Cost-Benefit Analysis and Alcoholism Treatment

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TALKING POINTS Psychiatry Pharmacy Formulary Neurology

- Mental health comorbidities are common in cases of alcohol abuse or dependence.
- Drug-based interventions are often evaluated using cost-benefit analysis.
- Alcohol abuse and dependence are characterized by a chronic course, which makes long-term evaluation important.
- Costly inpatient care has been increasingly replaced by less costly outpatient treatment.

Abstract

What is cost-benefit analysis (CBA) and how is it used to look at alcoholism treatment? CBA is a method by which managers and policy-makers evaluate alternatives that face society. This article begins by presenting the rationale for CBA and briefly discussing how it fits in with other economic analyses used to assess alcoholism treatment. It then discusses both costs and benefits in a conceptual manner, and follows with more explicit examples. It finishes by highlighting some good cost-benefit analyses that are available and indicating what we still have to learn.

Introduction

Cost-benefit analysis (CBA) is a method by which managers and policy-makers evaluate alternatives that face society. Just as the rational individual wishes to choose efficiently among attainable possibilities, agencies and governments similarly face budget constraints. Policy-makers and managers must choose among such alternatives as spending more on preventive care, giving additional support to technology-intensive facilities, or investing additional sums in medical research.

Economists typically posit that the rational individual will allocate his or her time and money so at the margin the last dollar or the last minute of time allocated to a good or activity will provide the same "bang for the buck." Families allocating the money among foodstuffs and students allocating their study time during finals week are acutely aware of such trade-offs at the margin.

Policy analysts and managers turn to CBA in situations where markets are either not readily available, or where there are imperfections in the markets that exist. Market imperfections may occur on either the cost or the benefit side. Individuals are generally aware of both the money and the time costs for treatment. Where the market may not function properly is in the information necessary to the individual regarding either the need for treatment, overcoming the stigma of treatment, or finding appropriate treatment locations.

The internal benefits to individuals include improved quality of life, improved productivity on the job, and longer life. Yet there may be additional benefits external to the individual through benefits (or averted costs) to the family or indeed to the community.

This article begins with the rationale for CBA and a brief discussion of how it fits in with other economic analyses used to assess alcoholism treatment. It then discusses both costs and benefits in a conceptual manner, and follows with more explicit examples. It finishes by highlighting some good cost-benefit analyses that are available, and by indicating what we still have to learn.

Basic Principles

The fundamental principles behind CBA reflect the need to determine an efficient allocation of resources when a market is either not readily available or when the market does not internalize all of the costs and all of the benefits. Following Folland et al,[1] individuals consume goods to the point at which the incremental or marginal benefit equals the incremental (marginal) cost. Because the marginal benefits exceed the marginal costs until the last unit, it follows that the total benefits exceed the total costs, and that the net benefit (total benefits less total costs) is maximized. This follows intuitively in that the consumption of one more unit of the good increases costs more than benefits, thus reducing the net benefit. The market, in this sense, works, and the analysis follows for all sorts of health-related activities, including eating healthy foods, exercising, buying vitamin supplements, or seeing one's healthcare provider for both routine and emergency care.

Figure 1 shows the dollar value of the investment or intervention on the horizontal axis and the dollar value of marginal benefits and costs on the vertical axis. At intervention level I_1, the incremental benefit is B_1 and the incremental

cost is C_1. It follows that increasing the size of the intervention to I_b would continue to bring incremental benefits that exceed incremental costs. If one continued the intervention past I_b the incremental costs would exceed the incremental benefits, hence reducing economic welfare. The increase in economic welfare by moving from I_1 to I_b defined by the shaded triangle in Figure 1.

Where, then, do markets fail when it comes to health care, and particularly substance abuse treatment? In the realm of public health, items such as air pollution control or water treatment are not always amenable to market solutions. Such issues are often addressed in large-scale projects that benefit large numbers of people. It may be difficult to find out how people really feel about such projects and to find all of the beneficiaries and make them pay for their benefits (eg, air pollution control).

For individuals, two particular issues come into play. Some do not have the income or wealth to go to the market. We try not to deny essential vaccinations, such as MMR (measles, mumps, rubella) or polio, or childrens' hearing or vision tests for those who cannot afford them, but we may not feel the same way about, eg, cosmetic surgery or in vitro fertilization. Programs to provide services that are deemed to be essential often involve (either explicitly or implicitly) cost-benefit criteria.

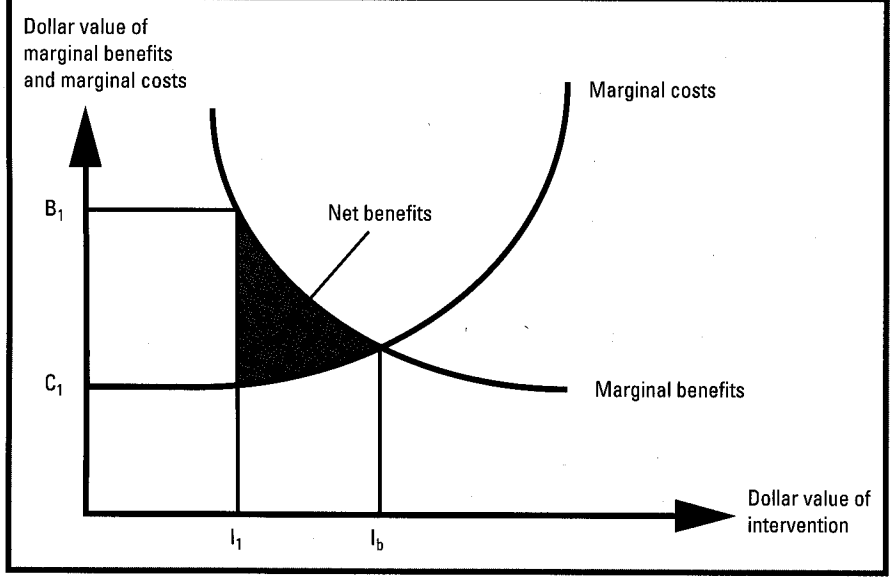
The second issue involves so-called externalities—benefits or costs that do not accrue to the user. The benefits of pollution control help not only those who are reducing the pollution, but those who would have suffered from the pollution even though they did not cause it. The benefits from vaccinations go beyond those who are vaccinated, to those whose risk of catching a disease is reduced because others are vaccinated.

For substance abuse and substance abuse treatment, one must be careful in defining the internal and the external costs and benefits. Substance abuse imposes three major costs that are fundamentally internal to the individual and his or her family.

1. Reduced job productivity and hence reduced earnings.
2. Reduced health for the individual, even if his or her earnings are not affected.
3. Earlier death.

Assuming that these costs are understood, the individual and his or her family choose to treat or not to treat substance abuse.

Figure 1. **EFFICIENT USE OF RESOURCES WHEN MARGINAL BENEFITS EQUAL MARGINAL COSTS**



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There are, however, external costs attributable to substance abuse. Drinking may lead to violence against other people, and drunken drivers kill innocent people on the highways. Drinking, by itself or in concert with other substance abuse, may lead to criminal activity. Pregnant women who drink risk damage to their unborn children. Thus there may be a societal choice to provide alcohol and substance abuse treatment even to those who would not choose it for themselves.

Cost-Benefit Analysis

CBA has a particular role in analyzing large-scale projects or interventions. Since both the benefits and costs may accrue over a number of years, they must be discounted. Simply speaking, a dollar promised a year from now is worth less than a dollar promised today. If the discount rate is 6%, a rate often used in healthcare cost studies, a dollar 1 year from now is worth \$1/1.06 or about 94.3 cents. A dollar 2 years from now is worth $\$1/1.06^2$ or 89.0 cents. So a stream of benefits of 1 dollar for 2 years, discounted at 6%, is worth \$0.943 + \$0.890 or \$1.83. These benefits would be compared with costs, similarly discounted.

To determine if a project is beneficial, one compares the present value of the benefits to the present value of the costs. Projects, investments, or interventions with positive net benefits are candidates for adoption. Yates[2] provides a particularly good "how-to" manual for conducting cost-benefit analyses.

It is not uncommon to find the cost-benefit criterion expressed as a ratio of discounted benefits to costs. Here:

$$\frac{B}{C} = \frac{\text{Present Discounted Value of Benefits}}{\text{Present Discounted Value of Costs}}$$

Ratios >1 indicate that the present value of social benefits exceeds the present value of social costs and that the project has a positive net benefit.

We must, however, be cautious. As noted in Figure 2, project A, a small-scale project, may have a high benefit-cost ratio (eg, 15/5=3), but a small level, 10, of net benefits. Project B may be a mutually exclusive, larger-scale project

that has a lower benefit-cost ratio (200/100=2), but a much higher level of net benefits (200–100=100, as opposed to 15–5=10). Project C, as also noted in Figure 2, does not provide benefits that exceed its costs, and would not be viable under any benefit-cost or net benefit criteria.

Measuring Costs and Measuring Benefits

Harwood et al[3] provide important insights into the costs of alcohol abuse, as well as the potential benefits of treating it. Harwood et al estimated the annual economic costs of alcohol abuse in 1992 as $148.0 billion, and updated their estimates to $165.5 billion by 1995. Their findings are summarized in Table 1.

There are several important features to note. First, healthcare treatment expenditures ($22.5 billion in 1995) accounted for <14% of all economic costs in 1995. The largest portion was in productivity impacts, both for those who are viewed as alcoholics and for victims. The $119.3 billion figure accounted for almost 72% of the economic costs.

Second, implementing healthcare interventions increases costs in one part of the table (healthcare expenditures) with the intent of decreasing them in another part. An intervention costing $500 million would be beneficial, eg, if it reduced productivity losses by $600 million. However, its net benefit would be to reduce healthcare costs by $100 million.

Third, some costs are almost certainly underestimated. For treatment costs, many analyses omit the time costs of traveling to the clinic, waiting for treatment, and receiving care. Yet, since many people pay little or nothing "out-of-pocket," these time costs may be crucial determinants of deciding whether to get treatment or not.

Another example is the difficulty of assigning a value to the pain and suffering that families of alcoholics and their victims experience. This is often referred to as "willingness to pay" for a treatment that would alleviate the pain and suffering. One can look at the alcoholic's inability to work, or his or her death, and estimate a cost. It is much more difficult to assign real costs to those family members whose lives are affected by these changes in the alcoholic's life. The inability to assign explicit values does not mean, however, that these are not costs. They should not be ignored in evaluating interventions.

Rationales for Interventions

Having demonstrated that cost-benefit calculations may replace market criteria, analysts must consider interventions according to cost-benefit criteria. Table 2 shows, eg, that over $38 billion of the 1995 costs of alcohol abuse could explicitly be attributed to external costs imposed by alcohol abusers on others. Of this $38 billion, 72%, or over $27 billion,

Figure 2. **A COMPARISON OF INTERVENTIONS**

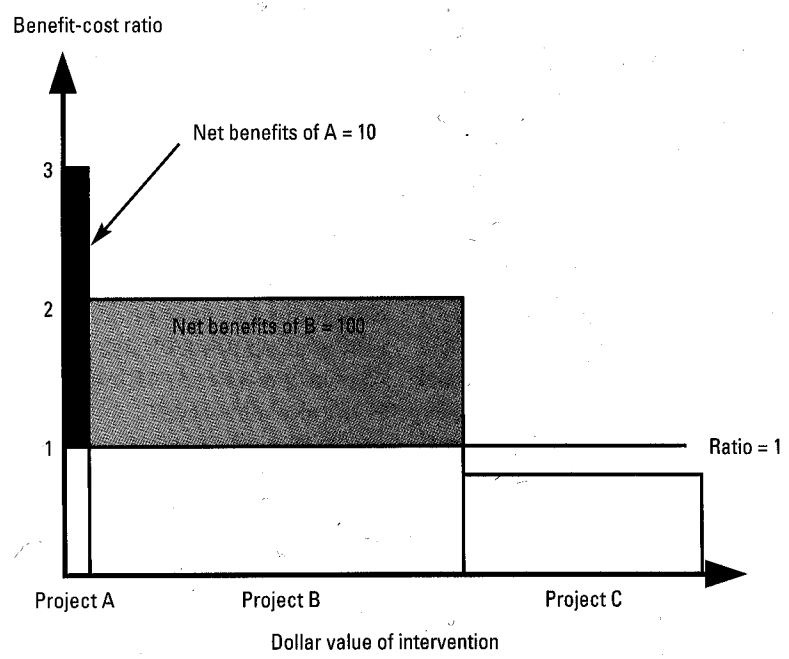

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Table 1. **THE ECONOMIC COSTS OF ALCOHOL AND DRUG ABUSE IN THE UNITED STATES—1992, 1995 (IN $000,000)**

	1992		1995	
	Dollars	**Percent**	**Dollars**	**Percent**
Healthcare Expenditures	**18,820**	**12.71**	**22,490**	**13.50**
Specialty alcohol	5,573		6,660	
Medical consequences	13,247		15,830	
Productivity Impacts	**106,997**	**72.29**	**119,302**	**71.63**
Lost earnings—premature death	31,327		34,921	
Motor vehicle crashes	11,100		*12,373*	
Other causes	20,227		*22,548*	
Lost earnings—illness	69,209		77,150	
Lost earnings—crime/victims	6,461		7,231	
Incarceration	5,449		*6,098*	
Victims of crime	1,012		*1,133*	
Other Impacts	**22,204**	**15.00**	**24,752**	**14.86**
Crime	6,312		*7,036*	
Social welfare administration	683		*761*	
Motor vehicle crashes	13,619		*15,182*	
Fire destruction	1,590		*1,772*	
Total	**148,021**	**100.00**	**166,543**	**100.00**

Note: Components may not sum to totals due to rounding.
Source: Harwood, Fountain, and Livermore (1992), Table 1.3.[3]
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was related to either lost earnings/premature death or destruction of motor vehicles. Surely an intervention to reduce these costs would be socially desirable.

One plausible intervention would involve the treatment of alcohol abusers who might not otherwise seek treatment. Such treatment, it follows, would reduce drunken driving and its costs. This reduction in deaths would presumably pass cost-benefit calculations.

The analyst must ask some important questions:

1. How effective is alcoholism treatment in ending alcoholism? If a treatment is not effective, then any expenditure on the treatment constitutes a waste of resources. Efficacy for a chronic disease, such as alcohol abuse or dependence, is difficult to measure since a patient may go for 6 months, 12 months, or longer without an alcoholism episode, but may then relapse. Does this constitute effective treatment?
2. What is the causal relationship between alcoholism and automobile accidents?
3. What percentage of those people causing accidents or deaths is made up of diagnosed alcoholics and what percentage is made up of those who would not be reached by any alcoholism screening or treatment program?

Without splitting hairs, one may also note that it is the driving rather than the drinking that causes the motor vehicle accidents. For this particular case, one might wish to compare a set of interventions imposing legal obligations on those who serve alcohol, providing alternative forms of transportation for those who are too drunk to drive, and/or increasing the penalties for drunken driving. A comparison of these (and perhaps other) types of policies by cost-benefit criteria could provide important information to policy-makers.

Cost-Benefit Analyses

There is a substantial literature evaluating alcohol treatment services. French[4] provides an invaluable review distinguishing among economic cost analysis, cost-effectiveness analysis, and CBA. Early work concentrated on *cost-offset* analysis, which compared the cost of a program with the dollar value of a single outcome, and did not include future healthcare costs. French appropriately terms this a *partial cost-benefit analysis* since it ignores improved productivity and any external impacts on others. Jones and Vischi have also contributed in this area.[5]

Early offset studies typically followed individuals over a period of time (as many as 6 or 7 years in some). Most of these studies used a "pre-post" framework on insured or clinic populations and looked at healthcare costs (both substance abuse- and nonsubstance-abuse–related) before, during, and after treatment. Some studies found that posttreatment substance abuse costs were lower than pretreatment costs, although it was hard to know whether the treatment made the difference. Some even argued that substance abuse treatment reduced or offset the nonsubstance abuse treatment costs.

This author and others have argued that more careful analysis is necessary, decomposing total costs into cost and utilization effects. For example, we compared those treated for alcoholism with those treated for drug abuse.[6] Using econometric models, we found that healthcare costs declined for both groups of substance abusers after treatment initiation, but the differences versus pretreatment levels are relatively modest. This does not mean that the treatments might not still satisfy cost-benefit criteria when external effects are added, but that the scope of the analyses does not provide information to allow such inferences.

Table 2. TOTAL EXTERNAL COSTS DUE TO ALCOHOLISM IN THE UNITED STATES—1992, 1995 (IN $000,000)

External Costs	1992	1995
Lost earnings—premature death		
Motor vehicle crashes	11,100	*12,373*
Lost earnings—victims of crime	1,012	*1,133*
Other Impacts		
Crime	6,312	*7,036*
Social welfare administration	683	*761*
Motor vehicle crashes	13,619	*15,182*
Fire destruction	1,590	*1,772*
Total External Costs	34,316	38,258

Note: Components may not sum to totals due to rounding.
Source: Harwood, Fountain, and Livermore (1992), Table 1.3.[3]
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In one of the best modern cost-benefit studies of alcoholism interventions, Fleming et al[7] evaluated a *brief intervention* remedy for at-risk or problem drinkers. The study was confined to problem drinkers, defined as men who consumed more than 14 drinks per week (168 g alcohol/week) and women who consumed more than 11 drinks per week (132 g alcohol/week).

There are six essential components to brief intervention. The physician:

1. States his or her concern.
2. Provides specific feedback to patients on how drinking is affecting them (eg, elevated blood pressure, liver function problems, family problems).
3. Gives a clear recommendation about changing their alcohol use.
4. Negotiates a drinking contract.
5. Provides a self-help booklet.
6. Establishes follow-up procedures.

In a detailed follow-up to the original Project TrEAT (Trial for Early Alcohol Treatment), Fleming et al assessed the benefits and costs of brief intervention, including emergency room and outpatient and inpatient hospital use, automobile accidents and traffic violations, criminal activity, alcohol and substance use, and health status measures. Costs were measured for those who participated in the intervention. Benefits are reported as avoided costs, comparing the 392 study patients with a randomized control group (382 patients).

The researchers report a benefit-cost ratio of 5.6:1. The benefits included savings of $195,000 in emergency room and hospital use and $228,000 in avoided costs resulting from motor vehicle events

and crime. The combined economic benefit was $1,151 per subject. The estimated total economic cost of the intervention was $80,000, or $205 per study patient.

This study illustrates the importance of evaluating external effects. Of the $1,151 in benefits per subject, $620, or 54%, was attributable to factors external to the individual, although the investigators acknowledge a wide confidence interval around this point estimate. Nonetheless, this finding suggests the importance of a public health intervention rather than a simple individual decision to seek treatment.

An economist also asks questions when he or she sees a benefit-cost ratio of 5.6:1. If this measured ratio is valid, then why do we not see these types of programs for treating large numbers of alcoholics? Indeed why aren't the insurers *demanding* that such programs be established? The Fleming study[2] finds that, from the perspective of a managed care organization (excluding the external benefits), the benefit cost ratio was 3.2:1.

Issues such as the overhead costs necessary to establish and maintain clinics and programs are vital in the evaluation literature. As careful as the analysts are, one must also ask whether the proper controls for selection into the program are being considered and, whether as one moves to other patients (presumably harder to treat), the outstanding benefit-cost ratio would stand up.

Conclusions

CBA has evolved into a valuable analytical tool for health services research and for alcoholism treatment in particular. At a time when care managers in all settings are looking to allocate their resources efficiently, CBA provides an excellent way of comparing alternatives by economic criteria. Several items, however, demand more attention.

Benefit-cost analysis is but one way of measuring the importance of an investment or an intervention. The net benefit of the Fleming study was $343,000, with a benefit-cost ratio of 5.6:1. A larger intervention, with a smaller benefit-cost ratio, may conceivably have higher net benefits and be socially more beneficial to society. Analysts and policy-makers must be aware of this trade-off.

Substance abuse and alcoholism treatments are interventions for chronic problems. The Fleming study looked at a 12-month period; therefore, predicting or discounting future benefits and costs was not a major problem. Methods must be developed, however, to analyze impacts over a longer time for this type of chronic condition.

A second issue regards the appropriate measure of economic benefits. Figure 1 shows that the appropriate benefit measure is an area under a marginal benefit curve yielding *willingness to pay*. This requires sophisticated questionnaires and modeling procedures, but it is essential if a proper benefit-cost analysis is to be conducted.

Analysts may wish to apply these improved methods to the question of gender differences in the net benefits of interventions. Does CBA offer additional insights into the desirability of inpatient as opposed to outpatient treatment for alcohol abuse or dependence? How does brief intervention compare with psychotherapy?

Finally, it is tempting but risky to extrapolate small-scale studies to the larger economy as a whole. To cite the Fleming study once again, this small-scale intervention in south central and southeastern Wisconsin appears to have been quite successful. If this type of intervention were to be mandated economy-wide, it would almost certainly require that resources be diverted from other uses, and these diversions may increase treatment costs such that the benefit-cost ratio is not maintained. Serious attention to such diversion is essential if CBA is to be used to extend successful local programs nationwide. ✦

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