COST-EFFECTIVENESS AND ALCOHOL-RELATED HIGHWAY SAFETY COUNTERMEASURES

An Annotated Bibliography with Commentary

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16. Abstract

A literature review of cost-effectiveness, cost-benefit analysis and related topics determined that these planning technologies are rarely utilized in the area of alconol-related highway safety countermeasures. The authors describe the situation as it is reflected in the literature. A rank-ordering of different modes of alcohol-related countermeasures according to specificity to target populations and objectives is presented according to subjective estimates of relative cost-effectiveness. Recommendations are offered regarding alcohol-related countermeasure planning and implementation. Annotated and unannotated bibliographies accompany the commentary.

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PREFACE AND NOTICE

This report was prepared as a result of a specific request by the State of Washington Traffic Safety Commission for a literature review and commentary on the relative cost-effectiveness of drinking driver countermeasure programs. The time period within which the present work was completed was between February 15 to March 15, 1974.

Given the limited time available for the task, we make no claims of the conclusiveness of this report. Our literature base was limited to the Library and the collection of the Public Communication Group of the Highway Safety Research Institute. It is our hope that the information found within this report will contribute in a small, but positive, way toward the development of more efficient and effective countermeasure programs.

The authors accept full responsibility for the content, conclusions and opinions expressed in this report which are not necessarily those of the Highway Safety Research Institute or the State of Washington Traffic Safety Commission.

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1.0 NARRATIVE

1.1 INTRODUCTION

Formal application of cost-benefit or cost-effectiveness analysis in highway safety has become a standard practice in traffic engineering, vehicle instrumentation, and physical factors planning. The application of cost-effectiveness technology in the area of alcohol-highway safety countermeasure planning, however, is uncommon. The present report deals with the cost-effectiveness analysis literature in the area and the state of the art on the basis of a review of the literature. We have offered certain recommendations.

1.2 THE STATE OF THE ART: COST-EFFECTIVENESS AND ALCOHOL-RELATED COUNTERMEASURES IN HIGHWAY SAFETY

Few published studies are available which are specifically related to alcohol-highway safety countermeasures. The most specific documents in our literature review include: Coppin (1961), Marsh, et.al. (1967), Morris (1962, Lenininger (1970), Harano and Peck (1971), Marsh (1971), Joksch (1972) and Lowery (1974). There are several characteristics of these "best" references which we found to compound our frustration. Definitions of cost, effectiveness, benefits, and other essential parameters were inconsistent and generally incomparable. Therefore we were unable to perform a comparative analysis of any single countermeasure between studies. Public information countermeasures were more comparable in terms of measures of effectiveness than other countermeasure modes; however, the design of the evaluative research and operationalization of dependent measures were widely variable.

In that we were not satisfied with the most specific literature, our net was cast over a wider literature which included cost-effectiveness studies of highway safety and transportation planning in general. Also we selectively reviewed alcohol-highway safety countermeasure evaluations and studies which addressed only the methodologies of determining

costs associated with transportation problem areas or countermeasure implementation. A final literature subset which was reviewed dealt with the general methodologies of cost effectiveness analysis. A total of 74 publications were reviewed of which 44 were considered to be appropriate for annotation.

The following publications were the most valuable in terms of methodological considerations: Prest and Turvey (1965), Arthur D. Little, Inc. (1968), Carlson and Hall (1968), Fox, P.D. (1968), The Institute for Road Safety (SWOV) (1969), Operations Research, Inc. (1970a, 1970b), and Saalberg (1971). Other papers which dealt with evaluation of countermeasure programs, measurement of cost and measurement of effectiveness are found in the bibliographies following this narrative.

As a rule, the literature suggests a relatively more difficult task confronting the planner who is involved with alcohol-highway safety countermeasures than one planning for improved traffic flow, street lighting or other physical factors. Objectivity of measurement, availability of data, and conclusiveness of definitions are uniformly less rigorous in the alcohol-highway safety area than in more traditional engineering systems. We consider the infrequency with which cost-effectiveness has been utilized in alcohol-related countermeasure planning to mean either that the technology lacks appropriateness or that the organizations responsible for planning lack necessary skills or enlightenment.

From our review we were able to classify broad countermeasure modes and, given certain assumptions, rank-order them according to the most probable area of effect. The basic assumptions are that the countermeasure is operating at optimum effectiveness and efficiency. For our purposes we have defined areas of effect into three strata: Prevention, Correction, and Attitudinal Change and Public Understanding. As can be seen in Table 1 different categories of countermeasures are expected to affect different areas of effect. Another way of saying this is to note that the six categories of countermeasures are differentially specific to the alcohol-related crash problem or to high risk target groups.

TABLE 1. SIX ALCOHOL/HIGHWAY SAFETY COUNTERMEASURE CATEGORIES ACCORDING TO MOST PROBABLE AREA OF EFFECT, GENERIC SPECIFICITY TO A TARGET GROUP, AND TWO CLASSIFICATIONS OF EXPECTED COST-EFFECTIVENESS

Category of Countermeasure	Most Probable Area of Effect			Target Group Specificity (Rank-Order)	Cost-Effectiveness with Crash and Casualty Reduction as Criteria (Rank-Order)	Cost-Effectiveness with Public Knowledge and Support as Criteria (Rank-Order)
	Prevention	Correction	Attitudinal Change and Public Understanding			
Treatment and Rehabilitation Court or Medical Referral	X	X		1	1	6
Enforcement License Suspension Increased Police Patrols Increased Conviction Rates with Fixed Jail Terms and Fines	X	X		2	2	3
Public Information Group Media Problem Drinker/Drivers	X	X	X	3	3	5
Age-Specific or Other Target Group	X		X	4	4	4
Mass Public Media	X		X	5	5	1
Public School Education	X		X	6	6	2

We have rank-ordered the countermeasure modes by specificity to the high risk drinking-driver target group, a generic classification which is entirely subjective (Table 1). On the basis of this rank-ordering and our observation from the literature that apparently the most cost-effective countermeasures are highly specific to target populations, we have proposed a rank-ordering of cost-effectiveness of the countermeasures with alcohol-related crash and casualty reduction as the effectiveness criterion (see Table 1).

We have concluded that highway safety planners might be better able to appreciate cost-effectiveness applications to alcohol-related countermeasure programs if the specific objectives of the program are well defined. Often there is an implicit assumption that all alcohol-related countermeasures are designed for the primary purpose of reducing the frequency of alcohol-related crashes and casualties; which is false. A major objective of many programs is to generate public support and understanding of the alcohol-highway safety problem in order to justify other, more problem-specific countermeasures. Public information programs, and public school education cannot be expected to produce immediate behavioral changes to the extent of countermeasures with a finer target group focus. Public information countermeasures, however, can be expected to provide a basis of public understanding which is a prerequisite for public countermeasure support. We have rank-ordered our defined countermeasure modes in Table 1 according to estimated cost-effectiveness with public knowledge and support as the effectiveness criterion.

1.3 CONCLUSION AND RECOMMENDATIONS

In conclusion, we suggest that certain changes are required in the planning and execution of alcohol-related countermeasures if cost-effectiveness analysis is to become a valuable tool.

1. Countermeasures should be implemented in an experimental environment with on-going and constant regard for objective and rigorous evaluation.

2. Only one countermeasure should be implemented at a time toward any single target group or objective. Simultaneous implementation of countermeasures confounds any meaningful evaluation of effectiveness.

3. The costs of evaluation and measurement should enter into the "cost" equation in a countermeasure cost-effectiveness analysis.

4. Countermeasures should be designed, implemented and evaluated on the basis of: 1) the specific target populations which are expected to be effected, 2) the most probable area of effect, and 3) the specific objectives of the program. All alcohol-related countermeasures do not uniformly affect crash and casualty reduction or public awareness. All countermeasure modes cannot be expected to have an equivalent preventive, corrective or attitudinal change effect.

2.0 INTRODUCTION TO ANNOTATED BIBLIOGRAPHY

The literature review of cost-effectiveness analyses of alcohol crash countermeasures covered more than 70 individual works. Of these, 44 were summarized, critiqued, and included in the Annotated Bibliography. Criteria used for deciding upon inclusion in this section were: general appropriateness of the study, specific cost-effectiveness focus, and the limited time constraint under which the literature search had to be carried out.

The entries have been listed alphabetically. No subject categorical divisions were used, since it was noted that several pieces overlap in the areas discussed, often containing both cost-effectiveness methodology and/or multiple countermeasure proposals.

Arthur D. Little, Inc. Cost-Effectiveness in Traffic Safety. New York, Praeger, 1968.

The book described the analytical approach to cost-effectiveness analysis in detail and evaluated data and measurement problems. Special consideration was given in one chapter to cost calculations for alcohol-related accident countermeasures and a model of these countermeasures was elaborated.

A social accounting system for calculating accident costs in a cost-benefit analysis was developed, differentiating economic from non-economic costs. Economic costs included were:

1. Property damage--repairs and/or replacement costs.
2. Personal injury--including both medical treatment expenses and net losses in production.
3. Death--costs of the death itself (funeral, etc.), and net loss of production to society.
4. Other costs--lost time for those involved, administrative costs and insurance costs (less transfers).

Non-economic losses (costs) included:

1. Loss of consumption by the victim and his family. These are considered personal losses, not societal as in production lost.
2. Pain, fear and suffering. The author suggests that these be assigned a value by referring to accident compensation data or on the basis of per capita wealth in the nation.

In calculating the costs of alcohol-related accident countermeasures a difficulty may arise as to where to assign the program costs. Direct measures such as road checks (breath tests) would be fully charged to the alcohol program; but measures such as highway lighting improvements would benefit all types of accident reduction.

The effectiveness of alcohol crash countermeasures was shown to be difficult to measure until there exists more precise data on just what percent of the cause of a fatal (or non-fatal)

accident was due to alcohol. Another limiting factor in current alcohol accident research was the lack of quantitative information on the accident involvement of drinking drivers and pedestrians, relative to the experience of non-drinkers similarly exposed.

The model of alcohol countermeasures which the Arthur Little study developed included six direct countermeasures (aimed at keeping people from driving after drinking) and five indirect countermeasures (to make the environment "more forgiving"). The direct countermeasures were: 1) publicity campaigns showing the physical dangers and penalties, 2) increased patrols and road checks, 3) new laws permitting pre-arrest breath tests, 4) stiff penalties, 5) general effort to reduce drinking and improved treatment of alcoholism, and 6) alternative transportation. The indirect measures were: 1) reduced speed limits, 2) improved roadways, 3) street illumination, 4) vehicle modification, and 5) improved emergency medical systems. The model remained untested in the study.

Beesley, M.C. and Evans, T.C. The Costs and Benefits of Road Safety Measures. European Conference of Ministers of Transport Report of the Ninth Round Table on Transport Economics, Paris, November, 1970.

The title of this pamphlet was somewhat misleading, since very little cost-benefit information was contained therein. There was a short discussion of the problems of valuation of costs and what should be included in economic costs as opposed to "subjective" costs. A table showing both subjective and economic cost estimates for accidents in Great Britian was presented.

Burkhart, C., Crancer, A. and Voas, R. Evaluation Report, Alcohol Safety Action Projects, 1971, National Highway Traffic Safety Administration, May 1972.

Based on the first year's results of nine ASAP projects, this was an attempt to evaluate the effectiveness of ASAP

countermeasures. The authors concluded that "reliable cost-benefit analysis is not feasible due to incomplete data for both program input and output"; but some rough cost and effectiveness figures were given.

If the full reduction of 79 lives from 1970 to 1971 at the ASAP sites is attributed to the ASAP countermeasures, there was a savings of $15,800,000, based on the NHTSA estimate that a highway fatality involves a loss to society of $200,000. This compared favorably to the actual ASAP expenditures in 1971 of $4,003,111. However, these figures represented neither complete costs nor benefits.

For example, total costs would have to include court and treatment costs not supported by ASAP budgets. Also a portion of the "start-up" costs of $750,000 nationally would have to be accounted for. Nor are opportunity costs considered.

On the benefit side, this ASAP evaluation understated savings, since no account was taken for the savings from injuries and property damage averted, and the more intangible savings in sorrow, grief and pain. Other unmeasured benefits may have accrued to society because of ASAP operations, such as decreased law infractions due to increased and more visible law enforcement, and increased productivity by rehabilitation of problem drinkers.

Campbell, H.E. "Courts and Prosecutors are the Weak Link in Preventing Drunken Driving," American Bar Association Journal. 46:43-45, 1960.

Documentation which is still valid in 1974, was offered to support the proposition that improved conviction procedures and increased probability of conviction can be a cost-effective countermeasure in highway safety. The author implied that this should be accomplished regardless of the impact on highway safety, which he predicted to be an outcome.

Carlson, W. and Hall, W. "Considerations in Cost Effectiveness," Chapter 6 of Highway Safety Project Evaluation Methodology, The University of Michigan, Highway Safety Research Institute, December 1968.

An overview of cost-effectiveness analysis as it applies to traffic safety is provided. The authors pointed out four essential considerations.

1. There must be an enumeration of costs and benefits. In testing benefits, they claimed, many studies overlook the complete causal chain of objectives; when measuring countermeasure benefits often they are based on intermediate variables only--i.e., pre-crash. A cost that is frequently overlooked in these calculations is opportunity cost, the best alternative foregone.
2. An attempt must be made to put values on the costs and benefits. However, in practice, many benefits such as grief averted cannot be adequately monetized and the authors felt an attempt should not be made to assign monetary value to such factors.
3. An important element of a cost-benefit analysis is discounting over time. Theoretically the discount rate reflects the opportunity cost to society of reordering the benefits and costs.
4. A complete analysis will include a thorough consideration of constraints external to the project itself--especially legal, political, physical.

In applying cost-benefit analysis to project evaluation, the authors recommended a "dimensional" perspective, since the proper measure of effectiveness is often intermediate. This approach involves allowing subjectives and intangibles to enter the decision to accept or reject a project.

Clark, C.D. Analysis of Washtenaw County Alcohol Safety Action Program Judicial, Referral and Diagnostic Activity. Final Report, October 1973, The University of Michigan, Highway Safety Research Institute.

Judicial activities were one of several countermeasures instituted in the Washtenaw County ASAP project during 1971-72. The scope of these activities did not include any attempt to change the type of legal sanctions (fine and/or jail), imposed on those convicted of alcohol-related offenses. DUIL convictions generally received a fine only--86% of convictions paid a fine only before ASAP and 89% during the ASAP period. In cases of "impaired" driving convictions, nearly 97% received only a fine both before and during the ASAP period. Such figures may well suggest the need for countermeasures involving stiffer penalties for convicted drinking drivers, since the threat of a fine may not be a sufficient deterrent.

No systematic cost-effectiveness analysis was carried out in this study. The author did point out one effect of the program was that three-fourths of alcohol-related traffic offenders were referred to counselors--61% of these were diagnosed as alcoholics, 10% as pre-alcoholics. Other findings of the study were that defendants arrested for DUIL were more likely to receive a reduced charge and conviction of "Impaired" than in the pre-ASAP years; and persons refusing the BAC test, those cases disposed without going to trial, and those represented by a lawyer were all most likely to receive reduced charges.

No cost data for these judicial countermeasures was given.

Clark, C.D. Analysis of Washtenaw County Alcohol Safety Action Program Police Countermeasure Activity. Final Report, September, 1973, The University of Michigan, Highway Safety Research Institute.

The Washtenaw County ASAP project included several countermeasures carried out during 1971-72. The one evaluated here dealt with police enforcement. Aimed at increasing the number of drunk driving arrests.

Three different police agencies participated in the special ASAP patrols, and each department used a slightly different method of selecting ASAP patrol personnel.

The measure of countermeasure effectiveness was limited due to two changes in the law which occurred during the evaluation period. In January 1972 the legal drinking age was lowered from 21 to 18, which may have had an impact on arrests of this group. A second change occurred in April 1972, when the presumptive limit of BAC for intoxication and impairment was lowered to .10% and .08% respectively. There was an increase in the number of arrested drivers age 16-20 during 1972, but the author claimed that only a small proportion of this increase was due to the lower presumptive limit. However, Clark felt that the ASAP patrols did seem to influence the arrests by the non-ASAP patrols.

The enforcement countermeasure did seem to be effective in meeting the program objective of reducing the number of very intoxicated drivers--the problem drinker. There was both an absolute and proportional decrease in the number of arrestees with BAC of .20 or greater, despite an increase in the percentage of persons over 21 arrested in 1972. This observation, however, was not based on an arrest population subject to random sampling selection, so no tests of its statistical significance could be used.

Clark, C.D. and Clark, F.A. Analysis of Washtenaw County ASAP Treatment Countermeasures. Final Report, Highway Safety Research Institute, The University of Michigan, December 1973.

Alcohol-related driving recidivism served as the primary measure used to evaluate the Washtenaw County ASAP treatment and rehabilitation countermeasure. Alcohol-related convictions and crashes were compared between all persons convicted of drunk driving during the program, 1971 to 1972, and a similar population convicted during the 1969 to 1970 baseline period. Results indicated that although recidivism rates measured by

drunk driving convictions were lower for the treatment population than for the comparison population, the differences were not statistically significant. However, in accord with program goals, the alcohol-related crash experience was significantly better for the program population. The authors suggested that better recidivism rates would have resulted if more individuals had been placed in treatment programs rather than legal sanctions only.

The treatment program utilized here included probation with supervision only, probation with educational classes and a drug treatment program. As noted above, DUIL recidivism rates, unlike alcohol-related crash rates, differed significantly by treatment subgroup, indicating largely independent subgroups of interest. While DUIL recidivism was higher for those with legal sanctions only, compared with those receiving ASAP treatment, it would have been expected to be lower since those not referred to ASAP generally had less serious drinking problems.

No formal cost-benefit analysis was carried out in relation to the treatment countermeasures. However, the study estimated that 28% of the resources spent on this group of drivers under treatment were recovered through crash prevention in the ten-month period studied.

Clay, M.L. "Which Drunks Shall We Dodge," Paper presented at the Twenty-Third Annual Meeting of the Alcohol and Drug Problems Association of North America, Atlanta, Georgia, September 10-15, 1972.

The author was concerned with identifying the high risk drinking driver. Based on her studies of male chronic alcoholic drivers, the sterotype image that all are high risk was found wanting. She stated that from a sample of 1273 chronic alcohol drivers, probably only 7% could qualify as prime candidates for a traffic safety countermeasures program.

Clay's research suggested that there exists among drinking drivers a "risk" continuum, from low to extra-high, and that law enforcement systems have processed high-risk drivers for

years. Her research group has developed a tool for building a successful early intervention program, called the Risk Potential Index. The RP Index, it was claimed, could identify the high-risk alcoholic drivers from driver record files. This would allow regular monitoring of their driving records, permitting appropriate countermeasures and later evaluation of their effectiveness.

Damkot, D.K. and Pollock, W.T. Evaluation of Traffic Accident Experience for Countermeasure Program Planning. Highway Safety Research Institute, The University of Michigan, Ann Arbor, Michigan, HSRI-320139-1, March 1973.

The report presented a statement of the state of the art of highway safety planning in Michigan. "There is often little relationship between what an evaluator wants in the way of information and what a project director may be able to collect and summarize in a reasonable time period. There may often be meager practical application value of a high powered research report and there may be little one can conclude from an action project that was operated without regard for eventual evaluation." (p.3)

Finkelstein, R. and McGuire, J.P. An Optimum System for Traffic Enforcement/Driver Control. Final Report, 2 Vol. GTE Sylvania, Inc., Mountain View, California, October 1971.

The two-volume report deals with several aspects of traffic enforcement and driver control (TE/DC). While there are no detailed alcohol-crash countermeasures outlined, several sections treat the drinking driver problem and offer recommendations.

Cost-Effectiveness. In the area of highway safety, the authors conclude that cost-effectiveness is often jeopardized by the fact that several major safety programs exist in a variety of departments, which makes budgetary allocations on a cost-effective basis impossible. Countermeasure programs are thus uncoordinated and not subject to overall comparative

review in a cost-benefit analysis. The authors suggest one over-seeing body with power of review and priority establishment.

An enumeration of several dozen possible elements contributing to the public cost of traffic safety are described which include detailed breakdown of items such as legislative costs, court costs, police enforcement costs, and administrative costs. Estimates are given for the cost to California per fatality, injury and property damage accident as follows:*

Fatal = $48,000 per person; Injury = $2,490 per person injured; Property damage only (PDO) = $393.00.

Applying California 1969 accident statistics to these figures, total statewide cost was estimated at $1,264,504,000. The estimated cost per mile driven in California in 1969 was $.0113.

*Estimates applicable for 1969-70.

Fox, B.H. "The Problem of Countermeasures in Drinking and Driving," Traffic Quarterly, 19(3):299-320, 1965.

Fox was convinced that countermeasure programs could be expected to have a large payoff if they exploited the human motivation to avoid accidents. Unfortunately, no promising suggestions were offered for programs with an optimal benefit-cost relationship.

One cost-gain proposal put forward was revocation of licenses for driving after drinking. However, in the California study cited it was found that 50% of drivers with revoked licenses continued to drive. Fox concluded that revocation is an effective countermeasure if rigidly enforced. No data were presented to support this conclusion.

Fox, P.D. "Cost-Effectiveness of Mental Health: An Evaluation of an Experimental Rehabilitation Program," Doctoral Dissertation, Stanford University, 1968.

The research was a cost-benefit analysis and experimental program evaluation which demonstrated that the most cost-effective treatment programs, in terms of societal benefits, are

not necessarily the most acceptable to the subjects themselves. This thesis was directly applicable to court-prescribed treatment programs for habitually drunk drivers.

Haddon, W. "Alcohol and Highway Accidents." Reprinted from Proceedings of the 3rd International Conference on Alcohol and Road Safety. British Medical Association, London, 1962.

This short, methodologically-oriented article does have one point of relevance for those interested in cost-effective alcohol countermeasures. Haddon stressed that the "essential requisite for rational countermeasure planning" (p.10) is the careful identification of the high risk population. He urged care in distinguishing among the types of drinkers who drive, in order that money not be wasted on extravagent campaigns aimed at the social drinker. According to Haddon, numerous empirical findings from several countries all pointed to the problem drinker, the "alcoholic abuser", as the basic problem in alcohol-related fatal accidents.

Harano, R.M. and Peck, R.C. "The Effectiveness of a Uniform Traffic School Curriculum for Negligent Drivers," Accident Analysis and Prevention. 4(1):13-45, 1972. (Also published as Report #37, California Department of Motor Vehicles, June 1971.)

The Uniform Driver Improvement School (UDIS) was a treatment countermeasure aimed at negligent drivers, based not on the traditional lecture approach but on a method of presentation emphasizing the importance of group interaction and discussion. It consisted of two weekly meetings of three hours each, for three weeks duration. The effects of this school on violations and accidents were compared with those of the regular court disposition. Also, a cost-effectiveness comparison was made between the UDIS program and the Group Educational Meetings (GEM), another program of the California Department of Motor Vehicles.*

UDIS classes were held from 1967-69. Subjects were recent violators who appeared in traffic court. The UDIS group included approximately 1700 males and 250 females. A randomly selected control group of similar size and composition was selected, however the experimental subjects were not assigned randomly to UDIS by the courts.

The post-treatment accident mean for UDIS participants was .187 compared to .209 for the control group, a 12% reduction. No significant difference by treatment was found for females.

The author's conclusion as to the effectiveness of UDIS as a treatment was that it was heavily influenced by the characteristics of the subjects attending the course. For male subjects, post-accident violation reductions occurred for older subjects, older subjects with few prior convictions, and younger with high prior convictions. Post-accident reduction occurred also for subjects with high prior convictions, and those with no prior accidents. No conclusive results were obtained for female drivers. These findings thus pointed out the need to distinguish between subjects with prior convictions and those with prior accidents.

In the cost-effectiveness analysis, the UDIS program cost per 100 drivers (assuming 25 males per class) was $1,130, the consequent accident reduction was estimated at 2.2 accidents per subject. Harano and Peck then applied this to the estimated cost per accident of $2,244. UDIS (18 hours) was also compared to the GEM program, which lasted 70 minutes, cost $360 per 100 drivers (12 drivers per class), and saved an estimated 2.3 accidents per subject. The authors posed the suggestion that UDIS was thus less cost-effective than GEM. Caution must be taken in evaluating these comparisons, however, since average accident costs were used. Any shift in the severity distribution of accidents, as a consequence of the programs, would significantly affect the results.

*GEM is discussed in detail in the Marsh study critiqued elsewhere in this literature search. It involves a trained analyst showing films and presenting course outlines on defensive driving.

Holmes, D. "The Evaluation of Highway Safety Programs," Proceedings of the International Vehicle and Highway Safety Conference, 88-94, May 30 - June 2, 1972.

The value of cost-benefit analyses in allocating highway safety dollars was explained and examples of cost-benefit applications in Britain were given. No example of alcohol-safety countermeasures were included. The stress was on the use of the cost-benefit analysis of highway design problems. Holmes claimed that the 1972-73 doubling of the road safety publicity budget was based on favorable benefit-cost ratios. Operational measures of costs and benefits in highway safety were given for Great Britain.

Howard, G.W. Evaluation for Behavioral Change Accomplished Through a Drinking Driver Educational Program. Doctoral Dissertation, University of Utah, 1972.

A target group countermeasure was evaluated to have achieved both behavioral and attitudinal changes among alcoholics with long arrest records for driving while intoxicated. Evidence was given that court procedures, in combination with effective treatment and rehabilitation programs, can provide an efficient and successful countermeasure in highway safety. N=79 subjects. The Johns Hopkins Hospital Questionnaire was utilized to determine a diagnosis of "alcoholic" versus "problem drinker".

Hutt, P.B. and Merrill, R.A. "Criminal Responsibility and the Right to Treat for Intoxication and Alcoholism," Georgetown Law Journal. 57(4):835-847, 1969.

The authors stated that, when recognized as a continuum of disease, alcoholism and problem drinking are most effectively dealt with through treatment as prescribed by the courts. It was suggested that court-related treatment is superior to punishment in both the effectiveness and cost dimensions.

Institute for Road Safety (SWOV), Netherlands. Alcohol and Road Safety. 2nd edition, Voorburg, Netherlands, 1969.

A critical review was presented of drunk-driving countermeasures intended to assist the Ministry of Transport in selecting countermeasures. It is a useful review of several types of countermeasures common to European countries and the U.S. Many empirical studies of the effects of countermeasures were evaluated. Most of the evaluations were not based on rigorous cost-effectiveness analysis. Rather subjective impressions of the effectiveness of various countermeasures were offered with little concern for estimates of cost. The decision-maker or planner might find some valuable insights in the relative ease of implementation of the measures outlined.

The Dutch Institute felt that one of the most potentially fruitful areas for cost-benefit experimentation lies in insurance policies and rates; something that has been used as a countermeasure against drunk drivers in Sweden and Canada. In Sweden some companies only issue insurance to drinkers pledging to drink only alcoholic beverages with less than 2.25(vol.)% alcohol. Fewer accident claims are made on these companies, but the total effect on reducing alcohol accidents is not known. A self selection problem in evaluating this technique is obvious. Canadian insurers likewise refuse to issue all-risk insurance to drivers convicted of drunk-driving and/or those disqualified from driving. Data on the effectiveness of these countermeasures in terms of fewer alcohol-related accidents was not in the report.

A second category of potentially cost-effective countermeasures is the selection of alcoholics and recidivists for prevention of driving after drinking. This approach was viewed as being effective if 1) they are a stable contributing group among serious accidents and 2) if it is possible to reliably predict alcohol-related accidents or convictions on the basis of medical and legal histories and psychological characteristics of drivers. In the Netherlands, the effectiveness of such medical or psychological screening was found to be low.

Joksch, H.C. A Comprehensive Search for Cost-Effectiveness Data for Highway Safety Countermeasures, Hartford, Connecticut, Center for Environment and Man, Inc., December 1972.

A broad literature review of cost-effectiveness studies, this work's particular strength was its extensive bibliography. A notable weakness was that no specific attention was given to drinking and driving, or alcohol-crash countermeasures. The section on driver improvement, however, offered relevant material.

Conclusions regarding cost-effectiveness of driver improvement methods were found to be difficult to measure, given the wide range of methods used. Most studies suggested the conclusion that certain programs (i.e., Experimental Individual Hearings for Females), have positive effects on certain individual categories of drivers. The length of duration of such effects appeared to be even more variable, ranging from four months to four years in the studies reviewed.

Kates, Peat, Marwick & Company. Evaluation of Public Education Campaigns - A Literature Review. Prepared for the Road and Motor Vehicle Traffic Safety Office, Ministry of Transport, Canada. Kates, Peat, Marwick & Company, Ottawa, Canada, June 1970.

This report contained several well executed public information campaign evaluations. The most frequent positive effect of the projects was short term attitudinal changes in the audience. Crash data was infrequently used as a measure of effectiveness, however violation data were common. It was apparent that long term effectiveness of single isolated public information campaigns cannot be expected. The possibility spuriousness in the utilization of violation data, rather than crash data as the most frequent measure of effectiveness was noted. These programs are relatively low on a cost effectiveness scale.if crash frequencies (or violations) are used as the result criteria. If public support of highway safety programs

is used, on the other hand, as the criteria of effectiveness, the programs are highly cost effective.

Leininger, W.J. "A Cost Effectiveness Approach to Allocating the Highway Safety Budget." VI World Highway Conference, Montreal, October 4-10, 1970.

The report presents a synopsis of the Operations Research, Inc. (ORI) modeling approach to cost-effectiveness and highway safety. Applications of the ORI model are found in the Wisconsin study, the four-state study of Arizona, New Jersey, North Carolina and Utah, cited elsewhere.

An effectiveness model was designed to estimate reductions in mortality, morbidity and property damage due to any new countermeasure implemented. The cost model was based on total systems costs. The allocation model had the purpose of determining, on a cost effective basis, the optimal mix of countermeasures, given the inputs from the cost and effectiveness models.

The greatest strength of the discussion of a highly complex framework and analysis devloped by ORI was the clarity with which it described the allocation model and its usefulness. The problem is put concisely as how to get maximum reduction of deaths (effectiveness), from a given budget; or how to minimize the cost of a given standard (countermeasure).

Lenininger described an example of the utility of the allocation model, based on data from a five-state application of ORI models. It was found that if $3,750,000 was allocated equally to each of five states, the result in expected reduction of deaths and injuries was 38.4 fewer deaths and 884.1 fewer injuries. However, if the same $3,750,000 was allocated to the states (or counties within them) on the basis of greatest marginal payoff, the expected result in reduced deaths was 40.3 fewer fatalities and 914.5 fewer injuries.

While the ORI model of cost-effectiveness is highly developed and complex, several problems must be faced if it is to be implemented.

1. Acquisition of statistically trained personnel to run the system.
2. Availability of adequate data.
3. The model tends to underweigh driver variables--the "host factor" in epidemological terms (the model includes only crash type and environment type).
4. The impact of several programs on crashes and economic and personal losses cannot be evaluated by the model adequately.

Livingston, C.F. "Alcohol Countermeasures Programs Can be Run at Reasonable Cost," Traffic Safety, 74(3):12,35, 1974.

Are alcohol countermeasures of the types instituted by the federally-funded Alcohol Safety Action Programs (ASAP) within the reach of local government financing? This was the question addressed by Livingston. Using both fiscal and operational data for 1972 from the operating ASAP projects he implied that they are.

Costs were calculated in two ways, average cost per licensed driver and average cost per individual processed (i.e., arrested or adjudicated). The following table indicates rough estimates of ASAP costs.

	Per Licensed Driver	Per Individual Processed
1. Enforcement	.53	$125.50
2. Adjudication and pre-sentence investigation	.42	58.08
3. Rehabilitation	.17	47.97
4. Public Information and Education	.23	54.82*

*Persons "processed" for this calculation (i.e., the denominator) was the number of ASAP arrests for DUI in 1972.

The benefit measure used, persons processed, was actually a conservative benefit measure of program impact, since

specially financed ASAP patrols might arrest other types of violators as well, hence additional benefits. However, neither was this a true estimate of total costs involved, since private costs were not included nor were they discounted over time.

Livingston noted other indications of cost-effectiveness of these countermeasures. The Minnesota ASAP for example, reported that fines paid by DUI arrestees ($165) more than paid for the extra patrol costs. Similarly, one might expect the cost of rehabilitation classes to be paid for by persons assigned to the classes. Problems of implementing innovative payment approaches were not addressed by the authors.

Lowery, F. "DWI Enforcement for $0.00 - How Communities Can Step Up Drunken Driver Arrests Without Adding to the Cost of Law Enforcement," Traffic Safety. 34(2):14,15 & 34, 1974.

The author argued that by increasing drunk driving arrests through increased numbers of police patrols and by assessing the costs incurred for each conviction to the convicted driver, a community can implement a zero cost drunk driving program. The author failed to count indirect costs in his assessment, including incurred costs for an arrest with no conviction and "human" costs for persons arrested. It was evident that the author's case was only as strong as the court procedures which complement an arrest. If court, jail and administrative expenses surpass a reasonable conviction fine, the zero cost argument is invalid. If court procedures and related costs are efficient, then the author's case is strengthened.

Marsh, W.C. Modifying Negligent Driving Behavior: Evaluation of Selected Driver Improvement Techniques. Department of Motor Vehicles, Research and Statistics Section, Report #36, Sacramento, California, 1971.

Pressure from the state budget office to defend the cost-effectiveness of its various driver improvement programs, following negative evaluations of Driver Improvement Meetings, led the Department of Motor Vehicles to carry out an extensive

evaluation of its programs--including cost-benefit analyses. The study was based on 15,000 California drivers between the ages of 16 and 60, having accumulated 3 1/2 to 4 1/2 selection points, in the last 12 months. The drivers were randomly assigned to nine different driver improvement treatments:

1. Control group, received only a letter to verify address.
2. W/L, standard warning letter only.
3. SIM, subject interaction meeting, conducted by specially trained driver improvement analysis. Group discussion encouraged.
4. LIM, leader interaction meeting, specially trained driver improvement analyst, (DIA) lead the group and attempted to involve each participant.
5. GEM, group educational meeting, the DIA showed films and presented course outline on defensive driving, encourages group discussion.
6. DIM, driver improvement meeting, with specially trained DIA giving a lecture presentation on safe driving and obeying the laws.
7. GAR, group administration review, the DIA delivered firm warning and a minimum of group discussion.
8. RIH, regular individual hearing, conducted by a regular DIA, in a formal atmosphere, emphasizing safe driving.
9. EIH, experimental individual hearing, specially trained DIA, emphasis on personal communication and insuring "due process".

The study group included 89% males, 11% females, the average age was 30.1, with 22% under 21 years of age and 7% over 50. Collision frequency during the year subsequent to treatment differed significantly for female subjects from that for the control group in five of the treatments as shown in the

table. For males there was no treatment with a significantly lower collision rate that the control group, but male drivers scheduled for the GAR treatment had significantly more collisions than the untreated control group, a unique finding in research on driver improvement programs.

An analysis was performed on the effects of a follow-up hearing administered to drivers who continued to accumulate traffic convictions and collisions after their initial treatment. The author indicated that such follow-up action results in collision reduction except among subjects in the control group.

The Cost-Benefit Analysis. Cost of the various programs were estimated from budget data, using a fixed 22.79% overhead. The author questioned the use of overhead and would have preferred marginal cost figures had they been available. Cost per warning letter sent was estimated to be 44¢, cost per driver scheduled for a hearing at $38.11. The GEM was estimated to cost $3.71 ($4.43 women only), GAR at $2.57 ($3.11 women only), and the cost of hearings was estimated at $31.54 for RIH and $37.41 for EIH.

These cost figures were then compared with costs saved (benefits) from accidents prevented, using the following estimates (1971-72) of $2,254 for males and $2,142 for females. Results indicated that the best treatment combination from a collision reduction standpoint was GEM for males and EIH for females, producing a net savings of over 3.7 million dollars annually. Such a differential treatment for females only may not be acceptable in practice, making the GEM treatment for both sexes the next best combination, at a savings of 3.4 million dollars.

Alterations in the California driver improvement programs since the research was performed could alter the author's findings, however, these were not evaluated. The validity of Marsh's cost-benefit analysis can be questioned on the basis of his use of average accident costs. Finally, from a drinking and driving countermeasure standpoint, the analysis does not

tell us how effective these treatment measures are in preventing alcohol-related crashes.

Marsh, W.C., Coppin, R.S. and Peck, R.C. "A Reevaluation of Group Driver Improvement Meetings," Highway Research Record, 163:120-131, 1967.

Coppin, R.S. A Controlled Evaluation of Group Driver Improvement Meetings. State of California: Division of Administration, Research and Statistics, Report #9, October 1961.

These two articles are considered jointly, since they represented similar evaluations of the effectiveness of group driver improvement meetings (DIM) in California between 1958 and 1962.

The aim of the DIM program was to reduce the cost of individual hearings with "negligent operators" estimated to cost in 1961 some $5.00 per individual. The DIM countermeasure was designed to have the additional positive effects of reducing future violations, convictions and accidents. While the DIM is not strictly designed as a countermeasure to alcohol-related crashes, its applicability to "negligent operators" obviously includes the drinking driver.

Coppin's evaluation of DIM effectiveness in 1961 was based on comparisons with a control group which did not attend the meetings. His major conclusions were highly optimistic:

1. A single DIM with a group of 15 drivers having accumulated violations, was an effective improvement technique, especially on older drivers.
2. DIM's led to significant reductions in both subsequent convictions and to delays in receiving future violations.
3. No significant reduction in accidents was noted, but with the continuance of such programs a reduction "undoubtedly" would occur.

Were these conclusions to stand up, a truly cost-effective countermeasure appeared obvious.

Unfortunately, an extensive reevaluation of the DIM program by Coppin and others proved to be much more pessimistic as to DIM effectiveness. The 1967 conclusions were:

1. There was no indication that any reduction in accidents can be attributed to DIM.
2. The DIM program was an effective means of reducing traffic convictions among persons who are eligible for the program.
3. For either accidents or convictions, no evidence existed that the DIM was more effective for one sex or age group as compared to another.

For several reasons the 1967 study should be considered more reliable than the earlier one. The same size was approximately four times larger, and tests of significance were possible for subsets of the samples. The 1967 study included all persons to which letters were sent inviting attendance to the DIM's, even if they did not show up subsequently at the meetings, which eliminated the bias of self-selection. The 1961 study did not include the 40% who were "no shows".

In conclusion, while the DIM seemed to offer the benefit potential of reaching many more people through lower hearing costs on a group basis, evidence was lacking that such meetings do indeed prove cost-effective in terms of accident reduction. It appears that much more fruitful research would be to test the effectiveness of DIM's on specific types of negligent drivers, such as those convicted of drinking and driving.

Morris, J.P. Road Safety Publicity; Quantifying the Effectiveness of Public Service Advertising. The Advertising Association, London, 1962.

This is a report on various short, intensive, publicity campaigns carried out in Great Britain between 1964 and 1971. These campaigns were aimed at a number of highway safety elements, including drinking and driving. The selection of a strategy of short, large does of media campaigns was felt to be

a better protector against extraneous variables entering into the picture. From the standpoint of a cost-effective alcohol crash countermeasure, none of the three campaigns concentrated on the population at greatest risk. The 1970-71 campaign was a multi-problem attack, aimed at seat belts use, pedestrians, passing illegally and other safety problems in addition to drinking.

In an introductory section on the economic costs of accidents, using Department of Environment (Great Britain) estimates Morris stated that average cost of a fatal accident at L13,000, average serious injury accident costs L700, a slight injury accident costs L230, and property-damage only accidents cost L100. The total economic cost of accidents in 1970 was thus some L346,000,000.

A short summary of the 1964 and 1967 Christmas season publicity campaigns against drinking, found them both expensive and failing to reduce drinking and driving. While not much behavioral change was found, the campaigns did seem to affect knowledge and attitudes toward drinking and driving.

Morris made a token attempt at a cost-benefit analysis of the 1971 publicity campaign. No clear indication of total costs was evident, but it was stated that over L200,000 was spent on media production and staff time. The estimated savings was the 11% reduction in fatalities following the campaign. Morris' somewhat unquantitative conclusion was that "the campaign paid for itself".

Operations Research Inc. Application of the ORI Cost-Effectiveness System to the State of Wisconsin. Final Report, June 30, 1970. Silver Springs, Maryland.

Operations Research, Inc. Application of the ORI Cost-Effectiveness System to Arizona, New Jersey, North Carolina and Utah. Final Report, 2 volumes, June 1970. Silver Springs, Maryland.

The two studies cited above offer examples of the application of ORI models of analysis. (The reader is also referred

to the Lenininger article cited herein for further discussion of the ORI technique of analysis and allocation of funds using the ORI model.) A major weakness of these studies was the lack of extensive analysis of the cost-effectiveness of alcohol-crash countermeasures. The countermeasures to which funds were allocated were driver education, spot improvement, traffic police, traffic control and pedestrian safety. In fact, despite the inclusion of a host of environment and crash types in their model, DUIL or impaired driving due to alcohol, was not included.

A partial cost-effectiveness analysis of one alcohol program, the breathalyzer, was carried out, but only on a cost basis. ORI claimed that data was lacking to carry out an effectiveness measure of the breathalyzer program. An enumeration of the private and public costs of this program was presented under the following categories:

Private Costs		Public (Social) COsts	
1. Time spent in custody		1. Equipment	
2. Releasee's time		2. Administration	
3. Arrestee's time		3. Training police	
4. Court costs of arrestee		4. Police time	
5. Cost of the inconveniences of a license suspension			
Subtotal	$1,678,095	Subtotal	$16,509

TOTAL SYSTEM COST: $1,694,604

The direct costs of implementing a countermeasure, with public funds, is hardly a complete measure of its social costs.

In the ORI viewpoint, several criteria must be met before a countermeasure can be given a complete cost-effectiveness analysis. These might be instructive to the decision-maker contemplating the analysis of an alcohol crash countermeasure.

1. The outputs (effects) must be definable and quantifiable.
2. It must contribute directly to accident reduction, not departmental efficiency or other ends.

4. Expenditures on the program must have varied sufficiently during a baseline period to see trends.

Prest, A.R. and Turvey, R. "Cost-Benefit Analysis: A Survey," The Economic Journal. 75(300):683-735, 1965.

The utility of cost-benefit analysis was determined to be greater in the public utility area than in human services or health program planning. The reasons listed for this determination were increased objectivity and more adequate levels of measurement in public utility planning.

Prouty, R.W. and O'Neill, B. An Evaluation of Some Qualitative Breath Screening Tests for Alcohol. Washington, D.C.: Insurance Institute for Highway Safety, May 1971.

Comparative evaluations of devices to estimate blood alcohol concentrations were described for use in pre-arrest police activities. No cost data were included, although an argument was advanced that pre-arrest blood alcohol concentration measures, if used in standard practice, would contribute to a reduction in alcohol-related crashes. The authors defended the roadblock countermeasure approach.

Recht, J.L. How to do a Cost/Benefit Analysis of Motor Vehicle Accident Countermeasures. Chicago, National Safety Council, 1966.

Recht, J.L. "What Will Your Safety Dollar Buy," Traffic Safety. 67(5):18-19, 1967.

In these two articles Recht outlined three approaches to cost-benefit analysis of highway safety countermeasures. In the How to ...Study, seven countermeasures are used in the illustrative analysis: 1) spot improvement, 2) spot improvement excluding major projects, 3) illumination, 4) vehicle inspection, 5) high school driver education (present standards), 6) driver education (improved standards, and 7) voluntary driver improvement. For each of these, numbers were plugged in to carry out a complete cost and benefit calculation.

Recht elaborated three possible approaches to cost-benefit analysis, describing the merits of each. "Complete range analysis" was seen as the ideal, since it covers the entire range of a proposal. But it requires a high degree of mathematical knowledge, and information currently available is often not preicse enough to calculte benefits for each activity. "Expected effect analysis" was viewed as a more realistic approach to cost-benefit, since it starts with the current level of activity and projects growth over five to ten years. Costs can be computed quite accurately, but the same benefit problem existis as in #1. Approach #3, "Break-even analysis" was thought by Recht to be the most practical for ordinary use by state and city government decision-makers, in evaluating accident countermeasures. There is no need for expert technical skills; difficulty of comparing benefits on a basis of unequal accuracy of estimates is avoided; it uses available information on benefits; and it gives realistic information that simplifies decision-making.

Reynolds, D.J. "The Cost of Road Accidents," The Journal of Royal Statistical Society, Series A. (General). 119(4): 393-408, 1956.

Two examples of successful cost-benefitial countermeasures were presented. Improved pedestrian crossings and improved rear-lighting systems were shown to produce benefits which outweighed the program and purchase costs. These examples demonstrated that cost-effectiveness can be expected only if the countermeasures are specifically designed for a well defined problem.

Road Research Laboratory, Department of the Environment. Road Research, 1970. London; Her Majesty's Stationery Office, 1971.

The Road Research Laboratory (RRL) in London annually issues a report on its activities. In this 1970 edition it announced a revision in its method of calculating the costs of accidents. Previously cost-benefit analyses of highway safety measures estimated the loss of production due to a fatal accident

as the value of lost future production (discounted), less the future consumption. However, for cost-benefit studies the purpose is to estimate the value of accident prevention measures. Therefore, the RRL now recommends more concern with the gain to the community in terms of resource costs from not being killed, which is the value of an individual's future production. Using this approach, it is not legitimate to count as savings the future consumption of those killed. The effect of the new method of calculating costs increases the cost of a fatal accident by 50% and that of an average accident by 10%.

Ross, H.L., Campbell, D.T. and Glass, G.V. "Determining the Social Effects of a Legal REform, The British "Breathalyser" Crackdown of 1967," American Behavioral Scientist, 13(4): 493-509, 1970.

The impact of the 1967 British law aimed at getting drunk drivers off the road was critically scrutinized in this study. They concluded that an impressive change can be attributed to this legal countermeasure.

In light of a linear trend in traffic fatality rates and fairly easy acquittal in cases of drinking and driving charges, the 1967 legal-enforcement countermeasure was instituted. It provided:

1. .08% BAC as the legal level of impairment.
2. On the scene breath tests were authorized--a follow-up breath test would be given at the police station, then a blood or urine test.
3. Failing the breath test provided mandatory punishment--license suspended for one year and a fine of 100 pounds or imprisonment up to four months.
4. The specific starting date for enforcement was given wide advance publicity.

The effectiveness of this countermeasure after 12 months was regarded as significantly positive by the authors (however of short duration). During the first year under the law there were 1,152 fewer fatalities. The dollar benefit was nearly 15 million pounds based on the Morris 1972 estimate of the average

economic cost of a fatality in Great Britain (13,000 pounds). The first month after the new law saw the largest single reduction in fatalities and serious injuries ever recorded (40%). The authors investigated alternative causal explanations, such as possible reduction in the number of miles driven, or number of drivers on the highway, increased enforcement, changed definitions, randomness or other accompanying events, but found no plausible alternative. The authors noted that the drop in accidents was especially significant on weekend nights, when the greatest incidence of driving after drinking was expected to occur.

The major weakness of this study from a cost-effectiveness point of view is the lack of cost data. The only cost stated is the "several hundred thousand pounds publicity campaign" carried out in conjunction with the new law during September - December 1967.

Saalberg, J.H. On the Applicability of Cost-Effectiveness Analysis to Alcohol-Highway Safety Countermeasure Programs. Highway Safety Research Institute, The University of Michigan, Ann Arbor, December 1971.

Saalberg outlined the key problems involved in developing and utilizing a valid cost-effective approach, with specific reference to its applicability to alcohol-highway safety countermeasures. He emphasized that determining the realistic cost of a countermeasure is a difficult task. There are multiple problems of determining opportunity costs (benefits foregone), distinguishing capital from operating costs and current from future costs, and the proper valuation of things with no market price, such as human life.

If measuring costs has many pitfalls, determination of benefits is even more difficult. With benefits there is a need to link specific gains (benefits) to specific activities, in order to be valid. This direct link of an input activity to an output benefit is most difficult to establish, given multiple confounding variables. If several countermeasures are implemented at the same time one has the extra burden of sorting out which activity is responsible for which benefit enjoyed. This is critical to

cost-effective analysis, Saalberg said, because relating the value of results to the cost of the activities producing them is the heart of the analysis.

Despite the multiple difficulties involved, the temptation to resort to a less costly, quicker and simpler "solution" based on common sense calculations, was also thought inadequate. This may lead to gross errors. Saalberg thus opted for a third approach--what he called "Phased Development". This involved a kind of incremental three phase approach to a full-blown cost-effective procedure. The first phase would be a simple linking of available countermeasure program budget dollar costs to the associated effects on output measures, such as alcohol-related deaths. This would be done for programs which have been functioning long enough to have data available. The second phase would be further analyses of the most promising programs. In phase III, a full-blown cost-effectiveness analysis would be completed, among the apparently most cost-effective programs.

Sackman, H. "Can Communities Re-Educate Drivers?" Proceedings of the Joint Conference on Alcohol Abuse and Alcoholism, 168-181, University of Maryland, February 21-23, 1972.*

This paper summarized the results of an extensive prototype demonstration project carried out in Santa Monica, California to test the feasibility of assisting and retraining convicted drinking drivers. Specifically, it was aimed at the needs of local communities setting up Alcohol Safety Action Programs (ASAP), with emphasis on assessing the cost-effectiveness of a variety of alternative countermeasures. There was no specific cost data given in this report, however there were some assertions on the cost-effectiveness of the various alternatives.

The countermeasures were aimed at retraining, rehabilitation and treatment. A sample of some 90 convicted drinker-drivers was provided by the courts, 30 to be used as a control group and 60 to be divided into two equal classes which were to receive a 12-week re-education program. The programs consisted of: 1)

*Project Documentation studies detailing the information discussed in this report can be found in the 3 volumes co-authored by Sackman, cited in the unannotated bibliography below.

counseling, 2) class retraining sessions, 3) group therapy and 4) crisis intervention in the form of a 24-hour hotline and a taxi service. The control group received only the crisis intervention service. The sample under study was probably not representative, however, since only 15% were females and 40% were Blacks or Chicanos.

Analysis indicated that both the initial and final interviews met most of the program's intended objectives (relieving anxieties, creating rapport and initiating helpful introspection). However, on-going counseling was only of limited value, based on low utilization.

Class re-training was considered to be both effective and efficient. This countermeasure involved four weeks of group classes on the effects of drinking and its consequences for driving, using films and lectures. Benefits in terms of information learned and retained were found among the problem drinkers, the recidivists and the alcoholics.

Fifty-five randomly selected drivers convicted of drinking were assiged to one of our short-term therapy groups. On the basis of this exploratory study, convicted drinking drivers, as a group, exhibited need for psychological help, and most of them considered the group therapy to be helpful. A key cost-effectiveness decision was the selection of subjects most likely to benefit from therapy, and a balanced combination of professionals and trainees as group leaders.

Results of the crisis intervention program were largely negative. It was found to be costly, ineffective in meeting project goals, and subject to misuse. Only 8% of the subjects used the hot line and only 9% used the taxi pickup service.

Samuel, A.H. and Parker, B. The Role of Criminalistics in the World of the Future, "An Example: Costs and Benefits of an Improved Drunk Driver Detection Device." Stanford Research Institute, Menlo Park, California, July 1972.

This is an hypothetical, speculative article which can offer some insights into the cost-effectiveness of drinking and

driving countermeasures. The report is based on a scenario that envisages the development of a device for determining blood alcohol concentration (BAC) which is reliable, acceptable and adequate to "guarantee" conviction, which would be installed in patrol cars. Provisionally it is assumed to be a skin sensor of some type.

A cost-benefit conceptual framework and accompanying mathematical model of the interrelations among variables is then developed, including cost elements which are assigned operational values. The cost elements include:

1. Research and development--which would include feasibility studies, design costs, construction, testing, prototype testing, engineering costs, in-service testing.
2. Cost of the device themselves--estimated at $2,500 plus shipping and installation.
3. Implementation costs. Added patrol cars and manpower.
4. Cost of processing offenders including court costs, treatment, and rehabilitation.
5. Maintainance and training costs.
6. Administrative costs.

All these cost estimates are discounted at 10%. It is to be noted that most cost-benefit studies do not clarify if they have in fact discounted costs to present values or not, and if so, at what interest rate. This is a common oversight in many cost-benefit studies, and should be guarded against because it can affect the attractiveness of one program as opposed to another.

The merits of this study are best seen in the instrument sensitivity analysis performed, which demonstrated a wide array of benefit-cost ratios depending on a variety of values for the key variables in the equation. For example values were calculaed assuming DVM reductions of 100, 500 and 1000, relating these to three combinations of efficiency in apprehending drunk drivers--.1, .25 and .5 (1.0 would be perfect, all drunk drivers being identified). A third variable, the number of vehicle miles traveled in a year, was also tested for varying sensitivity.

As a result of the analyses, a complete benefit-cost matrix was displayed, showing ranges of savings from a minus $57 million to a plus $4,205 million. Optimal cost-benefit decisions are best accomplished by first performing exercises like these carried out in this report. A decision-maker could then clearly identify the range of possibilities under given assumptions.

Schuster, D.H. "Evaluation of Attitude Changes as a Result of Attending a School for Problem Drinkers", (mimeo) State University of Iowa, January 1965.

121 problem drivers, including frequently drunk drivers, were enrolled in a 15 hour Traffic Survival School. No cost estimates were given, however, costs likely ranged from $20 to $45 per subject. Objectives of the program included a reduction in night time driving which was achieved for 60% of the subjects. No estimates were offered regarding monetary benefits in terms of predicted crash reduction.

The Center for Safety, New York University. Driver Education and Training: Plans for Evaluating the Effectiveness of Programs. New York: The Center for Safety, New York University, May 1968.

In that there is little evidence of a societal benefit from compulsory general driver education, an argument was presented which suggests that normal driver education program costs should be reallocated to target groups. The proposed reallocation of funds and energies was predicted to produce demonstrable societal benefits at a reduced overall societall driver education cost.

University of California at Los Angeles, Department of Industrial and Systems Engineering. Cost-Effectiveness of Mass Media Communications as Related to Highway Safety. Technical Report 70-3, Los Angeles, California, May 1970.

Three central objectives were stated by the authors of this study: 1) to increase understanding of the effects of broadcast media on traffic safety, 2) to determine the key factors in a persuasive message that are significant in determining the level of message effectiveness and 3) to establish a methodology of cost-effectiveness.

The countermeasure which was selected for experimental study was a media campaign aimed at increasing the use of safety belts (both lap and shoulder). While it was not an alcohol-related crash countermeasure, the cost-effectiveness of a media campaign to modify driver behavior should have relevance to the person interested in alcohol countermeasures.

The authors recognized that measures of effectiveness should relate to reductions in mortality, morbidity or property damge, however, the incidence of crashes in a small experimental community was too small for effective and accurate measurement. Thus, they proposed using an increase in safety belt usage as an intermediate measure of effectiveness of broadcast messages. They pointed out, however, that measurement of effectiveness may take place at any one of three levels: a) proximate results--i.e., the number of persons using seat belts after a media campaign, or number of increased arrests of drinkers; b) the effects of the countermeasure on accident frequency, severity and property damage; and c) or you may translate these benefits into an equivalent single dollar cost averted.

Before carrying out such a study, careful attention must be given selection of control and experimental communities. Criteria used should include the ability to block out as much extraneous media input as possible--therefore local stations with large percentages of the total market ought to be used. The media to be used should be specific to the driving population at greatest risk.

The actual field study proposed will include observation sites at three types of locations, to observe safety belt usage before and after the campaign. The locations would include the urban center, where most collisions occur, outlying intra-urban artery intersections, intersections known to be dangerous. Observations would be supplemented by interviews with a cross section of 300 drivers.

The present study stopped short of actually putting into practice the media campaign and measuring its cost-effectiveness, rather it was a program proposal. Some cost estimates were given, however. The consultant organization hired to measure pre and

post message responses of a selected sample of the population charged $1,300 per test for TV material and $1,000 per test for radio material. There was also an outline of the cost elements necessary for acquisition and analysis of data--observation, recorder and analysts costs.

Three important conclusions directed at state and local agencies regarding cost-effective countermeasures studies were offered:

1. The complexity of the procedure of measuring program effects is such that it probably is not possible for state and local agencies to carry out the experiments unassisted, except in isolated instances.
2. Nevertheless, it is recommended that some experimentation be continued by the National Highway Safety Bureau and/or other agency so as to establish the relative effects, or impact, of mass media communications programs.
3. Results of these selected experiments can be used as standard data by Federal, state and local agencies when comparing the relative cost-effectiveness or alternative mass media communications programs.

Williams, A. "Cost-Benefit Analysis: Bastard Science? and/or Insidious Poison in the Body Politick?" Journal of Public Economics. 1:199-225, 1972.

An interesting and well documented discussion was offered of the strengths and weaknesses of cost benefit analysis and appropriate utilization of the technique. The author emphasized that the methodology is appropriate to assist, but not dictate, policy decisions at the governmental level.

3.0 INTRODUCTION TO THE UNANNOTATED BIBLIOGRAPHY

This section lists 34 separate studies related to cost-effectiveness of highway safety programs. While they have not been described as to content, the authors felt their subject matter was of sufficient relevance to provide added breadth to the interested reader. In general, they have either been less directly related to alcohol-crash countermeasures, or in specificity to the cost-effectiveness focus than the annotated studies. The entries have been placed alphabetically.

Bjerver, Kjell. "An Evaluation of Compulsive Treatment Programs for Alcoholic Patients in Stockholm with Particular Reference to Longitudinal Development, Epidemiological Aspects and Patient Morbidity," Opuscula Medica (Supplement). 25:1-107, 1972.

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