ON THE APPLICABILITY OF COST-EFFECTIVENESS ANALYSES TO ALCOHOL-HIGHWAY SAFETY COUNTERMEASURE PROGRAMS

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16. Abstract Consideration is given to the application of cost-effectiveness procedures as one means of determining the most productive mix of alcohol-highway safety countermeasures. Key problems involved in developing and utilizing valid cost-effectiveness procedures in this realm are discussed. Alternative types of approaches are considered; namely, the simplistic "rule-of-thumb" approach and the sophisticated model-building approach. These are critiqued and rejected in favor of a third approach. This last involves the phased development of an operational cost-effectiveness analytic procedure. The approach outlined is intended to permit timely resolution of serious operational difficulties, particularly pertaining to data availability, to maintain a check on excessive expense before useful results are assumed, and generally to lead to a procedure that will be valid and relatively complete, yet implementable by operating agency personnel without undue cost or administrative burden.

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PREFACE

This report was prepared as the result of a request from the National Highway Traffic Safety Administration for a critique of cost-effectiveness procedures as they might be applied to the particular set of countermeasure programs concerning alcohol and highway safety. The basic aim of the effort that has led to this report has been to consider past efforts along this line, to analyze the problems that inhibit successful utilization of the cost-effectiveness approach, and to propose a viable method for proceeding to resolve these problems and produce a valid and implementable procedure.

The time and resources committed to the development of this report have been limited, and no claim is made that the discussion is definitive. The procedure proposed is not presented in great detail, but as outlined does hopefully give a sufficient sense of what is conceived as a reasonable course, so that the reader can make intelligent judgments concerning its potential worth as a line of thinking to pursue further.

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ON THE APPLICABILITY OF COST-EFFECTIVENESS ANALYSES TO ALCOHOL-HIGHWAY SAFETY COUNTERMEASURE PROGRAMS

1. INTRODUCTION

The National Highway Traffic Safety Administration's concern that cost-effectiveness procedures be developed for its Alcohol Safety Action Program's (ASAPs) programs is understandable. Good cost-effectiveness methods provide a formalized means for comparing the relative value of existing or planned program alternatives. Essentially cost-effectiveness involves quantifying to the extent possible the costs involved in implementing a program and the values of results to be achieved by the program. Costs and results are then related to each other either in the form of a ratio or some other appropriate index. Since this is done in a standard way across a number of programs, the method provides at least one basis for comparing the relative worth of different programs. The cost effectiveness results can be used either to select programs for implementation which will provide the greatest results for a fixed budget input or alternatively to determine the resources necessary to implement a "most effective" set of program activities.

As they have evolved over the past 30 years cost-effectiveness methods are primarily prospective planning tools, intended to aid decision makers in rationalizing the process of selecting the best means for attacking broad scale and complex public programs. In the past decade much has been attempted in the realm of social programs. Analyses have been undertaken in such diverse program fields as health, education, poverty, and urban redevelopment (particularly see references 8, 11, 12). In all of these, the action alternatives available are many and the need to clarify substantive bases for selecting among these alternatives is great. Certainly the NHTSA alcohol-highway safety programs and particularly the ASAP efforts can be classed with these significant social programs.

While the rationale for the cost-effectiveness approach is simple to state, valid, useful, and practical methods for implementing cost-effectiveness analyses are hard to come by. On this last point virtually all authories are in agreement. There are a number of major problems to be faced in implementing the cost-effectiveness method. I will turn to these shortly. A review of developments to date indicates clearly that the surface has barely been scratched in resolving a number of the important problems. Even the most ardent proponents of the cost-effectiveness method warn against over-optimism concerning the ease with which the method can be implemented and too simplistic reliance on the results at this stage in the development of the art.

The next section of this memorandum will discuss several of the most significant problems facing any attempt to implement cost-effectiveness procedures. None of these problems is peculiar to the subject area with which NHTSA is particularly concerned, but the discussion here will focus on matters especially to alcohol and highway safety programs. Following this discussion of problems, several alternative strategies for developing an ASAP cost-effectiveness method will be considered. The final section of the memorandum will describe one plausible and practical strategy for developing a cost-effectiveness procedure to be applied in the ASAPs. The strategy suggested calls for the phased development of a cost-effectiveness method. The phased development is proposed because this plan of attack can provide meaningful results quickly and at the same time can allow for more adequate resolution of the critical problems which currently hinder the implementation of most cost-effectiveness approaches.

2. PROBLEMS RELATED TO THE DEVELOPMENT AND IMPLEMENTATION OF COST-EFFECTIVENESS PROCEDURES

There are a number of problems, both practical and theoretical, which make the development of a useful and feasible

cost-effectiveness procedure difficult to achieve. No attempt will be made here to cover all the problems that must be confronted. Attention will be given to those which seem to be of greatest importance. Without adequate resolution of at least these problems, any cost-effectiveness procedure developed will be of questionable utility. What is worse, the results of an invalid cost-effectiveness procedure, because it gives the appearance of being based on "hard" quantitative procedures, may impair or lead astray the decision-making process rather than provide valid guidance and assistance.

2.1. THE PROBLEM OF MISSING AND HARD-TO-GET DATA

The problems related to data are discussed first because they are of enormous practical significance. Most discussions of cost-effectiveness do note that problems almost invariably exist concerning collection of adequate data, although many give only passing reference to the matter. Anyone who has dealt with the real world of data pertaining to alcohol and highway safety learns quickly from his reconnaissance efforts that the state of the data "out there" is poor at best and the difficulties this situation creates are not easily overcome.

As a critical case in point, it is useful to consider that data which many discussions state are easiest to assembly, namely, dollar resources input to program activities. It is true that assembling dollar cost information would be simple, say, in the case of ASAP projects, if the project activities occurred in total isolation and did not involve ancillary inputs from other sources. Unfortunately, from an analytic point of view (though fortunately from the point of view of program implementation) this isolation is non-existent. Most ASAP activities are imbedded in the on-going operations of many different agencies. Much of the cooperation sought as an integral part of ASAP efforts involves supplementary participation by agencies and individuals for which no reimbursement from ASAP funds occurs. This participation in the form of time spent by operating personnel, facilities utilized, and supplies expended does cost money and

is paid for. Without considering here the issue of where the line should be drawn in laying out an adequate picture of the cost involved in implementing ASAP activities, it is nevertheless apparent that that line must be drawn somewhere outside of the direct ASAP budget itself. Anyone who has attempted to draw together detailed information on how personnel within agencies spend their time and what the dollar costs of such time are, knows that this is an exceedingly difficult job. Time and budget information is rarely kept in a form which is amenable to such aggregation. Where such information is collected, it is often for immediate supervisory purposes, and it is destroyed shortly after being collected. No request is more likely to lead to administrative resistance than an attempt to get at the details of budget and expenditures. The matter is only further compounded in the case of the ASAP's because the programs do tend to involve many agencies, public and private, at the local, state and federal levels. Pulling together this cost information from police departments, courts, rehabilitation agencies, the individual offenders, insurance companies, and similar related organizations will be a costly and time consuming operation, particularly if it is done broadside and without careful prior planning. There are important theoretical considerations concerning the proper handling of costs within the cost effectiveness method and these will be returned to below. The point here is that the resolution of theoretical questions must remain academic unless and until the pragmatic problems involved in collecting cost information are resolved.

The situation with respect to data concerning the effects of programs activities is worse. In the case of costs, most agencies are forced to recognize the importance of budgetary and expenditure data, so that some records are kept. With respect to effects, while most agencies are concerned with whether or not they are accomplishing something by their efforts, careful tracking of hard data concerning the actual effects achieved is rarely required. In most cases only cursory information is

monitored. Furthermore, effects of concern to the cost-effectiveness analyst often occur at a later stage in the administrative process than where a given activity occurs. If these are tracked at all, the tracking is done by a different agency, often with different concerns than the one engaged in the activity of immediate concern.

In summary, the problems related to collection of the basic data required for the implementation of a cost-effectiveness procedure are difficult, and may be costly to resolve. Without a resolution of these practical problems, however, it is questionable whether it would pay to develop a carefully devised analytic procedure. One primary aim of any effort to develop a cost-effectiveness procedure for the ASAP's must be to consider carefully and to implement effectively adequate data collection procedures.

2.2. THE DIFFICULTY OF DEFINING AND LIMITING COSTS AND EFFECTS

I would like to touch on three particular aspects of this general problem area: the problem of partitioning costs; the problem of linking effects to given activities and then the partitioning of these effects; the problem of determining where along the continuum of direct-indirect costs it is valid to place a limit in developing an adequate cost-effectiveness analysis.

2.2.1. THE PROBLEM OF PARTITIONING COSTS. Rarely does any agency or even any individual within an agency perform a single function. ASAP funds may be put into an agency for the specific purpose of funding one or several activities, but the fact remains that in most instances the activities to be funded by ASAP dollars are carried on in conjunction with ongoing work. Moreover, the normal activities of an agency are often similar to, or even identical with, the activities which ASAP dollars are funding. In this case, ASAP dollars are supplemental to ongoing activities.

Two difficulties result with respect to defining exactly what are the costs of an ASAP-stimulated effort. First, there is the case where ASAP-funded efforts are in fact used for other purposes. I am not referring to the case where ASAP funds are delibrately diverted to other purposes, although this may in fact occur. The cases at issue are those that arise because agencies and their personnel perform multiple missions almost simultaneously. Take the simple instance of a special road patrol being paid for by an ASAP for the specific purpose of apprehending a greater number of drunk drivers. The "paid for" patrol will probably spend part of its time apprehending non-drinking traffic offenders, pursuing other crime prevention and detection activities, and engaging in other police duties not directly of concern to the ASAP effort. Perhaps this "dilution" of ASAP is an inevitable and necessary part of the ASAP effort. In this case it might be ignored. However, if one wishes to make cost and result comparisons across agencies or among ASAP's, it is important to know the differences in local practices and procedures so that corrections can be made for any biases that might be introduced.

The obverse of the above instance occurs in the case where a non-ASAP funded activity in fact fulfills ASAP missions. How, for instance, is one to handle the increased arrest activity among road patrols not funded directly by ASAP? Are these arrests to be considered free goods or are the costs of these efforts to be partitioned out and assigned to the ASAP?

Additional problems occur in those instances where manpower and resources allocated normally to other functions are diverted to the fulfillment of ASAP objectives. An agency may be operating within the same budget as before, but at a cost of less satisfactory performance in areas outside the ASAP purview. Should these "costs" in terms of diminished peformance be added on the cost side?

None of these issues is simple to resolve. But since a cost-effectiveness analysis, in whatever form, focuses on a

netting out of costs versus results, it is important to develop a picture of costs that is a reasonable reflection of reality.

2.2.2. THE PROBLEM OF LINKING BENEFITS TO ACTIVITIES AND PARTITIONING BENEFITS. A crucial assumption in the cost-effectiveness approach is that particular results of concern can be linked causally with activities that are intended to produce them. The assumption sounds reasonable and would be simple to act on if a given result, such as an increase in the number of arrests, was solely related to only a single activity, such as increased police patrols. Unfortunately, the real world is not so simple. Any important result of concern is obviously influenced by a number of different activities. Within the ASAP framework, the number of arrests, for example, can be influenced by increased police patrols, improved police training, and more efficient processing of DUIL arrests. Similar examples could be elaborated with respect to the other results of concern.

The situation of multiple links between results and activities would cause no great problem, if we knew with reasonable precision what the causal relationships were. The fact is that we know little about these relationships in any quantifiable sense. Analytic tools do exist that can cut into this type of question, but almost no prior work has been done in this area with respect to the problem of drinking driving.

The situation, then, is this. The cost-effectiveness method requires that results or the value of results be related to the costs of producing these results. The netting out of results vis-a-vis costs provides the basis for comparing the relative merits of various program alternatives. As seen in the previous section, it is no mean problem to determine even what the costs of any given activity are. The point concerning results is very similar to this. There is no easy basis for determining in a quantifiable sense how much of a given result flows from one or more programmed activities. We know that any important result should probably be partitioned among the activities which bring it about, in the same way that the costs of a given activity

should be partitioned among the various different results which that activity causes. There is, however, little precedent for determining how these partitions should be performed. In sum, the ground on both sides of the cost-effectiveness line is very mushy and ought to be traversed with caution.

2.2.3. THE PROBLEM OF DRAWING A BOUNDARY LINE AROUND COSTS AND EFFECTS. Mention has already been made of the difficulty involved in determining where to stop in the process of totalling up the costs and value of results with respect to any given countermeasure activity. It is convenient to use the terminology of "direct" and "indirect" costs and results, but it is important to recognize that these terms represent a continuum. There is no sure guide and no easily achievable agreement as to where "direct" lapses into "indirect", implying lesser concern usually, and "indirect" falls off into "unrelated", and therefore of no concern.

It may seem attractive, in terms of costs, to limit consideration only to the direct program dollar inputs to a given activity. But this attraction can be deceptive. In one situation, a given number of dollars input directly by an ASAP may represent only part of the effort generated by voluntary reassignment of other resources not paid for by ASAP dollars. In this latter case, there is also the problem of determining indirect opportunity costs engendered by the diversion of resources from other tasks. For instance, other things being equal, additional police assigned to road patrols might be drawn from downtown foot patrols, resulting in an adverse increase in street crimes and business thefts. Such an effect can be considered an indirect cost of the ASAP effort, unintended as it would be. However these and other indirect costs are handled, it seems clear that focusing only on the immediate program dollar input is a weak basis for establishing the cost side of the cost-effectiveness equation.

There is no easy solution to determining where to set the limits. Yet where the lines are drawn has important implications

for the netting-out of costs and results, which is the heart of the cost-effectiveness procedure. An adequate, standardized solution needs to be found if meaningful comparisons are to be made across countermeasures within any one ASAP and across ASAP's.

2.3. PROBLEMS OF VALUATION

Three problems concerning determining the value of costs and results bear particular mention. These are: placing values on phenomena which do not usually have prices or other simple quantitative measures of value attached to them; distinguishing the values of current expenditures and results versus those in the more distant future; and separating out operating costs from capital costs.

2.3.1. VALUING THE HARD-TO-VALUE. No attempt at a cost-effectiveness analysis in any significant public program effort can avoid this issue. In the case of the ASAP's, however, since the ultimate objective is to reduce the number of fatalities and injuries resulting from alcohol-involved crashes, resolving the question of how to handle the value of a human life is a paramount issue. This is certainly the most difficult of any of the valuation problems.

The most common method of dealing with the problem is to estimate the earnings that would have accrued to a dead person had he lived, or the earnings lost from time away from the job in the case of an injured individual. To these are usually added direct expenses of handling the individual as a result of a crash death or injury. There are questions that arise with respect to this latter, particularly in the cases where long-term care is necessitated, but these are minor compared to the issue raised in valuing life and suffering itself (2, pp.107ff; 4, pp.67-69; 14; 19,p.5).

While the earnings approach is the most common solution, this does not mean that it is simple to apply or that its results are satisfying, even when it is handled ingenuously. Estimating

the future earnings of an individual is a task involving many probabilistic guesses about what might have been. How long would he have lived, if the crash had not occurred? What are the chances that he would have changed his course of life, his occupation, or his employment status? What would have been his choices with respect to retirement? And so forth. There are of course, the laws of averages, of which acturial tables on life expectancy are the most obvious examples. But these laws are based on large numbers, and in many instances pertaining to particular ASAP's the numbers involved in any given year will not be large. Probabilistic estimates inherently contain error, and in the case of estimating future earnings, the errors become compounded because several concurrent estimates are involved.

Even assuming the problem of projecting earnings can be resolved adequately and, at the very least, a standardized and explicit method is applied, the question remains whether earnings (plus medical or interment expenses) adequately represent the generally perceived value of life and human suffering. Most people would probably answer in the negative. How is one to place value on those parts of a human's life for which payment is not made--value to a spouse, to children, to parents, to friends, or value in terms of non-job contributions to his community and the society? The answer is that no known way exists.

These problems have led to a second type of resolution of this particular problem, namely, not to try. In this approach, followed, for example, in the Operations Research Incorporated (ORI) procedure developed for NHSB in 1968, no attempt is made to place a dollar value on a death and instread, the number of deaths incurred is dealt with as is (10, p.56). This appears to be a more reasonable approach, although it is not as tidy as converting everything into a single dollar scale. It is not, however, without problems of its own.

Keeping the variable of life separate from other measures of costs and results which are tabulated in dollars creates a problem of incommensurate comparisons. How is one to rate a

program which results in a reduction of 100 deaths and costs $1 million against a program which leads to a reduction of 50 deaths and costs $500,000? Is half the result in terms of lives saved worth halving the cost of the program selected? In fact, the problem implied here is little different than that faced in trying to place a direct dollar value on life. Some resolution it seems is essential, if the cost-effectiveness procedure is to work in the case of the ASAP program. Any solution must inevitably involve a heavy input of judgment. Keeping the people numbers clear, rather than converting them to dollars, at least has the virtue of making the matter explicit throughout. In addition, it avoids what can be the very complicated mathmatical manipulations of an "earnings" approach, which produces no more valid results in any case.

In the alcohol-involved crash problem, life and human suffering are not the only hard-to-value phenomena of important concern. Civil rights and the freedom of the individual ought also to be taken into the accounting. There are judgmental methods of weighting the importance of such matters, although scaling them is a more difficult problem. No present method is apparently fully satisfactory and tested by time. At best, indicative approximations can be developed. The problem of dealing with all non-priced variables remains a thorn in the side of any attempt to develop cost-effectiveness analyses.

2.3.2. CURRENT VERSUS LONG-TERM COSTS AND RESULTS. The problem of how to handle current versus future values in cost-effectiveness analyses occurs because most programs of interest are implemented over fairly long periods of time. The ASAP's are no exception. Economic theory assumes that a dollar spent or gained today is worth more than a dollar to be spent or gained at some time in the future. The layman's folklore parallels this theoretical assumption with the aphorism that "a bird in the hand is worth two in the bush".

Most cost-effectiveness procedures attempt to handle this matter by discounting or deflating future costs and gains back

to a "present value". In effect, future values are deflated by some compound interest rate. While it is easiest to conceive of dollars being so deflated, it is not necessary that money values alone be so treated. The ORI cost-effectiveness procedure developed for NHSB suggests treating deaths in the same way (10, p.59).

Unfortunately, while the procedure employed is simple to state and the calculations are easy to mechanize, there is a crucial fly-in-the-ointment. The whole procedure stands or falls on the selection of a proper interest rate to use as a deflator. Selection of low percentage deflator necessarily gives an edge to future costs and present gains, while selecting a high percentage deflator has the reverse effect. What may seem like relatively small differences in percents can produce rather divergent results. The Arthur D. Little, Inc. volume on Cost-Effectiveness in Traffic Safety contains several pages of examples that make this quite clear (2, pp.94-104).

The reason that the problem is difficult to solve is that there is no simple guideline for selecting a deflator. Even further, there can be no certainty that a single deflator applied constantly across time is the proper reflection of reality. Can we be sure that all things of concern should be deflated at the same rate? Presumably, if all values are translated into dollars, this should bring them down to a single common denominator, which in turn has a single appropriate deflation factor. But the various factors of concern, such as police time, patrol cars, rehabilitation specialists' time, and so forth, tend across time to have shifting dollar values attached to them. These changing dollar values, for instance, in the form of increased salaries, are often considerable and should be taken into account, if a meaningful dollar deflator is to be used.

Secondly, even if all items of concerns are translated into valid dollar terms, there is the question of whether a constant deflator percentage is appropriate to use. Interest rates do

fluctuate considerably and one would think a trend of different rates ought to be used for longer-term forecasts. The problem is that this adds another significant element of uncertainty to an already complex picture.

Some cost effectiveness methods suggest avoiding the whole morass by not using any discounting procedure. A notable example is the National Safety Council procedure developed by J.L. Recht (14,p.13). Simple as this solution is operationally, it does not answer the problem. If no discount rate is used, then in fact a zero discount rate is being utilized implicitly, and a zero rate is as meaningful a figure to use as any other. What a zero discount rate does is make a program which has proportionately heavy future expenditures as opposed to start-up costs, appear more expensive than it is on any "present value" basis. Similarly, a zero discount policy will over-value future gains as opposed to immediate ones. The effect, other things being equal, is to bias results overly toward programs with proportionately high start-up costs or future benefits, as compared to what would be the case if a discounting factor were used.

In sum, there is again no simple solution to this important question. The best strategy probably is to use a range of discounting factors and to see how the relative cost-effectiveness measures of various program alternatives shift under different plausible circumstances. This may be a more laborious procedure, but it has the virtue of producing more meaningful results.

2.3.3. OPERATING VERSUS CAPITAL COSTS. A number of the ASAP's involve relatively heavy expenditures for capital items: breath-testing equipment, cars, and video cameras, to name only several prominent items. Capital purchases are generally made at one time, and the cost occurs at a single time as opposed to operating expenditures (including the maintenance of capital items) which occur across the life of the project. Nevertheless, capital items are utilized across the life of the project or until they wear out and have to be replaced.

The nub of the problem is that unless the costs of capital items are treated as though they did occur across time, distortions can occur in developing cost-effectiveness comparisons across alternative countermeasure activities and ASAP programs. Programs which include heavy capital expenditures during a given analytic period as compared with others which involve proportionately greater operating costs will appear more costly in a relative sense. This is a distortion, in fact, since the operating expenditures do not buy anything more than current activity, while the capital expenditures buy the services of items which last often far into the future.

Capital items, then, need to be treated differently; that is, their costs need to be spread out across time by some artificial, though hopefully logical, means. The normal way of doing this is to use some estimate of useful life of the item in question. The cost can be spread out over the estimated useful life either on a simple straight-line basis or on a basis which takes into account a real non-linear degradation or depreciation of the item. There are many formulae for doing this, of which the most notable are the ones developed for Federal income tax purposes. While these formulae can be applied, it is nevertheless a fact that real useful life is a difficult variable to project in the particular case. For a given item, real useful life is heavily dependent on how the item is used and how it is maintained. Any use of such formulae with respect to ASAP cost-effectiveness analyses is subject to uncertainty on this ground, since the capital items purchased are relatively few in number and therefore subject to significant variation from average useful life concepts.

The central point is that capital and operating costs ought to be treated separately. This applies not only to the capital items actually purchased by an ASAP budget, but also to capital items used as an integral part of any ASAP, though not paid for by it directly. This complicates any cost-effectiveness analysis, and not the least of the complications comes from the difficulties

involved in obtaining needed data, a matter discussed in other contexts repeatedly above.

2.4. THE HORNS OF A DILEMMA

The above discussion does not cover all the problems involved in developing a cost-effectiveness procedure, but touches on those which are most difficult to solve, particularly with respect to the alcohol-highway safety programs and the ASAP's. Other problems that bear consideration include: how to include political, administrative, and community reaction variables which are not reducible to dollar measures; and how to compare across activities if incommensurate measures are used.

There are two lines of thought concerning how to resolve these problems. One is that cost-effectiveness procedures, because of the important role they can play in decision-making, should be as complete and valid as possible. Most reported attempts to implement the cost-effectiveness approach and most of the literature on the subject tends to follow this line of thought. The ORI method developed several years ago for NHSB is an example of this approach.

The problem with this approach is that it proves to be costly and difficult to implement. The ORI report notes repeatedly that effective use of its proposed method is heavily dependent on its being implemented by competent scientific technicians, and these do not come cheaply. The more complex methods ought to produce more valid results, reflecting reality with greater accuracy. Unfortunately, even complex methods involve many tenuous assumptions that are often open to challenge. On the positive side, well-conceived and executed complex methods have the virtue of making the assumptions used explicit, so that the consumer of the analysis can see what he is dealing with.

The simplest and most serious question that can be raised with respect to the complex methods relates to the fact that the data they require is often not available. Why go to the bother

of developing a "good" analytic procedure when the data is not there to implement it, or if there, is so costly to gather and put in usable form that implementation is impractical?

In response in part to these considerations, there are those who argue that simplified procedures might just as well be used. At least these can be implemented, and even further they can be accomplished by regular operating personnel. The Recht procedure developed for the National Safety Council is an example of this approach (14). The first problem with a simplified procedure is that the simplicity is often deceptive. The Recht procedure, for instance, states that "the costs of the various proposals should include the total cost to the community, not just the cost incurred by one group, say a government" (4). The implications of this simple phrase have been discussed above (pp.9-10), and they are not easy to solve. More important, however, simplified procedures do not include valid solutions to the problems noted above. Rather they resort to simplistic formulae that are easy to use, or they pass the problem off altogether.

The great danger is that simplified approaches will produce results which are invalid and spurious, but which give a false sense of security because of their quantitative appearance. In this case, they can lead to bad decisions and be negative inputs to the decision-making process.

The dilemma, then, is whether to develop a relatively complete and valid procedure that will be more costly to implement or to opt for a simplified procedure which will be relatively cheap and easy to implement, but carry with it a high risk of being wrong.

3. THE POSSIBLE STRATEGIES

Given the above, there appear to be three alternative strategies possible in developing a cost-effectiveness procedure for the ASAP's: (1) Develop a full-blown analytic method at the outset; (2) develop a simple approach and hope the results are not too spurious; (3) recognize the problems of both approaches and attempt to develop a valid cost-effectiveness approach in

planned phases over a reasonable period of time, solving problems in tested-out increments along the way.

It should come as no surprise that the alternative this report suggests be followed is the third, a phased development. Before outlining a specific staged approach, it may be helpful to summarize explicitly for each general alternative the arguments for and against.

3.1. THE ONE-STEP FULL-BLOWN APPROACH

Indications are that this approach can produce an analytic framework which potentially will provide valid and meaningful results. It can reasonably be expected to produce results which at least theoretically provide better grounds for decisions than a simplified method. The arguments against attempting to develop a sophisticated cost-effectiveness method in a single jump include the following:

3.1.1. Such a development takes considerable time before usable results are available. This is particularly true in the alcohol-highway safety program area because there is little prior work in defining the critical causal links on which a cost-effectiveness procedure must be based.

3.1.2. The effort is expensive and implies a commitment at the outset to bear the total cost.

3.1.3. Until the effort is completed and tested, there is no substantial evidence that the results will be significantly better than would have been the case if a simplified method had been used. Very substantial funds must therefore be fully committed before any meaningful determination as to the worth of the effort can be made.

3.1.4. It is doubtful that this kind of approach provides effectively for solving the operational data problems discussed early in this memorandum in such a way that, even if theoretically valid, the method can be implemented by operating agencies without considerable additional effort and commitment of resources.

3.1.5. The methods evolved usually require costly "experts" to implement and considerable expense to maintain.

3.2. THE SIMPLE APPROACH

This approach appears to have the virtue of taking minimal time to put in place, of involving modest cost, and of being

fairly easy to implement at the operating level (for instance, by local ASAP staffs). On balance, these virtues appear illusory.

3.2.1. Any simple method may be easily subject to attack and in this sense can be a political liability rather than an asset.

3.2.2. The results may be so weakly based that they will confuse and may easily misdirect decision-making.

3.2.3. If a serious attempt is made to generate comprehensive cost data, some major problems confronting a more sophisticated approach will have to be faced, in any case.

3.2.4. In general, the utility of the results is so questionable that it is doubtful they are worth even relatively modest expenditures of time and money to develop a version directly applicable to ASAP purposes.

3.3. PHASED DEVELOPMENT

A phased approach to the development of a cost-effectiveness procedure for the ASAP's should lead to a method which is as theoretically sound as any one-shot sophisticated approach. It should certainly be more soundly based than any simplified method. Unlike the one-shot sophisticated approach, however, it can be designed to provide usable results at an early stage in the developmental process. The total time required for full development is probably longer then that to create a one-shot sophisticated method. However, the greater assurance that the final product will be feasible to implement more than compensates for this negative factor. To summarize other arguments for a phased approach:

3.3.1. Early costs ought to be modest, and further expenditures can be conditional on the productiveness of the previous phases.

3.3.2. The phased approach allows for careful incremental testing in real world situations. Knowledge about the success or failure of the effort does not become available only after an extended period of expensive effort, as would be the case in a one-shot approach.

3.3.3. The phased approach allows time for solving more adequately the very serious problems that exist with respect to availability of data. The initial phase can focus on data known to be readily available, with future phases relying increasingly on more detailed, less accessible, or newly collected data.

3.3.4. As each phase provides some meaningful results and demonstrates practical utility, it should provide visible evidence supporting further development.

3.3.5. If usable results prove more difficult to achieve than had been anticipated or if budgetary constraints change, the effort can be suspended at the end of a phase with some substantial product still in hand.

3.3.6. Because the phases can start with an interim simplified approach to be developed progressively across time, it is possible to build in a procedure for training operating personnel in the implementation of the procedures, raising the level of their skills in reasonable steps. This avoids the twin dangers of attempting to train people in a more or less sophisticated procedure in one fell swoop or of making operating personnel completely dependent on specialized and costly technical talent. Either of these latter approaches can easily lead to the shelving of any implementation effort.

4. PROPOSED DEVELOPMENT STRATEGY

The phased strategy outlined below is based on a realistic appraisal of the existing data situation, the dollar and manpower resources that will probably be available to implement any procedure, and the pressing need for some usable results to be produced at a relatively early time in the future. The ASAP

effort has limited resources available to it, given the enormous nature of the task involved. The staffs are already heavily burdened with the work involved in running the programs. Given these facts and the various problems discussed in some detail above, a modest start that produces usable if limited results at minimal cost seems a sensible way to progress.

Three phases of development and operational implementation will be sketched out. The first is basically a direct input-primary output analysis of the existing ASAP's, utilizing data on ASAP dollars as the input measure and data on the effects of ultimate concern as output measures: Alcohol-involved crashes, fatalities, injuries, traffic arrests and convictions. The relationships and comparisons developed will undoubtedly be more or less crude, but the results should be informative and will provide the basis for greater analysis in depth in the following phase. One primary aim of phase one work will be to determine analytically those several countermeasure areas that appear to be responsible for the major part of any effects achieved.

Phase two will build on the previous work, focussing particularly on the several most significant countermeasure areas delineated in phase one. For these, detailed cost-effectiveness procedures will be developed, including resolution of problems concerning the data required for more intensive analysis. Phase three will utilize the results of developmental work in the previous phases to expand detailed cost-effectiveness procedures to all the major ASAP countermeasure areas. Assuming the successful completion of each phase, the end product would be a fully developed cost-effectiveness method, one which is an theoretically sound as the real world will permit and which is demonstrably practicable.

As will be clear in the more detailed steps sketched out below, the strategy allows for the training of operating personnel in implementation of the analysis at each phase of the development. It is believed that utilization of existing

personnel will be the most efficient and most certain means of insuring that any procedure is implemented on a continuing basis.

The suggested timing of the phases is intended to coordinate with the next several annual ASAP evaluations. Thus, each phase is scheduled for implementation initially at the time of an annual evaluation, so that increasingly rich cost-effectiveness results can be available across time.

4.1. PHASE 1

It seems logical to start the development of a cost-effectiveness procedure by taking a rough cut at correlating and comparing direct input of ASAP dollars with changes in the alcohol-related phenomena of primary concern: Crashes, fatalities, injuries, arrests and convictions. The aims of this effort would be (1) to determine generally the extent to which ASAP inputs can be associated with any significant changes that occur; (2) to distinguish whether different patterns of ASAP inputs, i.e., different weightings of dollars expended across countermeasure areas, are associated with different levels of overall results when the various ASAP's are compared, and (3) to pin-point those countermeasure activities which seem to be most highly associated with positive results.

It is important to emphasize that since the methods used would be relatively crude and since a number of the major problems discussed above would not be resolved, the method evolved in this stage can be considered only a rough approximation of a full-blown cost-effectiveness procedure.

The details of a procedure remain to be worked out, but the general means by which the several aims cited above can be accomplished are not difficult to state. The first aim would require relating an ASAP's aggregated expenditures for a given period, e.g., one year or one quarter, to the gross changes in crashes, fatalities, etc., that occur during the same period. If the short period of a quarter is used, then it would probably

also be desirable to develop a relationship between total ASAP dollars spent to date and the results that occur. The statistics so developed could be aggregated for all ASAP's to gain a total national picture. In addition, comparisons could be made across the ASAP's to determine whether significant differences in results appear to be occurring and whether these are correlated with different dollar inputs.

The second aim, to distinguish whether different patterns of dollar inputs across countermeasures are associated with differential results, would be accomplished by an extrapolation of the tactic sketched out above. Dollar inputs for a given ASAP would be detailed according to the countermeasure activity area where they have been applied. In effect, a profile of ASAP dollar inputs would be used in developing relationships with the results of concern. The dollars would stand as approximate measures of the differential weighting of countermeasure efforts across the ASAP's, or, for a given ASAP, across different time periods. Again, a warning is necessary. Since little or no attempt would be made during this phase to take into account non-ASAP inputs, the dollar weighting utilized could only be taken as a crude approximation of real ASAP-generated effort. With this explicitly understood, however, the differential profiles of ASAP dollar inputs, when related to direct outputs, could indicate whether differences in results are related to how ASAP efforts are distributed across countermeasure areas and what the more productive patterns of effort seem to be.

Dealing with the patterns of dollar inputs should lead to conclusions concerning which countermeasure activities seem to produce the greatest impact on over-all results. There are a number of readily available statistical techniques that can be applied to sharpen and confirm impressions. Assuming some areas will stand out, the ground is then set for more detailed development of a cost-effectiveness procedure in phase two.

It should be evident that this first phase requires data which ought to be easily available to any ASAP staff.

Information on dollar inputs, alcohol-related crashes, and drinking-driving traffic offenses presumably is being assembled as a matter of course by each project. This does not mean that there are no problems to be confronted in implementing the analysis. An obvious one that needs to be faced in making comparisons among ASAPs is how to handle significant differences in distinguishing the crucial phenomena. For instance, the different presumptive limits of intoxication used among the states make some comparisons uncertain. This has obvious implications if one is trying to use drinking-driving convictions in comparing effectiveness across programs. Aside from some knotty matters like the one just cited, however, the larger problems relating to data discussed early in this memorandum need not be resolved before this first phase can be implemented. Therefore, there will need to be little, if any, disturbance of the on-going operational system.

The progression of work steps that appears reasonable to follow is:

4.1.1. Develop in detail a standardized procedure.

4.1.2. Test the procedure using one or two ASAP projects.

4.1.3. Prepare a preliminary manual incorporating the procedure.

4.1.4. Train ASAP staffs in implementation of the procedure.

4.1.5. Implement the procedure, monitor its implementation, and evaluate its effectiveness and workability.

4.1.6. Prepare detail plans for the Phase 2 development.

With details concerning the work required to execute Phase 1 remaining to be worked out, it nevertheless seems reasonable to estimate that about six to nine months ought to be sufficient to reach the point of implementation (that is, to get through 4.1.4 above). The last two steps would, of course, follow naturally on the implementation, although much of the planning

for Phase 2 could be done while implementation of the Phase 1 procedure is taking place.

4.2. PHASE 2

Phase 2 would have as its chief aim working through the problems discussed in the early part of this memorandum focussing on the several most significant countermeasure activity areas delineated in Phase 1. This should lead to an operational analytic procedure that more completely approximates a true cost-effectiveness approach. The procedure developed would be as complete as possible with respect to the logical requirements of a valid cost-effectiveness approach. It would not yet constitute a full cost-effectiveness approach, since detailed coverage of the remaining countermeasure activity areas would remain to be completed.

In this phase, major attention would be given to resolving the serious data problems discussed earlier. Undoubtedly, the data requirements for this phase will go significantly beyond those items easily and regularly collected by the ASAP staffs as a matter of course. However, if the first phase has proven successful and the utility of the general effort has thereby been demonstrated, the difficulty of resolving the problems related to more extensive data collection should be reduced.

The same general work steps as were outlined for Phase I are applicable to this second phase. In terms of timing, it appears reasonable to plan for implementation of the procedures developed in this phase as part of the next succeeding annual evaluations. This would mean again a six to nine month period for development. Evaluation of Phase 1 implementation and final planning for Phase 3 would occur after the implementation of the Phase 2 procedures was complete.

It would be valuable to repeat the Phase 1 aggregate analysis during these project evaluation efforts so that a trend of results would continue to evolve and so that even the Phase 1 methodology could be further refined.

4.3. PHASE 3

Contingent on the successful conclusion of Phase 2 and drawing on the procedures developed during that period, Phase 3 would have as its target rounding out a comprehensive cost-effectiveness approach for all the major aspects of ASAP countermeasure activity. The countermeasure activity areas not subject to detailed analytic development in Phase 2 would be dealt with during Phase 3. The progression of work during this phase would follow the same steps previously identified. The successful conclusion of Phase 3 would mean that a fully developed cost-effectiveness procedure for the ASAP's and the alcohol-highway safety countermeasure activities encompassed by them was in place. The procedure would have been tested out in practice. It would be embodied in a manual to be used for instruction and reference. And, finally, operating ASAP staff personnel would have been trained in its implementation.

While it is difficult at this point to be sure what time would be needed to execute fully Phase 3, particularly since the number of countermeasure activity areas that would be covered in Phase 2 is unknown, it seems reasonable to anticipate that a comprehensive procedure would be ready for implementation in time for the next succeeding annual ASAP project evaluation.

In summary, then, the phased development strategy suggested above would encompass three years from start to completion. The first product of the effort would be operational within nine months of the start, and increasingly more comprehensive and detailed procedures and results would be implemented annually thereafter. The time span involved over-all may seem long; it is about twice that taken by the earlier ORI effort. As has been indicated above, however, the development of a sound cost-effectiveness analysis is difficult to achieve. Developing a procedure that will fulfill the theoretical promise of the cost-effectiveness approach and that is practical to implement on an on-going basis means breaking new ground in the highway safety field, if not in the general realm of social program efforts.

It is believed that that results that can be achieved justify the time to be spent, particularly since the ASAP cost-effectiveness procedures ought to be generalizable to the whole realm of alcohol-highway safety countermeasure efforts and should have applicability to other countermeasure areas as well.

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