population. These

might include the costs of travel to the program location, time for lost activities, or costs of lost income. Even the costs of child care should be considered. Such costs can differ among different cultures or by economic levels: low-income mothers might be unable to afford reliable child care and might consider it unwise or unsafe to leave children at home in the care of others.

CONSIDERATIONS IN THE MEASUREMENT OF OUTCOMES COSTS

The second major subject of this chapter is cost-measurement. In prevention studies, there are two types of costs, and each has a different type of measurement and associated difficulties. First, there are costs of administering and conducting a particular intervention program. Second, there are the costs associated with the prevention of risk factors or adverse outcomes such as years of healthy life lost.²

In the prior section, the considerations in measuring and defining costs associated with a particular intervention or program were reviewed. Costs and their measurement for adverse outcomes forgone, i.e., prevented, have their own set of considerations. These considerations come from the extensive body of literature on measuring the costs of various illnesses.

Methods for studying cost of illness are described concisely and clearly by Rice and colleagues in the second chapter of *The Economic Costs of Alcohol, Drug Abuse, and Mental Illness: 1985* (Rice et al. 1990). Several applicable ideas are presented. Although these ideas have been applied to treatment, they also apply to prevention, even though prevention data may be more difficult to obtain.

One of two general approaches to measuring adverse costs forgone is the human capital approach, which was pioneered by Rice and is the more widely used approach. The human capital approach assumes that an individual's value is measured by his/her earnings, or potential earnings, and the value of life is the potential earnings discounted over an average individual's life.

The usefulness of the human capital approach comes from the ready availability of data needed. The costs of alcohol, tobacco, and other drug disorders are measured by costs of health treatment, health-related costs of premature death, and the like.

The human capital approach is either incidence based or prevalence based. The former focuses on a short time period, typically 1 year, and includes a smaller population, i.e., new cases in that period. The latter focuses on lifetime costs and usually includes a larger number of cases. Prevalence-based studies are done more frequently because prevalence data are more available than incidence data.

In addition to health and related costs, the human capital approach includes other nonhealth costs such as costs of police and criminal justice, motor vehicle crashes, crime, social welfare program administration costs, destruction of property, lost productivity of crime victims, and the like. These nonhealth costs are tied to consequences of alcohol and other drug use, but not to tobacco.

The human capital approach fits well with the conceptualization of costs of adverse outcomes prevented by an intervention program. The costs of illness forgone or prevented, and the costs of premature death prevented, can be measured and then associated with a particular intervention program. The same applies to nonhealth costs: the probability of a portion of the target population ending up in the criminal justice system can be measured, and the costs saved by a particular intervention or program that reduces that probability also can be measured.

The human capital approach has at least one large weakness: it yields low values for children and adolescents. These younger persons are often key target populations for prevention programs and interventions. The same weakness applies to persons of color, another key target population. That is, because the expected lifetime incomes of these groups may be lower than average, the costs of improved years of life attributable to a prevention program may be correspondingly lower.

The willingness-to-pay approach is the second general approach. It is another way to measure the valuation of human life for both morbidity and mortality. In this approach, individuals say directly or indirectly how much they would be willing to pay to reduce the likelihood of illness or death. It focuses on the individual and thereby includes all aspects of well-being, including labor and nonlabor income and the value of leisure, pain, and suffering.

The applicability of the willingness-to-pay approach to measuring adverse costs forgone is not immediately obvious. The approach would ask how much targeted individuals would be willing to pay to prevent early death or illness from drugs, alcohol, tobacco, or other

illnesses. As for all other diseases, individuals have a difficult time knowing how to answer this type of question. If the target population is young, the population may discount the future more than an older population, thereby biasing cost-measurements. Also, individuals at risk may not be able to answer this type of question because they might deny that they are at risk, also biasing cost-measurement.

Rice points out other problems with the willingness-to-pay approach: it is difficult to implement in practice, and it depends on the income distribution of the population (e.g., the rich can pay more to stay well).

One of the most important considerations in the application of cost-effectiveness analysis and related types of studies is the clear accounting of costs. The more detailed and the more clearly specified the costs are, the better for analysis. Only in this way can specific findings for a prevention program in one community be made comparable to that in another community.

Researchers have three approaches or perspectives available for conducting drug abuse prevention research: a primary prevention model, a communicable disease model, and a risk factor model (Bukoski 1991). Costs are easier to define and measure in the first type, the primary prevention model, because the costs of disease and death are known. Also, the incidence and onset of disease are known, and their costs can be measured. The other two models frequently end up with the same cost-measures as the primary prevention model.

The objectives of effectiveness analysis need to be clearly stated: the focus can be either on outcomes as measured by illness, death, and social and employment status, or on the impact of prevention programs or strategies on the progress of drug use. As noted, the costs of outcomes can be measured, but the costs of changes in behavior, e.g., drug use, are more difficult to measure (other than in an outcome of illness or death).

If cost-effectiveness or cost-benefit analysis is focused on evaluation of a program's or strategy's impact on risk factors, again the costs are difficult to measure. For example, peer pressure or perception of harm of use are risk factors. In order to explain these factors in risk terms, there has to be an explicit model of how these factors affect outcomes (Pentz 1994). If the STAR Program in Kansas City finds lower levels of alcohol, tobacco, and marijuana use at 1-year and 4-year followup among the target populations, how can the costs of lower levels of use be measured except in terms of outcome(s)?

The model of MacKinnon is instructive here: the prevention program influences such mediating variables as biological, psychological, behavioral, and social factors, which in turn have an effect on outcomes (MacKinnon 1994). To the extent that the mediator analysis model can specify how prevention programs affect mediating variables and outcomes, that model will have an important impact on how well costs can be assigned to outcomes.

It may be possible to conduct a willingness-to-pay study to explain these costs in economic terms. The considerations described above still apply. Also, the target population's willingness to pay may change as a result of the program or strategy. This change confounds the cost-measurement.

The cost-savings or cost-offset analysis should be applied carefully. Without careful analysis and measurement, it could be concluded that doing nothing might be better. A "comment" in the *New Yorker* (1994) is worth citing:

Florida says that it has spent a billion two hundred million dollars over the past five years in medicaid payments for smoking-related illnesses. But that figure is misleading. While smokers use a lot of State-sponsored healthcare, and about three and a half billion dollars a year of Federal medicare money, they also tend to die around five years earlier than nonsmokers. That means five fewer years of the heavy health-care burden of old age, five fewer years of nursing-home care, and five fewer years of drawing a Federal pension.

What the comment misses, however, is that before they die, smokers use much more in healthcare services than they save the Nation by dying sooner.

A FEW SUMMARY CONSIDERATIONS

It must be remembered that cost-effectiveness analysis can be a useful tool in differentiating relative impacts among programs or strategies, but it is only one factor among several that are used in decisionmaking. It is not a certainty that all programs are cost-effective (or cost-beneficial): because the costs of substance abuse to the Nation are so high and the costs of prevention on a per-person

basis are so low, it may seem obvious, a priori, that prevention programs and strategies pay for themselves. Prevention programs should be expected to improve health as measured by certain outcomes at a reasonable cost (Weinstein 1990).

Finally, remember also that only a substantial body of research in the substance abuse prevention field will significantly influence decisionmaking. Without this body of work, researchers will continue to use resources inefficiently and to the detriment of both patients' and at-risk groups' welfare (Maynard 1993). At this time researchers need to devote more efforts to improving cost-effectiveness research in the prevention of substance abuse problems. Cost-effectiveness is not a final determinant of programs' usefulness in prevention success, but it is an important component of the decisionmaking process.

NOTES

1. This occurs whether the added medical problems are attributable to the substance abuse problem or occur at the same time, regardless of cause.
2. These costs, in particular, can be seen as benefits if conducting cost-benefit analysis. In cost-effectiveness analysis, two programs under comparison may cost the same to run but produce different impacts on the healthy years gained by the targeted population as a consequence of the programs.

REFERENCES

- Bukoski, W. A framework for drug abuse prevention research. In: Leukefeld, C., and Bukoski, W., eds. *Drug Abuse Prevention Intervention Research: Methodological Issues*. National Institute on Drug Abuse Research Monograph 107. DHHS Pub. No. (ADM)91-1761. Washington, DC: Supt. of Docs., U.S. Govt. Print. Off., 1991.
- Cartwright, W., and Kaple, J.M., eds. *Economic Costs, Cost Effectiveness, Financing, and Community-Based Drug Treatment*. National Institute on Drug Abuse Research Monograph 113. DHHS Pub. No. (ADM)91-1823. Washington, DC: Supt. of Docs., U.S. Govt. Print. Off., 1991.
- Cazares, A., and Beatty, L., eds. *Scientific Methods for Prevention Intervention Research*. National Institute on Drug Abuse Research Monograph 139. DHHS Pub. No. (NIH)94-

3631. Washington, DC: Supt. of Docs., U.S. Govt. Print. Off., 1994.
- Clayton, R., and Cattarello, A. Prevention intervention research: Challenges and opportunities. In: Leukefeld, C., and Bukoski, W., eds. *Drug Abuse Prevention Intervention Research: Methodological Issues*. National Institute on Drug Abuse Research Monograph 107. DHHS Pub. No. (ADM)91-1761. Washington, DC: Supt. of Docs., U.S. Govt. Print. Off., 1991.
- Collins, L.M., and Seitz, L.A. *Advances in Prevention Intervention Research*. National Institute on Drug Abuse Research Monograph 142. NIH Pub. No. 94-3639. Washington, DC: Supt. of Docs., U.S. Govt. Print. Off., 1994.
- Comment. Blowing smoke. *New Yorker* June 13, 1994. p. 6.
- Cummings, S.; Rubin, S.; and Oster, G. The cost-effectiveness of counseling smokers to quit. *JAMA* 261(1):75-79, 1989.
- Hilton, M., and Bloss, G., eds. *Economics and the Prevention of Alcohol-Related Problems*. Research Monograph 25. NIH Pub. No. 93-3513. Washington, DC: Supt. of Docs., U.S. Govt. Print. Off., 1993.
- Hser, Y.-I., and Anglin, D. Cost-effectiveness of drug abuse treatment: Relevant issues and alternative longitudinal modeling approaches. In: Cartwright, W., and Kaple, J., eds. *Economic Costs, Cost Effectiveness, Financing, and Community-Based Drug Treatment*. National Institute on Drug Abuse Research Monograph 113. DHHS Pub. No. (ADM)91-1823. Washington, DC: Supt. of Docs., U.S. Govt. Print. Off., 1991.
- Hueston, W.; Mainous, A.; and Farrell, J. A cost-benefit analysis of smoking cessation programs during the first trimester of pregnancy for the prevention of low birthweight. *J Fam Prac* 39(4):353-357, 1994.
- Hurley, S. A review of cost-effectiveness analyses. Supplement. *Med J Aust* 153:S20-23, 1990.
- Leukefeld, C.G., and Bukoski, W.J., eds. *Drug Abuse Prevention Intervention Research: Methodological Issues*. National Institute on Drug Abuse Research Monograph 107. DHHS Pub. No. (ADM)91-1761. Washington, DC: Supt. of Docs., U.S. Govt. Print. Off., 1991.
- MacKinnon, D. Analysis of mediating variables in prevention and intervention research. In: Cazares, A., and Beatty, L., eds. *Scientific Methods for Prevention Intervention Research*. National Institute on Drug Abuse Research Monograph 139. DHHS Pub. No. (NIH)94- 3631. Washington, DC: Supt. of Docs., U.S. Govt. Print. Off., 1994.

- Maynard, A. Economic aspects of cancer care. Supplement. *Eur J Cancer* 29A:S6-9, 1993.
- Mrazek, P., and Haggerty, R., eds. *Reducing Risks for Mental Disorders*. Washington, DC: Institute of Medicine/National Academy Press, 1994.
- Pentz, M. Target populations and interventions in prevention research: What is high risk? In: Cazares, A., and Beatty, L., eds. *Scientific Methods for Prevention Intervention Research*. National Institute on Drug Abuse Research Monograph 139. DHHS Pub. No. (NIH)94- 3631. Washington, DC: Supt. of Docs., U.S. Govt. Print. Off., 1994.
- Plotnick, R. Applying benefit-cost analysis to substance abuse prevention programs. *Int J Addict* 29(3):339-359, 1994.
- Rice, D.; Kelman, S.; Miller, L.; and Dunmeyer, S. "The Economic Costs of Alcohol and Drug Abuse and Mental Illness: 1985." Report submitted to the Office of Financing and Coverage Policy of the Alcohol, Drug Abuse, and Mental Health Administration, U.S. Department of Health and Human Services. San Francisco, CA: Institute for Health and Aging, University of California, 1990.
- Russell, L. *Is Prevention Better Than Cure?* Washington, DC: The Brookings Institution, 1986.
- Tolley, K., and Rowland, N. Identification of alcohol-related problems in a general hospital setting: A cost-effectiveness evaluation. *Br J Addict* 86(4):429-438, 1991.
- Wagenaar, A.; Murray, D.; Wolfson, M.; Forster, J.; and Finnegan, J. Communities mobilizing for change on alcohol: Design of a randomized community trial. *J Commun Psychol*. Monograph Series CSAP Special Issue: Community Partnership Program, 1994. pp. 79-101.
- Weinstein, M. The costs of prevention. Supplement. *J Gen Int Med* 5:S89-92, 1990.

AUTHOR

Albert Woodward, Ph.D., M.B.A.
 Office of Applied Sciences
 Substance Abuse and Mental Health Services Administration
 Parklawn Building, Room 16-105
 5600 Fishers Lane
 Rockville, MD 20857

**Click here
to go to
next section**