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COST - BENEFIT MODEL FOR SUBSTANCE ABUSE TREATMENT PROGRAMS

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This paper presents a literature review and a specification for a Cost-Benefit model applied to substance abuse treatment programs. It is important in adapting a model that it is not only theoretically and methodologically sound, but also seeks to utilize the best existing cost benefit analysis techniques. Ideas, concepts, and procedures found in other studies are used to support the model developed. Model specification involves the determination of the appropriate variables and statistical techniques, keeping in mind the data most readily available from the programs intended for analyses. Cost-benefit analysis is commonly used to provide guidance to policy makers when considering appropriate projects to fund.

INTRODUCTION

Every organization is confronted with the economic problem of allocating scarce resources to achieve multiple objectives. Answers to two specific questions must be determined by each organization: 1) What is to be produced, and 2) How is it to be produced? At the firm level in the private sector, market research attempts to identify those goods and services that consumers are most likely to purchase. Correct decisions of goods and services to produce will result in profits and incorrect decisions will result in losses, prompting adjustments to be made. The answer to the second question concerns productive efficiency; using least cost production methods. Again, the market economy rewards the organization that lowers costs with higher profits. The market economy works remarkably well, in most cases, in the private sector in dealing with these issues.

For non-profit organizations and in the public sector, it is more difficult to answer the two questions. The major problem is that the good or service is not sold in the market, or if it is, the price is arbitrary and not generally related to the cost of production. National defense, public roads, elementary and secondary schools, and parks are but a few examples of public goods with little or no price. Many public services also have prices unrelated to the cost of production, such as flu vaccination, Small Business Development Center services, and a wide variety of social services. For these goods or services, the market is unable to operate to provide answers to the two questions stated above; nevertheless, they are produced.

Since the market price mechanism is not functional to provide an efficient quantity of public goods or services, the government intervenes to assure society's efficiency norms. Public policy makers have the task of uncovering society's preferences, as well as the costs of providing public goods or services. Cost-benefit analysis is one method commonly used to provide guidance to policy makers when considering appropriate projects to fund.

This paper presents a literature review and a specification for a Cost-Benefit model applied to substance abuse treatment programs. A literature survey of methods/methodological issues is critical to determine which models have received acceptance as applied to substance abuse treatment corrections programs. This is important in adapting a model that is not only theoretically and methodologically sound, but also seeks to

utilize the best existing cost benefit analysis techniques. Ideas, concepts, and procedures found in other studies will be used to support the model developed.

Public officials and program managers frequently are asked about the economic returns on public expenditures for drug abuse treatment. Society is increasingly aware of the scarcity of resources and that choices must be made concerning the allocation of these resources among competing programs. The trend toward setting cost-conscious priorities has certainly been evident in health care. "In the area of treatment for substance abuse, there is mounting pressure on treatment modalities to demonstrate their cost-effectiveness in order to maintain funding." (Sindelar and Manning, 1997: 189)

As increasingly larger sums of public funds are budgeted to support criminal justice programs, such as substance abuse treatment programs, the importance of evaluation has become evident. Considerable interest and expenditures have been associated with evaluation of correctional intervention and other crime and offender prevention programs. Beginning in 1998, the Pennsylvania Department of Corrections has been involved in multiple program evaluation projects, each of which had grants in the range of \$150,000 and above. Evaluation results inform program staff and policy-makers about the degree to which programs are effective. Do programs achieve their socially expected results, and how successful are they in providing their intended target populations with the envisioned services and/or control?

Model specification involves the determination of the appropriate variables and statistical techniques, keeping in mind the data most readily available from the programs intended for analyses.

Brief History of Cost-Benefit Analysis

Many books and articles on cost-benefit analysis (synonymous with benefit-cost analysis) provide a history of use of this analysis. A brief, but useful, presentation is provided by Thompson (1980, 1-2):

Until 1965, benefit -cost analysis was performed primarily for the Corps of Engineers in the prospective evaluation of water resource projects. In the mid-1960s with the advent of Lyndon Johnson's Great Society programs and with a new stress on program accountability and assessment, dramatic change began.

Heavy emphasis was placed on the Planning, Programming, Budgeting System (PPBS) and on quantitative program evaluation. Benefit-cost analysis began to be applied to social programs with startling results: for both the programs and the discipline.

Until fifteen years ago [1965] benefit-cost analysis seldom consisted of more than (1) identifying main program effects, (2) somehow valuing them monetarily, (3) summing up costs, and (4) comparing the benefits and costs through division or subtraction. For social programs, it soon became clear that this was not enough: that diffuse secondary and tertiary effects might be as important as primary effects; that externality effects and subtle effects on market prices had to be taken into account; that discounting was a more sensitive and delicate art than had hitherto been believed; that effects on length and quality of human lives are extremely difficult to value. In response to these insights from applications in social programs, benefit-cost analysis has had to adapt itself to drastically new situations in order to survive.

Published literature reviews of "first generation" literature on the cost-effectiveness of drug treatment programs include: Apsler and Harding (1991), Peele (1990), and a review of specific studies by Sindelar and Manning (1997). As noted by Sindelar and Manning (1997: 189), the earlier literature "is plagued with problems such as inconsistencies in the perspectives taken, use of intermediate goals instead of ultimate goals, and too narrow a perspective of outcomes."

Not only has cost-benefit analysis (hereafter referred to as CBA) survived, it has grown and is now routinely applied to all types of social programs including those in criminal justice. The adaptation continues; although unanswered questions remain that require continuing refinement of the analysis.

CBA has become the analysis of choice for evaluations of substance use prevention and treatment programs. While CBA has been recommended (Plotnick, 1994; French, 1995; French, Rachal, and Hubbard, 1991; Welsh and Farrington, 2000), only a few studies have applied systematic cost-benefit analysis. As noted by French et. al. (2002: 435), "methodological guidelines for substance abuse researchers are scarce (Cartwright, 1998; French, 1995; French et. al., 2000; Zarkin et. al., 1994), and some of the existing empirical studies do not conform to accepted principles and techniques of economic evaluation (Drummond, et. al., 1997)." Continuing, French et. al. (2002: 435) suggests that "Advances in economic analyses of addiction treatment have lagged behind other areas of health care partly because of the variety of substance abuse treatment approaches and the complexity and multiplicity of treatment outcomes so often demanded of addiction treatments (e.g., improvements in drug use, crime, employment, health)." This study provides a general framework of CBA that can be applied specifically to substance abuse programs.

Conceptual Framework

CBA is an analytical framework that is straightforward;

however its application involves a number of important considerations. The basic idea of CBA is to comprehensively identify and measure all relevant costs and benefits of a program that accrue over time to determine if the costs exceed the benefits. Both costs and benefits are converted into monetary terms so that a B/C ratio can be calculated. When the B/C ratio is greater than 1, a program is said to be "efficient," in the sense that society receives a greater benefit than it costs to produce it. For example, if the benefit cost ratio is \$6.50 (\$6.50/\$1.00), this indicates that for each dollar spent on the program, \$6.50 in benefits is generated.

T. F. Nas (1996) compares alternative decision criteria of net present value and internal rate of return to the B/C ratio. Welsh and Farrington (2000) gave two reasons to prefer the B/C ratio: 1) A single measure of the benefits of a program that is derived from one dollar of expenditure, and 2) B/C ratios can be compared for different time periods when different programs occurred and for different country's currency (say in 1976 British pounds.) Rufener, Rachal, and Cruze (1977: 10), state "However, given the conditions surrounding investments in most social programs, the benefit cost ratio is generally accepted as the appropriate decision criterion." The Benefit-Cost ratio (B/C) can be expressed as:

Present Value of Future Benefits

Current Program Costs + Present Value of Future Costs

CBA and Cost Effectiveness Analysis (hereafter referred to as CEA) are frequently conducted from different perspectives. These include the societal perspective, the provider or program perspective, and the patient or client perspective. The perspective is important in conducting a CBA or CEA analysis in order to properly determine whose benefits and costs are to be considered and the necessary data to be collected. Warner and Luce (1982) and Sindelar and Manning (1997) discuss the role of perspective and its relationship to study design and appropriate cost categories. The societal perspective is the one most often taken by government policy makers (French, Rachal, and Hubbard, 1991). According to Gold et. al. (1996), the societal perspective is advocated for program evaluation over a private perspective because the former is neutral across stakeholders and more comparable across programs.

CBA includes consideration of multiple types of outcomes associated with a program being evaluated. For substance abuse treatment, these multiple outcomes may involve areas such as: crime, criminal justice expenses, health, employment, and receipt of social welfare benefits. Monetary conversion factors are used to create a common metric allowing for benefit values to be aggregated. In contrast, CEA typically are concerned with a single outcome such as abstinence from drug use. Since only one goal is involved, there is no need to convert the outcome into a monetary measure. If there is only one outcome, or if the principle benefits expected from a program cannot (or perhaps should not in the case of abuse, etc.) be given monetary values, CEA is an alternative.

There is consensus in the literature that CBA has several essential steps (Thompson, 1980); and several other studies are referenced in Welsh and Farrington (2000). The following six

steps are appropriate for the application of CBA to social program evaluation, including substance abuse treatment programs and to establish the framework for the model:

1. Define the scope of the analysis
2. Identify the relevant costs and benefits
3. Estimate the monetary value of costs and benefits
4. Calculate present value of costs and benefit streams
5. Conduct sensitivity analyses
6. Discuss any costs or benefits that could not be monetized.

Define the Scope of the Analysis

This step involves understanding the nature of the evaluated program in terms of its purpose and objectives, clients served, and treatment processes used. An on-site visit is conducted along with the collection of written descriptive materials.

Identify and Estimate the Relevant Costs

All program costs must be identified and determined, including both explicit and implicit costs. From an economic perspective, all resources in the provision of a good or service have alternative forgone uses. Thus the resource has an opportunity cost associated with the value of the resource in an equivalent alternative use. For most explicit costs, the price paid in the market to acquire a resource is equal to its opportunity cost. Identifying and calculating the explicit cost associated with program outlays is straightforward as found in most accounting budget documents. The depreciation of assets used in the delivery of a program is another cost that must be calculated. The appropriate depreciation estimate should be

related to the extent of asset usage for the program being evaluated. All costs and benefits are matched to the specific time period in which they are incurred and estimated. All donated resources used by a program must also be included, such as building space, equipment usage, time of volunteers (including family members), and other donated goods and services.

The Drug Abuse Treatment Cost Analysis Program (DATCAP) is recommended to collect cost data. There are a number of desirable features associated with DATCAP that should result in the collection of cost estimates that are accurate and reliable. These include:

- Cost categories are consistent with other studies and with economic theory.
- The costs considered are the costs related to the treatment program being evaluated.
- For each cost category, a standard set of questions is utilized.
- A consistent method of cost estimation is followed.

The economic opportunity cost concept, central to cost/benefit analysis, is operationalized in DATCAP. Program comparisons over time or with other programs require standardization, which is facilitated by using opportunity costs and accounting costs. DATCAP includes cost categories that encompass a wide range of costs associated with many treatment programs. The appropriate specific cost will differ from program to program and will need to be considered and specified for each program evaluated. The general cost categories are specified in the table below.

General Cost Categories

Personnel	Supplies and Materials	Major Equipment	Contracted Services	Buildings and Facilities	Miscellaneous Resources	Not Recorded Elsewhere
Direct Salaries	Medical	Office Furniture	Laboratory	Total space	Utilities	Goods
Fringe Benefits	Office	Computers	Repairs/maintenance	Total usable space	Insurance	Services
Volunteers	Housekeeping	Electronics	Security	Rate of use	Taxes	Contracts
	Food	Medical	Housekeeping	Rental Rate	Telephone	
		Residential	Advertising		Printing	

After compiling the cost data associated with resource use, total annual cost estimates are calculated for each cost category and for the program as a whole. Using client utilization data, the treatment cost is calculated for one client for a specified period of time.

Identify and Estimate the Relevant Benefits

The social benefits of a substance abuse treatment program are measured in terms of the subsequent reduction in social costs that can be attributed to the program. Monetary benefit categories referenced in the literature (Kim et. al., 1995; Rufener et. al., 1977; Plotnick, 1994) include:

- Reduction in health care costs for drug related medical treatment,
- Reduction in costs of crime: law enforcement, judicial

system use, corrections, non-drug crime, and drug traffic control,

- Reduction in costs of other social services,
- Reduction in administrative costs of income support programs,
- Increased productivity (earnings) of substance abuse victims and families.

Other relevant benefits that are more difficult to monetize include:

- Improved child care (improved social functioning and educational motivation; reduced abuse and neglect),
- Better parenting,
- Reduced fear of crime and costs of victimization,
- Reduced family stress,
- Lower mortality of abusers.

A successful substance use/abuse treatment program will generate social benefits into the future, ideally over the lifetime of the client. Conceptually, the social benefits resulting from treatment for each individual client would be determined for each year of the client's life and these values would be discounted to obtain the present value of future benefits. It is also recognized that the life expectancy of a treated drug user is greater than an untreated user. The social benefits of a program would then be the sum of the present value of the annual benefits associated with individual clients.

Since future benefit data for clients recently completing a program do not yet exist, we must extrapolate to estimate these benefits. Ideally, an experimental design approach would be used where data in a period(s) subsequent to treatment could be compared between groups receiving treatment and groups untreated. This comparison would allow for the estimation of benefits due to treatment of different social benefits. Such a comparison for two or more periods subsequent to treatment would show trend effects for differences between groups for each benefit. Does the social benefit growth rate decay, remain the same, or increase over time? Unfortunately, such a research design is not always possible, especially regarding publicly funded programs. These programs may require admission of clients into a program who meet a certain eligibility criteria making untreated control groups impossible to establish.

An alternative research design is to compare pretreatment and post treatment client behaviors and experiences related to different social benefits. Typically, information is collected from clients concerning a variety of demographic and other factors at the time of admission into a program. The Addiction Severity Index (ASI) is a data collection instrument widely used in many treatment programs across the country. The ASI is administered primarily for clinical purposes; however, some of the measures collected can be used for cost-benefit analysis. The admission version of the ASI covers the past 30 days as well as lifetime experiences and asks for information related to medical status, employment, alcohol and drug use, legal status, family and social relationships, and psychiatric symptoms. A follow-up version is typically administered six months post release and gathers information on the same variables for the previous thirty days or for the entire prior six-month period. Michael French has developed methodological guidelines for including selected ASI variables into cost-benefit analysis (French et. al., 2002).

Regardless of whether the ASI or some other instrument is used to collect pretreatment and post treatment data on social benefit variables, the methodology for estimating the economic (dollar) benefits of a treatment program is similar. For each selected benefit variable, the magnitude and statistical significance of the mean change from baseline to post release follow-up is determined. The difference in the mean value for each benefit variable can then be converted into a monetary benefit with an appropriate monetary conversion factor related to the unit cost estimate. For example, if this average post treatment benefit is for the past thirty days, the estimate will have to be extrapolated to cover the full follow up period. The appropriate extrapolation rate is an empirical issue and will differ by type of benefit and treatment program. "Thus using

follow-up data, if available, the analysis should account for the likelihood of recidivism and patterns of reduced drug use to estimate an expected level of benefits for the average client." (Plotnick, 1994: 347).

When follow-up data is collected for only a few short periods after a client's release from a treatment program it is difficult to analyze trends concerning the growth rate for a selected benefit. The extrapolation rates are thus subject to considerable uncertainty. Therefore, it is important to use sensitivity analysis to explore to what extent different assumptions about the extrapolation rate impacts the estimated benefit.

Calculate Present Value of Costs and Benefit Streams

Future annual estimates for each category of social benefits would be projected using extrapolation rates appropriate for each benefit. While the estimates for benefits in a future year can be summed to give the total benefits for that year, it is not appropriate to sum across all years to get total benefits associated with a program due to the time value of money. To make benefits of one year comparable with those of another year, a discount rate must be selected to convert the benefits in each time period into their present value. The mechanics of discounting is shown by the formula:

$$PV \text{ of } B_i = \sum_{t=1}^n \frac{B_{it}}{(1+r)^t}$$

where B_{it} is the monetary value estimated for (B)enefit i in time period t . The discount rate is r . The sum of the present value for all benefits will give the total program benefits.

The discount rate is defined as the "cost associated with diverting investment resources from alternative investments or from consumption," that is, the opportunity cost. (Economic Analysis of Investment and Regulatory Decisions - Revised Guide, Chapter 5, 1998: 3). Unfortunately, there is no agreement in literature or practice as to what this rate should be in cost-benefit analysis. The U.S. Department of Transportation and Federal Aviation Administration in the Economic Analysis of Investment and Regulatory Decisions - Revised Guide (1998) have summarized four commonly used methods for estimating the discount rate. These four methods are: the marginal social discount rate (MSR), the marginal opportunity cost of capital (MOCC), a weighted average of the MOCC and MSR, and the shadow price of capital.

The MSR is the opportunity cost of society for foregoing current consumption for future consumption. Society must be compensated to forego a known amount of consumption for unknown consumption in the future. When this rate is used to discount benefits and costs, it represents the ratio that society would evaluate. It is also an after-tax rate of interest. Many decision makers use the U.S. Treasury rates as a proxy for this discount rate. The Treasury rates available include the Treasury Bill which is short-term, the Treasury Note which is intermediate term, and the Treasury Bond which is long-term. If the cost-benefit analysis covers an extended period of time the long-term Treasury bond rate would be the most

appropriate. These rates are readily available and commonly used.

The opportunity cost for decision making purposes in the private sector is the MOCC. This rate represents the foregone investment opportunities in the market. Market rates used are generally before tax. The actual rates used will depend on the time horizon of the analysis and the perceived risk of the social program. If a program is viewed as high risk, then a higher discount rate would be used to compensate for the additional uncertainty of the decision. How to adjust for this risk is also an unresolved issue in the literature and practice. There are several methods to estimate the risk of a program, but which method is most appropriate is an empirical issue that has not been resolved.

A weighted average of the MSR and the MOCC is a method that has been suggested in order to take into account the opportunity costs of both society and the private sector. If funding for a program is derived from various sources, including public and private, then this method would be appropriate. One method of weighting the MSR and the MOCC would be the percentage of public funding and the percentage of private funding used to finance the program. Other techniques could be used and again this is an empirical issue that has not been generally agreed upon in literature or practice.

The last technique to estimate the discount rate is the shadow price of capital approach. Of the four techniques, this is the least likely to be used due to the difficulty of this method. "The present value of the future consumption yielded by one dollar of capital is known as the shadow price of capital." (Economic Analysis of Investment and Regulatory Decisions - Revised Guide, Chapter 5, 1998: 6) Several variables are needed to calculate the shadow price of capital. These variables are difficult to estimate and some are not available for some programs. This method is used more often in corporate decision-making.

Because interest rates change and the risk of programs vary, a sensitivity analysis to evaluate the appropriate discount rate is recommended. By employing different discount rates in calculating the present value of costs and benefits, the decision maker can determine a range of reasonable estimates. There is an inverse relationship between the benefit-cost ratio and the discount rate; therefore a program could be viewed as not worthwhile if a too high of discount rate were used.

For example, if the benefit-cost ratio is greater than one for a range of discount rates between 4% and 10%, then the program may be viewed favorably. If the range was 25% to 40%, then the ratio may be less than one. However, the reasonableness of the high discount rates must be questioned. Discount rate estimates must be reasonable and justifiable, that is, rates must be in the ballpark of market rates and be historically possible. This makes the use of Treasury rates very desirable for many social programs.

Another issue of concern is adjustment for inflation. The general rule is to discount nominal cash flows with a nominal rate and discount real cash flows with the real rate. Real cash flows are in today's dollars and the real rate has been adjusted for inflation. This is most used since it is much easier to estimate benefits and costs in today's dollars. Real rates can be

estimated by the difference between the nominal rate and expected inflation. Most published rates of interest are in nominal terms.

While there are conceptual issues with determining the appropriate discount rate (r) to be used in the discounting process, this is not of significant practical concern when benefit data is only available for a year or two into the future. Sensitivity analysis can be used to determine if a range of values around the rate used in the formula make any difference in the outcome of the analysis.

Conduct Sensitivity Analyses

Sensitivity analysis is an important component of an economic analysis when the parameter estimates used in the analysis have uncertain precision (French, et al., 2002). One approach of conducting sensitivity analysis is to set reasonable upper and lower bound estimates for a variable that is dependent upon assumptions made. Results from the sensitivity analysis will show a range for the variables based on the upper and lower bounds. As noted by Barnett and Escobar (1987: 391), "Sensitivity analysis can be used to indicate the range of values within which assumptions can be safely ignored or the specific conditions that must be found or produced if a policy or program is to yield the desired results."

Discuss Any Costs or Benefits that Could Not be Monetized

Once a conservative benefit-cost ratio has been developed for a program, it is appropriate for policy makers to consider other benefits or costs associated with the program that could not be converted into a monetary measure. Some of these factors, identified above in the discussion of benefits, are difficult to quantify in monetary terms. If a program reduced the spread of a communicable disease, there is certainly social value but it is difficult to place a dollar value on the benefit. Nevertheless, this information may be very valuable at the margin in making a political decision. Attempts should be made to identify any significant benefits or costs that present difficulty in quantifying. Plotnick (1994: 356) states:

Specific benefit-cost analysis raise controversy because, whatever the findings, some interest group may stand to lose and will contest the findings. Even without political motivations, any analysis has limitations and can be questioned because, like other evaluation methods, its findings rest on judgments about which impacts to quantify, decisions about how to measure the impacts due to the program, assumptions about how to value impacts and how to project impacts beyond the observation period, the choice of discount rate, the quality of the data, and other methodological concerns. Limits on time and resources prevent investigation of the size of all possible benefits and costs. Moreover, some program effects may be inherently nonquantifiable, yet considered crucial to its success or political viability. Nonetheless, if carefully done with attention to the sensitivity of the findings to different assumptions, a benefit-cost analysis can improve the basis upon which policy decisions rest.

The application of a common methodology associated with CBA is appropriate for different types of substance abuse

treatment programs. For specific treatment programs, however, the relevant costs and benefit variables will have to be carefully specified to account for differences in program attributes and data available. In addition to a better understanding of program efficiency in terms of a benefit to cost ratio, these studies should be helpful in developing strategies for better data collection that can improve future evaluations.

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