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# DETERRENCE OF THE DRINKING DRIVER: AN INTERNATIONAL SURVEY

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16. Abstract This report surveys the international literature on drinking-and-driving laws to determine what is known concerning their impact on driver behavior. Its particular concern is with reported adoptions of "Scandinavian-type" laws, which define the drinking-and-driving offense in terms of exceeding a prescribed blood alcohol concentration, and which are designed to create the impression of relatively certain, severe and prompt penalties for their violation.

The review of the literature finds that Scandinavian-type laws have been widely adopted in the last 20 years, and that informative reports exist on experiences in Norway, Sweden, Great Britain, New Zealand, the Australian State of Victoria, Candad, the Netherlands, and France. There are also reports on enforcement campaigns based on these laws in several countries, including the United States.

Evidence was found that adoption and enforcement of Scandinavian-type laws has nearly always produced a deterrent effect on drinking and driving in the short run, as measured by statistics on crashes and especially on serious casualties during main drinking hours. However, it was found that the deterrent effects are consistent with an explanation in terms of an increase in perceived threat due to publicity and newsworthiness accompanying the legal change or campaign, followed by learning through experience that the probability of apprehension remains low.

The study provides hope that Scandinavian-style laws may prove effective in controlling drinking and driving, but it raises the question for further research of whether the level of enforcement needed for long-term effects is politically feasible.

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## METRIC CONVERSION FACTORS

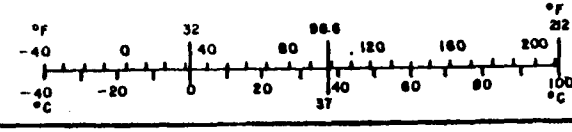
### Approximate Conversions to Metric Measures

| Symbol | When You Know | Multiply by | To Find | Symbol |
|---|---|---|---|---|
| | | **LENGTH** | | |
| in | inches | *2.5 | centimeters | cm |
| ft | feet | 30 | centimeters | cm |
| yd | yards | 0.9 | meters | m |
| mi | miles | 1.6 | kilometers | km |
| | | **AREA** | | |
| $in^2$ | square inches | 6.5 | square centimeters | $cm^2$ |
| $ft^2$ | square feet | 0.09 | square meters | $m^2$ |
| $yd^2$ | square yards | 0.8 | square meters | $m^2$ |
| $mi^2$ | square miles | 2.6 | square kilometers | $km^2$ |
| | acres | 0.4 | hectares | ha |
| | | **MASS (weight)** | | |
| oz | ounces | 28 | grams | g |
| lb | pounds | 0.45 | kilograms | kg |
| | short tons (2000 lb) | 0.9 | tonnes | t |
| | | **VOLUME** | | |
| tsp | teaspoons | 5 | milliliters | ml |
| Tbsp | tablespoons | 15 | milliliters | ml |
| fl oz | fluid ounces | 30 | milliliters | ml |
| c | cups | 0.24 | liters | l |
| pt | pints | 0.47 | liters | l |
| qt | quarts | 0.96 | liters | l |
| gal | gallons | 3.8 | liters | l |
| $ft^3$ | cubic feet | 0.03 | cubic meters | $m^3$ |
| $yd^3$ | cubic yards | 0.76 | cubic meters | $m^3$ |
| | | **TEMPERATURE (exact)** | | |
| °F | Fahrenheit temperature | 5/9 (after subtracting 32) | Celsius temperature | °C |

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.


### Approximate Conversions from Metric Measures

| Symbol | When You Know | Multiply by | To Find | Symbol |
|---|---|---|---|---|
| | | **LENGTH** | | |
| mm | millimeters | 0.04 | inches | in |
| cm | centimeters | 0.4 | inches | in |
| m | meters | 3.3 | feet | ft |
| m | meters | 1.1 | yards | yd |
| km | kilometers | 0.6 | miles | mi |
| | | **AREA** | | |
| $cm^2$ | square centimeters | 0.16 | square inches | $in^2$ |
| $m^2$ | square meters | 1.2 | square yards | $yd^2$ |
| $km^2$ | square kilometers | 0.4 | square miles | $mi^2$ |
| ha | hectares (10,000 $m^2$) | 2.5 | acres | |
| | | **MASS (weight)** | | |
| g | grams | 0.035 | ounces | oz |
| kg | kilograms | 2.2 | pounds | lb |
| t | tonnes (1000 kg) | 1.1 | short tons | |
| | | **VOLUME** | | |
| ml | milliliters | 0.03 | fluid ounces | fl oz |
| l | liters | 2.1 | pints | pt |
| l | liters | 1.06 | quarts | qt |
| l | liters | 0.26 | gallons | gal |
| $m^3$ | cubic meters | 35 | cubic feet | $ft^3$ |
| $m^3$ | cubic meters | 1.3 | cubic yards | $yd^3$ |
| | | **TEMPERATURE (exact)** | | |
| °C | Celsius temperature | 9/5 (then add 32) | Fahrenheit temperature | °F |



ACKNOWLEDGMENTS

Among social scientists a sociologist must be the first to acknowledge that an essay such as this, though it bears a single name as author, is in fact a group product. Space does not allow mention of all the individuals who have rendered significant aid in this task or in the prior studies that led up to it, and I shall confine my mentions here to those people who graciously responded to calls for specific assistance during the past several months of writing and revision of this manuscript. Of course, I did not always follow their advice, and responsibility for the contents rests with me. My advisers and critics were: Johannes Andenaes, Jean Beyrand, Murray Blumenthal, Robert Borkenstein, Tracy Cameron, James Frank, Harold Grasmick, Paul Hurst, Ralph Jones, Kent Joscelyn, Edward Kearney, Joseph Little, Thor Norstrom, Brian O'Neill, Robin Room, and Reginald Sharp. I am also deeply indepted to the staff of N.H.T.S.A., especially Theodore Anderson and Monroe Snyder, and Robert Voas, James Nichols, and John Moulden, for securing the time and resources necessary to undertake this essay.

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# I. INTRODUCTION

The past hundred years may well be termed the Century of the Automobile. The automobile surely merits consideration among those inventions that have revolutionized world history, changing the physical and social dimensions of human existence, modifying pre-existing bases of everyday life and opening a Pandora's box of associated social problems. This report will survey one of the most serious problems related to the automobile -- crashes associated with drinking and driving -- and will summarize evaluations of attempts to use law to control this problem through the mechanism of general deterrence.

In the course of this report it will be evident that drinking and driving has emerged as a major correlate, and very likely a major cause, of automobile crashes, especially the more serious and damaging of these. From the earliest perceptions of this link, policymakers have attempted to control it by deterrence through law: threatening the drinking driver with legal punishments on the theory the this will result in a reduction of the threatened behavior and a consequent reduction in loss of life, limb and property in crashes. World experience with classic drinking-and-driving law being disappointing, the last half-century has found governments everywhere espousing "Scandinavian-type" laws, designed to maximize deterrent effectiveness by following a model originally developed before World War II in the Scandinavian countries. These laws contain provisions to increase the apparent certainty, severity and celerity of penalties consequent on drinking and driving.

Although the effectiveness of the original Scandinavian laws on drinking and driving has not been adequately demonstrated, the introduction of similar laws in other countries in recent years has often been accompanied by informative evaluations, especially in the last decade. The bulk of this report will survey the evaluations that have taken place throughout the world. It will attempt to generalize concerning what we have learned and what we need to know in order to understand better the functions of law in this problem area and, more generally, the abilities and limitations of law in controlling behavior.

The major lesson of the research reviewed here may well be that, in the area of drinking and driving, general deterrence does work. In many cases experience has shown that a convincing increase in threatened punishment from drinking and driving has been followed by notable and measurable declines in associated crashes. However, an equally important lesson for the policymaker is that in no case does the accomplishment of deterrence seem to have been permanent. Where the increased threat has taken the form of an enforcement campaign, with an intended beginning and end, effects beyond the termination of the campaign have rarely been noted. Where the increased threat has taken the form of a permanent change in the law, subsequent events have revealed a gradual return of the drinking-driving problem to the level of to a pre-existing trend.

The conclusion of this report will sketch the bounds of our knowledge concerning legal deterrence of drinking and driving, will suggest future research, and will draw policy implications.

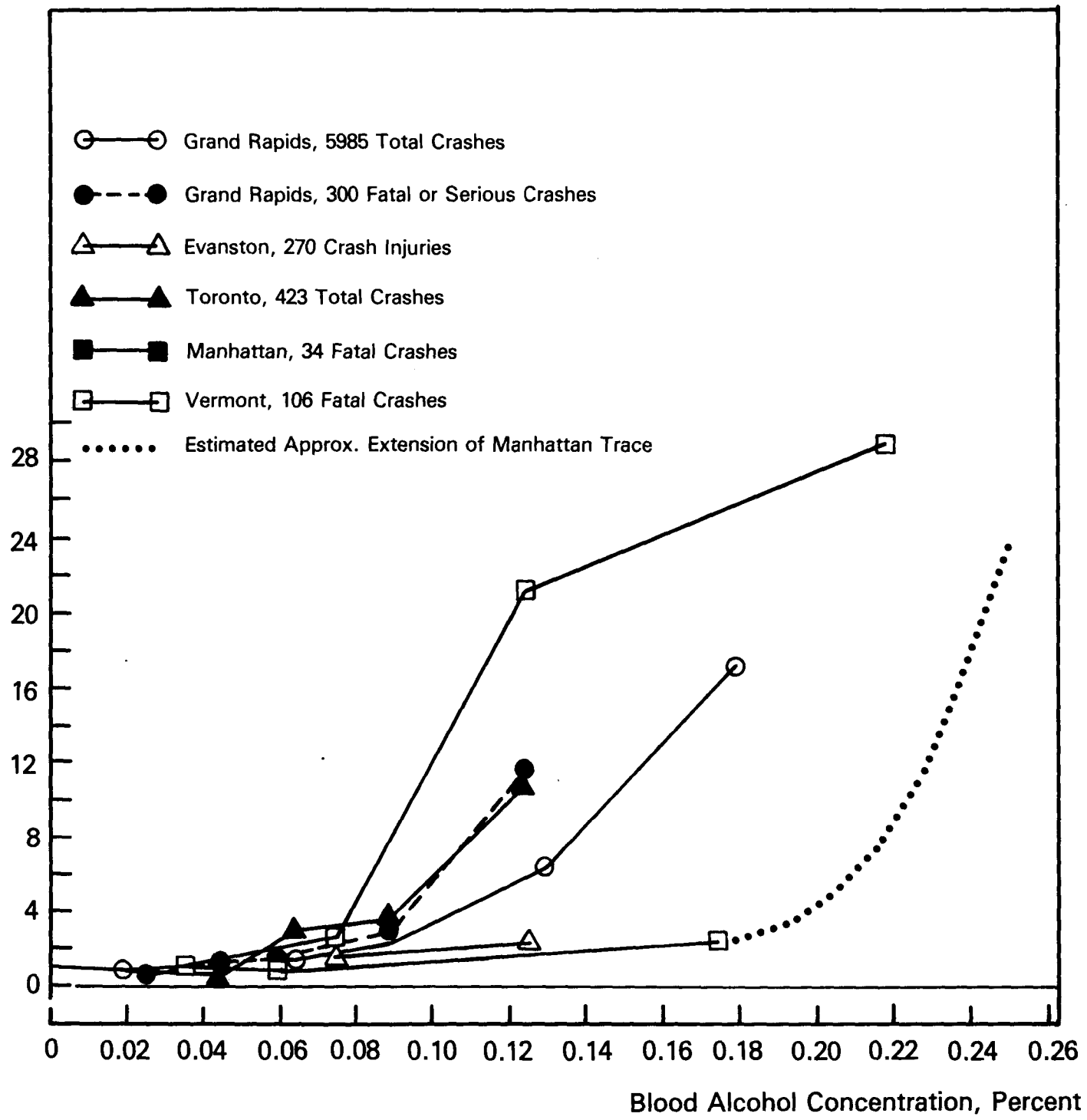
## II. THE PROBLEM OF DRINKING AND DRIVING

A contribution of alcohol to traffic crashes has been recognized for many decades, indeed for as long as the automobile has been recognized as serious transportation rather than a rich man's toy (T. Cameron, 1977, p. 123). However, the nature and extent of this contribution was initially only vaguely understood, and both popular and legal views of the problem centered on the grossly intoxicated driver. This conception supported laws which prohibited driving while "under the influence of intoxicating liquor," driving in an "intoxicated condition," or just plain "drunk" driving (Fisher and Reeder, 1974, p. 173). These laws, which I call "classical," aimed their proscriptions at clearly blameworthy conduct. Both penalties and procedure were drawn from the criminal law, and seemed to be appropriate to the behavior in question. However, the shifting definitions of the object of sanction during the classical period suggest that even in the case of grossly impaired drivers there were problems in obtaining convictions when the impairment did not result in a crash (Force, 1977).

A better definition of the problem of drinking and driving began to emerge in the third decade of this century, as practical scientific techniques for the measurement of blood alcohol became available. Two major lines of research developed: one focusing on the relationship between blood alcohol and skills and judgment in experimental and limited field settings, and another line, developing later, centering on the prevalence of blood alcohol concentrations among crash-involved drivers. The first line of research led to the finding that judgment and skill were noticeably affected by relatively low concentrations of alcohol in the blood, much lower than would suffice to give a clinical picture of drunkeness (Jones and Joscelyn, 1978, pp. 35-50). The second line of research led to the finding that drivers involved in crashes very often had extremely high blood alcohol concentrations (Jones and Joscelyn, 1978, pp. 7-34).

The major achievements of this second line of research are summarized in Figure II-1, which reproduces the calculations by Paul Hurst (1970) of the relative probabilities of crash involvement at different blood-alcohol concentrations. The calculations are based on data from five North American studies dating from 1938 to the 1960's. The figure shows that amounts of alcohol greater than 0.05 percent (unit of weight/percent of volume) in the blood are associated with important increases in crash probabilities (although this level is considerably under that at which the usual clinical symptoms of intoxication appear in most individuals). Moreover, relative crash probabilities increase exponentially with increases in blood alcohol. The picture presented in this figure is confirmed by the results of more recent studies (e.g., Farris et al., 1976; Boston University School of Law, 1976). Apart from the Manhattan study, based on a very small sample, the literature suggests that the increase in probability of crash involvement is even greater when considering crashes involving fatal and serious injuries and for drivers judged "responsible" for crashes.

As of 1980 there is a voluminous literature on the relationship between alcohol and traffic crashes, fortunately summarized in recent reviews by students of alcoholism (T. Cameron, 1977) and of traffic safety (Jones and Joscelyn, 1978). These reviews point to the following conclusions about alcohol and crashes:




*1.0 = Relative Probability at Zero Alcohol.

Source: Hurst (1973), p. 91.

***Figure II-1. Relative Probability of Crash Involvement as a Function of Blood Alcohol Concentration.***

1. Alcohol is often found in the blood of drivers involved in crashes of all kinds, and proportionately more in the more serious crashes as defined by fatalities and serious injuries.

2. Alcohol is disproportionately present in the blood of drivers in single-vehicle crashes and in that of drivers judged responsible for multiple-vehicle crashes.

3. Drivers with alcohol in their blood are more likely to be found at nights and on weekends, at times and places where crash-involvement is high, and among people such as young males who are disproportionately involved in crashes.

4. The more elevated the blood alcohol level, the greater the risk of crashes.

It is also the case that there is much relevant to policy in general and deterrence in particular that we do not know with precision about drinking drivers. For example, it is possible that some of the association of alcohol with crashes may reflect the causal impact on crashes of other variables associated with both alcohol and crashes, rather than a causal influence of alcohol consumption upon crashes. Such variables could be social (e.g., being a young male causes both the consumption of alcohol and the experience of crashes) or psychological (e.g., being depressed causes both). It is also not clear that drivers who accumulate drinking-and-driving convictions form part of the same group as drivers who get involved in crashes, though both samples are characterized by heavy drinkers. It is also not clear whether drivers who become involved in fatal crashes form part of the same group as drivers who experience other kinds of crashes. One of the major questions that has yet to be answered with precision concerns the role of alcoholics or "problem-drinkers", as compared with "social drinkers", in the various groups discussed.

In short, alcohol is today understood as an important correlate of traffic crashes, especially the most serious and damaging ones. Its exact role is not precisely known, and not all of the association between elevated blood alcohol levels and serious crashes is necessarily direct and causal:

> . . . although research has clearly indicated that alcohol plays a substantial role in traffic problems, both at the time of the accident and in the personal histories of accident-involved persons, any general, single-cause model of traffic accidents cannot account for the intricate interrelationships of personality, situational and demographic factors in the chain of events which lead to traffic crashes (T. Cameron, 1977, p. 258).

However, a direct and causal link very likely explains a large part of the association between alcohol and crashes, and one can justify the conclusion from the policy viewpoint that techniques restraining people from drinking and driving are likely to have important social payoffs. One possible avenue for achieving this policy goal is deterrence through law.

## III. THE DETERRENCE MODEL

This report appraises what Jones and Joscelyn (1978) term the "legal approach" to the problem of drinking and driving. The endeavor to alleviate the problem through law can be compared with and opposed to alternatives such as the "health approach," (i.e., public health), "public information and education approaches," "technological approaches," and a "systems approach" integrating the others. Jones and Joscelyn state that "the concept of deterrence is the basis (sic!) for the legal approach to controlling the drinking driver" (p. 110) but some legal scholars (e.g., Andenaes, 1974 and Hauge, 1978) stress other linkages between law and problematic behavior within which the deterrence model must be situated.

Deterrence is but one among several goals of the criminal law. Others are retribution, rehabilitation, and incapacitation. The legitimacy of applying criminal sanctions to behavior is based most fundamentally not upon deterrence but upon retribution or, simply stated, punishment of wrongdoing. Retribution may not appear to be a constructive approach to social problems, but the functionalist tradition in sociology points to the fact that punishing violators may strengthen a threatened norm and increase group cohesiveness in the face of deviance. Indeed, a certain level of punished deviance may be necessary and desirable precisely in order to provide illustrations of the normative boundaries for behavior (Erikson, 1966). Furthermore, a strong claim can be made that even well-intentioned and humanitarian measures may not be imposed upon unwilling subjects by the criminal law in the absence of culpability and that the degree of blameworthiness sets a limit on the nature and extent of the measures that may legitimately be applied (Packer, 1968). The achievement of retribution may be evaluated simply by inquiring whether law violators are receiving punishment.

Rehabilitation and incapacitation are also classic goals of the criminal law and are implicated in the legal approach to drinking and driving. Rehabilitation refers to measures such as education and treatment applied to offenders with the intent of modifying their incentives to participate in similar offences in the future. Success in rehabilitation is judged in part by the recidivism rate of former offenders. Recidivism may be defined in terms of additional convictions or, more sensitively, by self-reports that provide information about formally undiscovered behavior. Research concerning rehabilitation among violators of traditional criminal laws has led to the general conclusion that few if any programs produce the intended improvements and this fact may well yield pessimism with respect to the possibilities of rehabilitating drinking drivers. However, legal actors in this area are strongly motivated to accomplish rehabilitation, and the pessimism may be premature. As summarized by Cook:

> It is safe to conclude that correctional rehabilitation programs, taken collectively, have had a small effect on crime rates in the past, and that a number of notable programs have failed completely. But as long as it can be shown that one or more existing, practical rehabilitation strategies can produce a positive effect on convicts' behavior in the community, then rehabilitation remains a viable objective of the correctional system (1977, p. 166).

Incapacitation is achieved through legal sanctions that restrict the violator's ability to commit new violations, even though he might wish to do so. The classic example is imprisonment, which eliminates recidivism for a period of time by physically constraining the offender. Incapacitation may occur for drinking drivers by means short of imprisonment, although these may act imperfectly. License suspension represents an attempt at incapacitation, as would the seizure of vehicles owned by the drinking driver.

Deterrence is yet another goal of the legal enterprise. In this report I am concerned with general deterrence, the effect of threatened punishment upon the general population, influencing people to refrain from a prohibited act through a desire to avoid the legal consequences. This is to be contrasted with specific or individual deterrence, the effect of an experienced punishment upon convicted offenders making them more sensitive to the consequences of threat in the course of their future activities. Specific deterrence is based on individual experience in a manner similar to rehabilitation. General deterrence is based on a threat that has not been directly experienced.

General deterrence must be distinguished from other general consequences of the threat of legal punishment, such as habit formation and moral education. These consequences are expected to be long-run results of exposure of a population to a legal threat. What is done at first due to fear of the consequences may be converted by internalizing the rule into the product of conscience. These long-term influences are grouped along with general deterrence in Andenaes' (1976) concept of general prevention. In this report I shall not be concerned with measuring long-term influences, other than to assume that they depend on successful short-term general deterrence in order to become established.

The deterrence model has its origin in the speculations of Beccaria, Feuerbach, and the English Utilitarians. It can be regarded as a restatement of the First Law of Demand in economics. Briefly stated, it proposes that the efficacy of the legal threat is a function of the perceived certainty, severity, and celerity of punishment in the event of a law violation. The greater the perceived likelihood of apprehension, prosecution, conviction and punishment, the more severe the perceived eventual penalty, and the more quickly it is seen to be administered, the greater will be the effect of the legal threat.

Deterrence, unlike rehabilitation, is measured not in terms of recidivism rates but in terms of reducing the general violation rate for the law in question. Even with a very high recidivism rate, a low rate of total violations could indicate that deterrence was being accomplished. Conversely, violations could be widespread and general deterrence a failure even though few individual violators repeated their crimes.

The deterrence model is intuitively plausible and is supported by its association with a basic law of economic theory that has received impressive confirmation over the years. Therefore, the question usually posed for the model is not whether it is valid in general but under what conditions it is more or less valid. As stated by the relevant panel of the National Academy of Sciences:

> . . . the evidence certainly favors a proposition supporting deterrence more than it favors one asserting that deterrence is absent. The major challenge for future research is to estimate the magnitude of the effects of different sanctions on various crime types . . . (Blumstein et al., 1978, p. 7).

The social science literature raises several specific questions concerning the conditions of deterrent effectiveness (Grasmick and Green, 1980). For instance, to what degree are the three independent variables of the model interactive? Does severity of penalty make a difference, for example, only when there is relative certainty of apprehension and conviction? Because of the rarity of drinking-driving convictions, this question is highly relevant in the present context. Again, is the model itself interactive with other social control variables, such as peer-group pressures and internalized standards for behavior? This question raises the issue of popular support for drinking and driving laws. Further, is deterrence dependent upon social and psychological characteristics of the potential violator, e.g., rational decision-making, instrumental motivation, etc. (Chambliss, 1966; Zimring and Hawkins, 1973)? The characterization of the drinking driver as a problem drinker is relevant here. And further yet, what is the relationship between objective certainty, severity, and celerity of punishment and the perceptual analogues of these variables that necessarily intervene in the sequence described by the deterrence model (Gibbs, 1975)? This question points to the necessity of studying the drinking-driving law in action as well as the formal law (Ross, 1970).

Evaluation of the deterrent effect of law is facilitated by situations in which the threat is variable, i.e., in which the certainty, severity and/or celerity of the threatened punishment differ from place to place or time to time. This variation may be provided by differences in the formal law, especially in the matter of severity. However, a study of differences in the formal law will provide a fair test of the deterrent model only to the extent that these are widely perceived by the subject population. Certainty is usually studied through variations in enforcement policy where the formal law is unchanged. Again, such a study is a fair test of the model only if the variations are appropriately perceived by the public. Because of the importance of public perception, it might be possible to test the deterrence model by focusing on publicity compaigns designed to increase threat perception even in the absence of changes in the formal law or its application. However, in fact most publicity compaigns are initiated in order to acquaint the public with actual changes in penalties or enforcement, and the intervention becomes a complex mixture of law and communication. Celerity, the "orphan variable" in the deterrence model, is the subject of very little empirical research. It is measured in terms of the law in action, e.g., in the average time from commission of the offence to conviction. Again, it properly enters the model only in the form of perceptions.

Evaluation of empirical variation in terms of a theoretical model like deterrence is most straightforward and least ambiguous when the variation is created as part of a classical experiment. The classical experiment is a research design whereby application of an intervention is assigned to individuals or equivalent groups at random. It is a design that avoids a wide variety of threats to valid conclusions, but for reasons of ethics as well as practicality it is rarely if ever accomplished for variations in the

formal law. It is, however, a useful model for studying variations in enforcement. An example of such a study in general criminology is the Kansas City Study (Kelling and Pate, 1974), which randomly assigned different levels of police patrol to different segments of the city and tested to see whether the populations of the heavily patrolled areas reported less criminal victimization. (They did not, but the study has been criticized for failing to vary the patrol conditions sufficiently.) Similar designs, though less elegantly controlled, appear in the general traffic literature, reviewed in two recent summaries (OECD, 1974; Fennessy, et al., 1968). For instance, studies of the effect of patrol devices on speed often have included matched comparison road segments (Shumate, 1961; California Highway Patrol, 1966). Studies of specific deterrence of violators have also manipulated actual sanction threats in a experimental manner (Kaestner et al., 1967; Blumenthal and Ross, 1973; and Blumenthal, 1975). As will be seen below it is possible to use experimental design to study effects of variations in patrol in the drinking-driving area (M. Cameron, 1980) though the principle of randomness in police patrol is a divisive political issue in many countries and truly random law enforcement is rare (Havard, 1977).

The most common methodology in recent deterrence studies has been analysis of natural variations in actual levels of punishments among different jurisdictions, usually American states. The results of this large literature have been generally supportive of the deterrence model for traditional criminality, especially in the matter of "certainty" -- the probability of arrest and/or conviction -- but also in the matter of severity (Cook, 1979, p. 29). A special case in this literature is the death penalty, which less rigorous research has declared not superior in deterrent effectiveness to its alternatives, but which some recent studies have endorsed. However, this methodology has been strongly criticized, most recently by the prestigious panel of the National Academy of Sciences (Blumstein et al., 1978), which finds nearly insuperable technical problems due to errors in measuring the crime rate, the confounding of incapacitation and deterrence, and the possibility that the level of crime affects sanctions in addition to sanctions affecting crime. For these reasons the panel concludes "we cannot yet assert that the evidence warrants an affirmative conclusion regarding deterrence" (p. 7) in general, and that specifically, "available studies provide no useful evidence on the deterrent effect of capital punishment" (p. 9). Interestingly, despite the overwhelming predominance of correlational studies in the deterrence literature relating to general criminality, the method has been very little used in the study of traffic law -- a notable exception being the Votey (1978) studies of Scandinavian drinking-and-driving legislation -- so the disrepute cast on the method by the Academy's report will have little effect on the state of knowledge concerning deterrence of drivers.

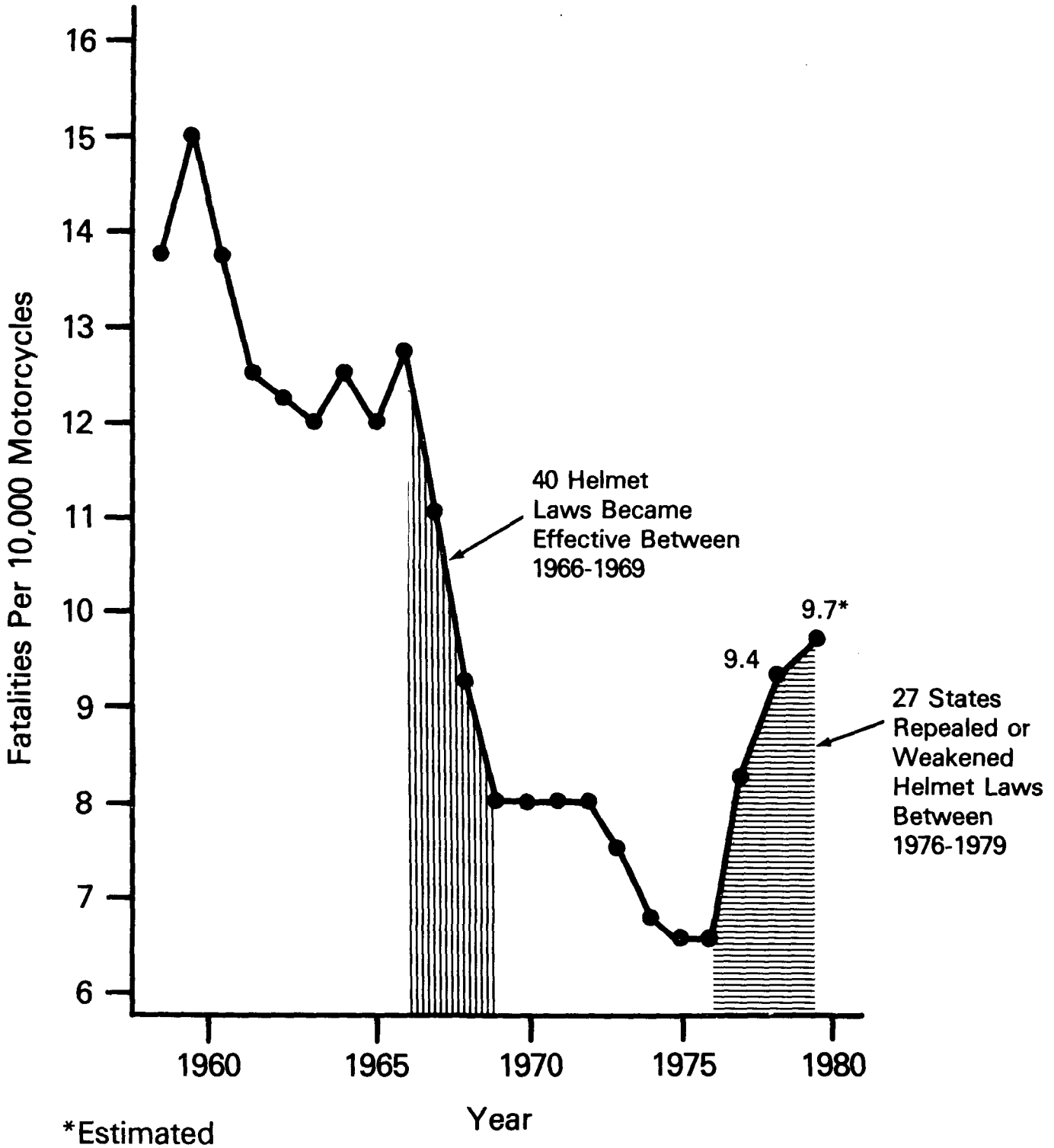
Another approach to the study of deterrence is the quasi-experimental analysis of policy changes. Two specific methodological models are most often followed: the before-and-after model, in which data are gathered at isolated points prior and subsequent to the policy change and the observed differences are attributed to the change, and interrupted time-series analysis, in which a long series of data points surrounding the policy change is available. The former design is methodologically weak, since the differences observed could as easily be ascribed to various rival explanations including other specific causes (history), long-term secular trends

(maturation), simultaneous changes in the measurement only (instrumentation), behavioral changes caused by taking measures (testing), random fluctuations (instability), and reversion of extreme situations towards normality (regression). The latter design, properly executed, controls for these rival explanations and yields more easily interpretable results (Campbell and Stanley, 1963; Ross, 1973). Examples of quasi-experimental designs can be found in the literature on deterrence of traditional criminality but are more common in the field of traffic law, perhaps because the availability of valid routine measures of the problem is greater for traffic than for most traditional crime thus facilitating the use of interrupted time-series analysis. An excellent example of a positive demonstration of legal effectiveness with interrupted time-series models appears in the United States Department of Transportation's (1980) report on the adoption and repeal of mandatory helmet laws. Figure III-1 is reproduced from this report. It documents changes in the crash fatality rates for motorcycles during the adoption of mandatory helmet laws by 47 states between 1966 and 1975 and their repeal by 27 states subsequently. Special studies of four states repealing the compulsory helmet laws showed that helmet use declined from nearly 100 percent to about 50 percent. The motorcycle fatality rate demonstrates concomitant variations that can be assigned to no cause other then the legal changes.

Given the difficulties of utilizing experimental methodology for evaluating legal innovations generally, especially those in the formal law, and given the inherent weaknesses of correlation techniques in the study of deterrence, it seems fortunate that studies of deterrent effectiveness in the area of drinking-and-driving law can utilize quasi-experimental methodology. A variety of criterion measures are available for adoption in this area in evaluating the deterrent effects. These are: blood alcohol concentrations among drivers in general as detected by roadside surveys; statistics of total crashes and of more specialized and limited crash series; alcohol-related crashes as judged by police; and alcohol-related crashes as judged by medical personnel.

The most straightforward of these measures is the first, the presence of high concentrations of alcohol in the blood of random samples of drivers. This is what drinking-and-driving law is intended to prevent. It is a good measure, and procedures have now been standardized to a degree that will permit comparisons among data over time and across jurisdictions, even internationally. Controlled studies using roadside surveys of drivers can provide estimates of relative crash probabilities for subgroups and can provide attitudinal and other collateral data. Nonetheless, the measure is infrequently used, the principal reasons being cumbersomeness, difficulty and expense. To secure sufficient survey data to evaluate even a simple before-and-after study in a limited jurisdiction involves the expediture of thousands of dollars and the results, as with all before-and-after studies, will necessarily be ambiguous; to procure enough data for interrupted time-series analysis multiplies these expenditures. Moreover, roadside surveys can raise political problems for officials sponsoring them, since they may be seen as unwarranted governmental intrusions into private behavior.

In this light, the advantages of official crash series become manifest. Crash series are routinely gathered and published nearly everywhere, albeit




*Estimated

Source: U.S. Department of Transportation, 1980, p. II-3.

***Figure III-1. Motorcycle Fatalities Per 10,000 Motorcycles.***

with some delay. The data-gatherers are usually (though not always) sufficiently removed from the utilizers that problems of contamination by sponsors of an intervention are remote. The series are detailed and extensive, lending themselves easily and cheaply to the preferred interrupted time-series methodology.

The most widely available of crash series is total reported crashes. The principal difficulty in analyzing total crashes for evidence of effectiveness of drinking and driving laws is that they reflect many causal factors in addition to alcohol. It is estimated that a totally effective deterrent of drinking and driving would lower a typical North American total crash series by only about 6 percent (Reed, 1980), posing difficult problems for the power of statistics currently available to analyze interrupted time series. Furthermore, total crashes are incompletely reported and are therefore subject to the previously mentioned possible instrumentation biases, particularly if the series are gathered by agencies with stakes in demonstrating or negating a policy outcome.

For these reasons, more refined crash series are more useful in research on deterrence of drinking and driving. The knowledge that alcohol is more likely to be involved in serious injury crashes and fatal crashes, single-vehicle crashes and night-time crashes, suggests the usefulness of these specific series as measures of effectiveness. Modern statistical bureaus usually publish series like these, and unpublished series can often be generated from computerized files of standard crash records where published figures are lacking. A deterrent effect of a drinking-and-driving law is more likely to be detected in data limited to serious crashes on weekend nights than by the series of total crashes. The principal problem with the more restricted series is that because of a reduced data base they tend to be more variable, containing relatively more error, especially for small jurisdictions like cities and counties.

Alcohol-related crashes as judged by the police might seem an attractive index, being closely related to the problem studied, but police error in judging the presence of alcohol is so great as to render these data virtually worthless (Waller, 1971). The possibility of instrumentation effects is also present with these series. These data should not be used in scientific studies.

Alcohol-related crashes as judged by medical personnel may on the other hand be a useful index if these judgments are based on systematic testing of cadavers or of injured and hospitalized patients. Unfortunately, in many studies the administration of tests for blood alcohol is at the discretion, legitimate or de facto, of police and other untrained personnel (including doctors using only clinical evidence in deciding whether to test). Studies based on such data typically yield large "dark figures" of untested bodies (Andenaes, 1978,p. 48-49). It is an error to assume that the untested are without blood alcohol, yet there are no general formulas for handling them otherwise. These data are therefore to be used with caution in scientific research.

The availability of valid and appropriate data series for performing interrupted time-series analyses provides one justification for an interest in traffic law studies on the part of students of deterrence and of general criminology. Not only are the data series usually available but the traffic law field, especially in the matter of laws concerning drinking and driving, is one in which natural variation relevant to potential deterrence is occurring. Jurisdictions throughout the world are changing the severity of penalties, engaging in increased enforcement efforts, undertaking massive publicity campaigns, and in other ways affecting the level of actual and perceived legal threat. Furthermore, in most countries drinking-and-driving legislation appears to have the characteristic of mala prohibita, the type of law in which legal prohibitions operate without the intrusion and support of custom and morality. This is especially the case as the prohibited conduct departs from conceptions related to gross incapacitation and encompasses considerable segments of what in most societies is considered normal drinking behavior. In these situations there is the opportunity to trace not only possible deterrent effects but the more subtle, longer-range effects posited in the general prevention literature (Hauge, 1978).

Research based on traffic law has met with the disdain of many criminologists who, focusing on more traditional and more "important" problems, have ascribed low status to the problems on which the traffic law is based, to the law itself, and to the research associated with it. This low status is damaging to criminology. Traffic crashes are a major social problem when measured in deaths and dollars. In the country with the lowest crash rate in the world, traffic crashes are the most important cause of violent death, far eclipsing homicide and suicide. The yearly cost of associated damage is in the billions. The relevant law is technically sophisticated, and those in charge of its application are often interested in empirical accomplishments rather than symbolism and are oriented to encouraging scientific experimentation and other types of study. The quality of research in academic institutions, consulting firms and government institutes has increased enormously in recent years. At present the research community is self-critical and capable. It is true that pressures may be felt from vested interests including automobile manufacturers, highway engineers, education and enforcement groups, and in some countries temperance movements, but these groups have not in recent years been able to dominate the field.

The study of drinking-and-driving law is now on the front lines of deterrence research. In the short run it may tell us more about the conditions of validity of the deterrence model than any other research enterprise currently under way.

## IV. THE SCANDINAVIAN MODEL

In the early years of the Century of the Automobile all attempts to use law to control crashes related to drinking and driving followed the model I have termed "classical". A major change in these laws took place before World War II in Norway and Sweden. These countries in similar ways arrived at the legal approach to drinking and driving which I term the "Scandinavian model". After a delay of more than two decades the Scandinavian model began to be adopted outside the original countries and within the last few years it has come to mark the legislation of virtually all nations with significant automobile populations. In this section I will illustrate the model by describing the Norwegian and Swedish laws and show that it conforms more closely than classical laws to the prescriptions of theoretical deterrence. I will then review the evidence concerning the attainment of deterrence in Scandinavia and speculate as to why it is difficult to draw evaluative conclusions about the Scandinavian laws. Since I have published a detailed report on Scandinavian laws based on research available through 1974 (Ross, 1975), I shall confine my efforts here to summarizing, focusing and updating the earlier work.

Classical laws were not well formulated to present sure threats of severe punishment to follow shortly upon hazardous drinking and driving. Perhaps their major defect was in failing to persuade the populace that punishment would be at all certain. Consider, first, the fact that levels of alcohol consumption likely to increase crash risk many times were not likely to be included in prescriptions against driving while "intoxicated" or "under the influence" of intoxicating beverages. Moreover, as a practical matter substantial degrees of alcohol effect were unlikely to produce behavioral cues to police intent on detecting violations. Finally, even drivers most strongly affected by alcohol could count on the vagueness of the legal criteria and the pro-defendant biases of Western criminal procedure to lower their chances of being convicted in courts operating under classical laws.

Additional problems occurred for classical drinking-and-driving laws in the areas of severity and celerity. Even for convicted drivers, punishments were frequently unexceptional. In Sweden, for instance, they were originally and for many years limited to licensing actions which, in the context of a poor society lacking dependence on the automobile, could be regarded as relatively mild at the time. Legislatures and courts in most countries were loath to apply imprisonment as a routine sanction to any traffic offenses, including drinking and driving, where no immediate harm had been done. Furthermore, until the development of modern court management and the bureaucratic handling of many traffic violations, drivers could expect considerable lags in their interactions with traditional criminal law systems which compromised the principle of celerity.

Although there eventually accumulated considerable scientific evidence concerning the riskiness of driving with even moderate blood alcohol concentrations, the proposition was not firmly established until about the middle of the century. The transformation of the law in Norway and Sweden

took place well in advance of this development, due to the strength of a moralistic temperance movement in the Northern countries rather than to any superior understanding of the nature of the drinking and driving problem. As noted by Andenaes:

> In the Storting [Norwegian Parliament] rather strong expressions were used about the role played by alcohol. In 1930 the Storting's Road Committee stated that "a deplorably large part of the accidents that occur through driving an automobile are caused by the driver being under the influence of alcohol." During the legislative proceedings in 1935 several speakers dwelt upon the same theme. One member said, "One can examine the police reports and see how large a part of the accidents that have occurred on the roads in connection with the driving of a motor vehicle have happened because of drunkenness . . ." Another said, "I know that the most serious traffic accidents in this country occur because of alcohol. At least 75 percent of the accidents occur because the drivers have been drunk." . . . It seems that none of the speakers had any systematic material on which to base their statements. And these statements contrast strangely with the information given in the annual reports of the Oslo police . . . The statements rather show what a loose foundation the legislators were building on (1978, p. 47-48).

On this "loose foundation" the Norwegian Parliament constructed a drinking-and-driving law that, with minor modifications, remains in force to this day. As compared with classical law, the Norwegian legislation of 1936 appears to conform more with the principles of deterrence. The most radical change of the new law was to define the culpable act as driving while possessing a blood alcohol level in excess of 50 milligrams per 100 milliliters of blood (0.05% w./v.). The need to define and prove that a driver was "drunk" or "under the influence" of alcohol was obviated, and the new criterion was garbed in the mantle of prestigious "science". A very likely result of this definition would be an increase in actual certainty of punishment for drinking drivers. Increased certainty of punishment would derive in part from simplification of conviction for those charged. By itself, the redefinition of the offense would not be expected to affect apprehension. However, the practice by Norwegian police of verifying driver's licenses and insurance papers in "random" roadblocks, coupled with the availability of breath testing devices in the event of the odor of alcoholic beverages, might have been expected also to increase the risk of apprehension for the drinking driver.

Sweden introduced fixed blood alcohol criteria for drinking and driving a few years after Norway, in 1941. The Swedish law differed primarily in that it established two levels of violation: between 80 and 149 mg./100 ml., and 150 mg. and over, with different levels of punishment. Although the Swedish prohibition covered a smaller sector of the alcohol-involvement scale, it was designed to produce the same effect on the more limited population being addressed. With the exception of lowering the lesser offense limit to 50 mg., the Swedish law like the Norwegian remains basically the

same today. However the impression of certainty in Sweden may have been affected positively by rules passed provisionally in 1974 and permanently in 1976 permitting police to demand breath tests for blood alcohol without restriction in the course of scheduled roadblocks as well as in connection with crashes and certain traffic violations.

The redefinition of the drinking-and-driving offense was accomplished in both Sweden and Norway on the background of prior statutes prescribing relatively severe punishments for drinking and driving. Thus the Scandinavian model is characterized by severity as well as relative certainty. In Sweden, the penalty (absent very rare extenuating circumstances) is imprisonment for the more serious offense and heavy fines for the less serious, and license revocation applies to both offenses from the level of 80 mg. (0.08% w./v. in U. S. notation) upwards. Imprisonment and license suspension routinely apply to the single-level Norwegian offense.

No information is reported concerning the celerity with which punishment of drinking drivers is achieved in Norway and Sweden. However, prompt administrative action to suspend the driver's license is very much a part of the Scandinavian model. It is accomplished in various countries either on the spot by the police or within a few days by administrative agents -- in any event, considerably quicker than the outcome of criminal procedures.

In short, the Norwegian legislation of 1936 and Swedish legislation of 1941 furnish a model for the control of drinking drivers that has served as the basis for replacing classical laws in many countries. Fundamental to this model is a redefinition of the offense, and subsequent mode of proof, i.e., to speak of blood alcohol concentrations and laboratory analyses rather than subjective descriptions of behavior. Also pertaining to the model are sanctions considered severe and depriving, such as imprisonment and loss of license, and promptness in the disposition of at least some aspects of pending cases. These characteristics of the law accord with practical suggestions for behavior control derived from the theoretical model of deterrence.

Perhaps surprisingly, although the laws of Norway and Sweden created the model that has recently swept the Western world, there is no scientifically valid evidence to date of the deterrent effectiveness of these laws in their home countries. Five lines of evidence have been raised by Scandinavian observers in support of claims for deterrence, but a review of these finds them to be inconclusive. A sixth line of argument that has been offered recently must also be dismissed. These arguments will now be reviewed.

Perhaps the most commonly heard evidence supporting the deterrent effectiveness of the Scandinavian laws is testimony from residents and visitors based on introspection and unsystematic observation. People are said to be aware of the law and to fear its threat. The stereotypical anecdote concerns parties at which great quantities of liquor are consumed by all present except the drivers (a role often said to be occupied by wives, even in these reputedly egalitarian societies). Although one hesitates to doubt the anecdotes, they provide no scientifically acceptable evidence for the proposition they illustrate. Johannes Andenaes, one of the strongest (and

most reasonable) proponents of the effectiveness of these laws, states the relevant caution:

> What has been described is the situation as it presents itself to many middle class or upper middle class groups. How far it fits the bill for other social groups, for example professional chauffeurs or young persons, is more uncertain. It may be the case that there has been a tendency to overestimate the general deterrent effect of our strict drinking-and-driving provisions because those who usually take part in the public discussion of them make generalizations based on their own and their acquaintances' reactions. Politicians, judges, professors, policemen, and traffic safety experts, generally speaking, allow themselves to be motivated by the threat of punishment. These are groups that would experience a prison sentence for drunken driving as a social catastrophe, and they consist of people who generally have a considerable ability to control momentary impulses. In their social circles drunken driving would be regarded with astonishment, anxiety, and disapproval. Besides they can comfortably afford to hire a taxi as an alternative to driving themselves. Making a generalization from this circle to the whole body of motorists is obviously risky. Systematic studies of the conduct or attitudes within different groups of motorists are not available (1978, p. 38-39).

A second argument offered for the effectiveness of the Scandinavian laws cites the relative stability of the rate of recorded violations over time in the face of increasing traffic and occasional modifications of the laws in the direction of greater restraint on motorists, as well as greater alcohol consumption. This relative stability is held to be evidence of deterrence (Ross, 1975, p. 294). However, the argument is not satisfactory, for any number of factors could explain a constant offical violation rate, especially where the known violations are a very small proportion of total estimated illegal behavior. This constancy could, for instance, be a reflection of a constant amount of resources being devoted to the control system of police and courts. As found during my visit to Scandinavia:

> That diametrically opposed conclusions can be drawn from the same data used to support the deterrence hypothesis in this argument is indicated by the official opinion of the MHF (the Swedish Temperance Motorists' Association) that the doubling of <u>absolute</u> numbers of arrests from 1950 to 1967 indicates that the problem of drinking and driving is <u>not</u> under control (Ross, 1975, p. 294).

More impressive evidence is raised by Andenaes' recent article: violation rates per 100,000 registered vehicles in Norway actually declined following the legislation of 1936. However, examination of the curve suggests that the decline was part of a larger secular fall in the violation rate during the 1930s, and the change in slope does not appear to be significant. Even if this were not the case the evidence could still be met with the rejoinder that violation rates are a product of official activity and have no necessary relationship to the amount of actual drinking and driving on the highways. For instance, it might have been that the legal control

system experienced some temporary difficulties in adapting to the new formulation of the offence, which would have produced the one-year dip in formal violations noted by Andenaes. Given the failure of fatalities to follow the shape of the violations curve after 1936, Andenaes' point lacks convincing power.

A third argument is based on the impression that alcohol is less often found in the blood of fatally injured drivers in the Scandinavian countries than elsewhere. According to the director of MHF, the Swedish Temperance Motorists Association:

> The recently presented Swedish report concerning the legislation about drunken driving calculates that of the total number of fatal casualties in road accidents in Sweden between 10% and 30% occur in accidents involving drivers under the influence of alcohol. Even if the proportion of drivers under the influence of alcohol is disturbingly high the fact is that it seems to be about 20% lower than in countries with more liberal regulations. If drunken driving in Sweden were to deteriorate so that the proportion of fatal accidents involving alcohol rose from 30% to the "international" level of 50%, it is possible to work out mathematically that the total number of fatal accidents in this country per year would increase . . . It is reasonable to assume that thanks to our relatively stringent and consistent legislation nearly 500 lives are saved on our roads every year (Surell, n d.).

A principal problem with this argument is that it is not supported by the facts. Tables IV-1 and IV-2 display relevant data from all known studies of blood alcohol among Norwegian and Swedish drivers. The Swedish study referred to in the quotation was based on an unrepresentative sample of fewer than half of all drivers killed in Sweden in 1968. In fact, no Swedish study of traffic fatalities has found blood alcohol in proportions as low as 10 percent; rather the range is between 25 and 32 percent. Recent research in Norway provides estimates of up to 45 percent of drivers killed in crashes with illegal blood alcohol concentrations. Moreover, studies of injured drivers in both countries show proportions of drivers with elevated blood alcohol that are well within international norms (OECD, 1978. p. 25).

Table IV-1. Percentage of drivers with blood alcohol concentrations above a specified criterion: Norwegian studies.

| Population | Source | Subjects | BAC criterion | Percent over criterion |
|---|---|---|---|---|
| Fatalities: | Lundevall and Olaisen, 1976 | 56 drivers, 1956-59 | 0.5 pro mille* | 27 |
| | " " " " | 69 drivers, 1973-75 | 0.5 pro mille | 45 |
| | Andenaes and Sørensen, 1979 | 133 drivers, 1976-77 | 0.5 pro mille | 32 |
| Injuries: | Bø et al., 1974 | 74 drivers | 0.5 pro mille | 46 |
| | Reigstad et al., 1977 | 11 drivers | Any trace | 27 |
| | Ringkjøb and Lerein, 1977 | 63 drivers | Any trace | 62 |
| Non-crash: | Bø, 1971 | 1908 drivers | 0.5 pro mille | 3 |
| | Christensen et al., 1978 | 1152 drivers | 0.5 pro mille | 1 |

* 0.05 percent w./v.

Table IV-2 Percentage of drivers with blood alcohol concentrations above a specified criterion: Swedish studies.

| Population | Source | Subjects | BAC criterion | Percent over criterion |
|---|---|---|---|---|
| Fatalities: | SOU 1970:61 | 200 drivers | 0.5 pro mille* | 32 |
| | Hansson, 1972 | 92 drivers | 0.5 pro mille | 25 |
| | Bonnichsen and Lingmark, 1972 | 232 drivers | 0.5 pro mille | 32 |
| | Bonnichsen and Äquist, 1968 | 473 drivers | 0.5 pro mille | 27 |
| Injuries: | Bjerver et al., 1955 | 71 crash victims | Any trace | 32 |
| | Linköping Hospital, unpub. | 350 drivers | 0.5 pro mille | 20 |
| | Bonnichsen and Solarz, 1980 | 228 single-veh.driv. | 0.5 pro mille | 27 |
| | " " " " | 338 mult.-veh. driv. | 0.5 pro mille | 6 |
| Non-crash: | Persson, 1978 | 9125 drivers | 0.5 pro mille | $<1$ |

* 0.05 percent w./v.

It is true that roadside surveys of non-crash-involved drivers find very low proportions in Scandinavia, which is compatible with the idea of deterrence. However, this fact is also compatible with the idea that other differences between the Scandinavian countries and comparison jurisdictions affect the level of alcohol consumed by non-crash-involved drivers. Examples of such factors might be different patterns of liquor use, including abstention at most times, legal controls over the availability of alcoholic beverages, different patterns of vehicle ownership and use, etc. Indeed, the conjunction of low levels of alcohol in the blood of drivers in general along with high levels among crash involved drivers presents an enigma that is not easily explained under any simple model of legal effectiveness. One possible line of explanation is suggested by Andenaes, who notes that drivers convicted of violating the laws tend to be persons with alcohol problems and other social adjustment difficulties:

> The groups in question here present poor targets for the law's deterrent and moral effect. In short, it is reasonable to believe that the law's motivating effect is strongest among those who would have represented only a moderate traffic accident risk even if they had consumed alcohol in excess of the legal limit (1978, p. 46).

The frequency of personal and social pathology among those convicted of drinking and driving is sometimes cited as an argument in itself for the deterrent value of the Scandinavian laws, due to the inference that the people without problems have been deterred. There is good support for the premises of this argument, though control groups of non-convicts, equating for social class, are generally lacking (Ross, 1975, p. 297). However, the conclusion does not follow. Mentally healthy white-collar Scandinavians may refrain from drinking and driving for a variety of reasons, of which law furnishes only one. Furthermore, the same finding concerning problem conditions among drinking drivers recurs in jurisdictions that find it impossible to state any claims for the deterrent values of the their laws (Ross, 1975, p. 298).

A fifth argument offered for the deterrent effectiveness of the Scandinavian laws concerns the public knowledge and support for these laws found in survey data. Again, the data need not be challenged, though the implication that support is greater in Scandinavia than elsewhere is not necessarily correct (Ross, 1975, p. 296). Hauge has recently demonstrated that the Norwegian law is known in detail, and that the 50 mg. level "has become part of the moral climate" (1978, p. 68). Knowledge of a law is a prerequisite to its deterrent effectiveness, and we may concede that this prerequisite has been fulfilled. However, it is a necessary and not a sufficient condition for deterrence, and the argument goes no further.

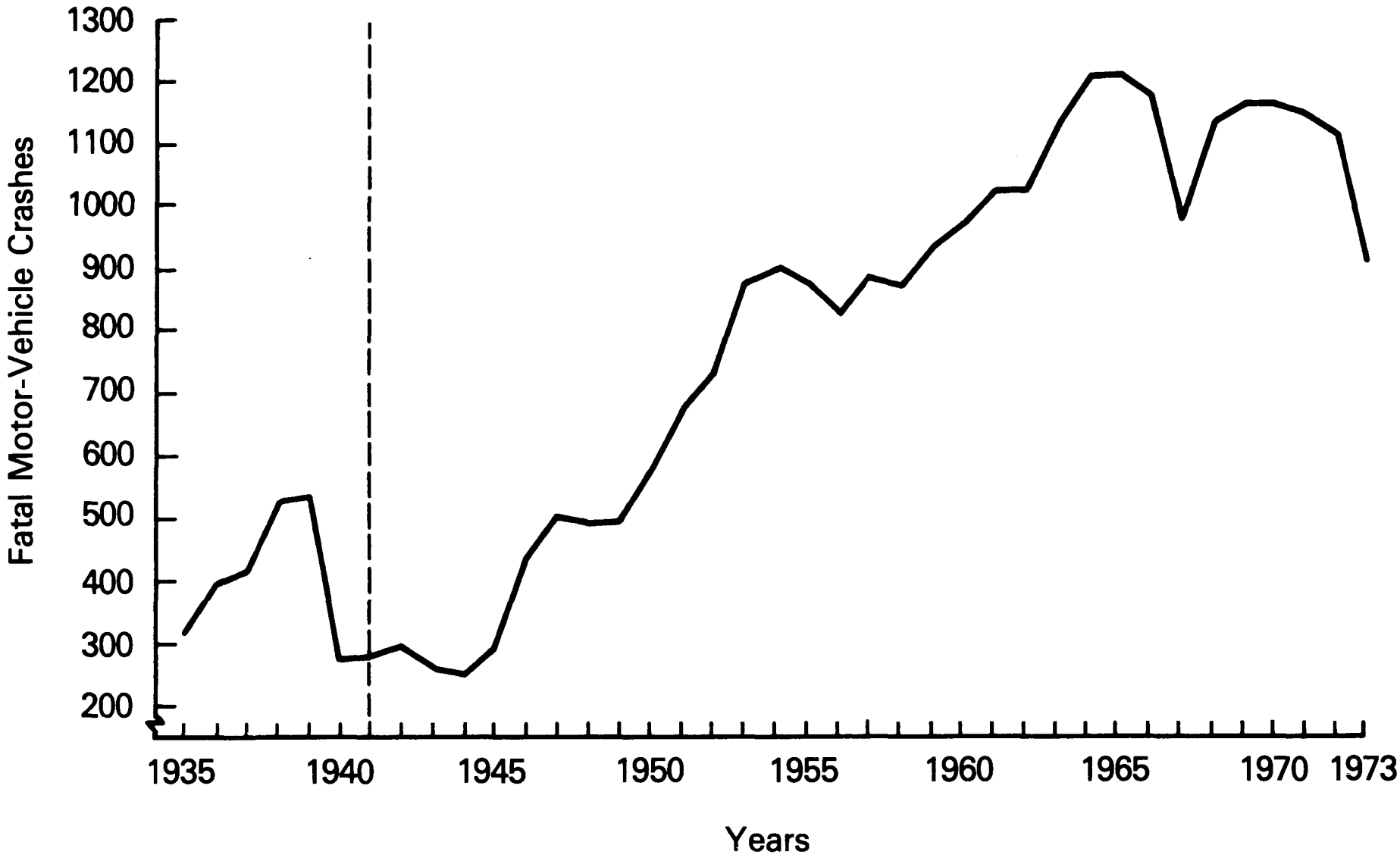
The claim of a scientific demonstration of deterrence for the Scandinavian model has recently been put forward by Harold Votey in papers applying correlational analysis to data on naturally occurring variation, over time in Norway and among counties in Sweden. Votey's claims are strongly worded:

> This analysis and the accompanying empirical evidence indicate that apparent ambiguities in the data which measure drinking, driving and law enforcement activities can be sorted out with the use of models that specifically account for the interrelationships that jointly generate the data. Furthermore, it appears that fundamental theories of deterrence are supported by the data, once the simultaneity of the relationships is specified (1978, p. 96).

To this reader, the argument and methodology of Votey's work are so poorly communicated as to be nearly incomprehensible. The method in general is known to suffer from very serious flaws, as stated by the National Academy of Sciences in their review of the literature (Blumstein et al., 1978), and some scholars have arrived at the conclusion that these problems are so fundamental as to render the method virtually useless for the study of deterrence (Cook, 1979). Concerning Votey's specific application of the method, the best advice available to me (Zador, 1978) suggests that an arbitrary selection of input variables and a variety of debatable assumptions concerning their formal status negate the elegance of the mathematical models and statistical procedures used to process them. Because of the large number of variables used and the short length of the data series, it is not difficult to find close fits between expected and empirical values in this type of exercise. The "proof of the pudding" will be in Votey's ability to predict future values from his econometric model. In the interim, it would seem that little reliance should be placed on the results of his analysis.

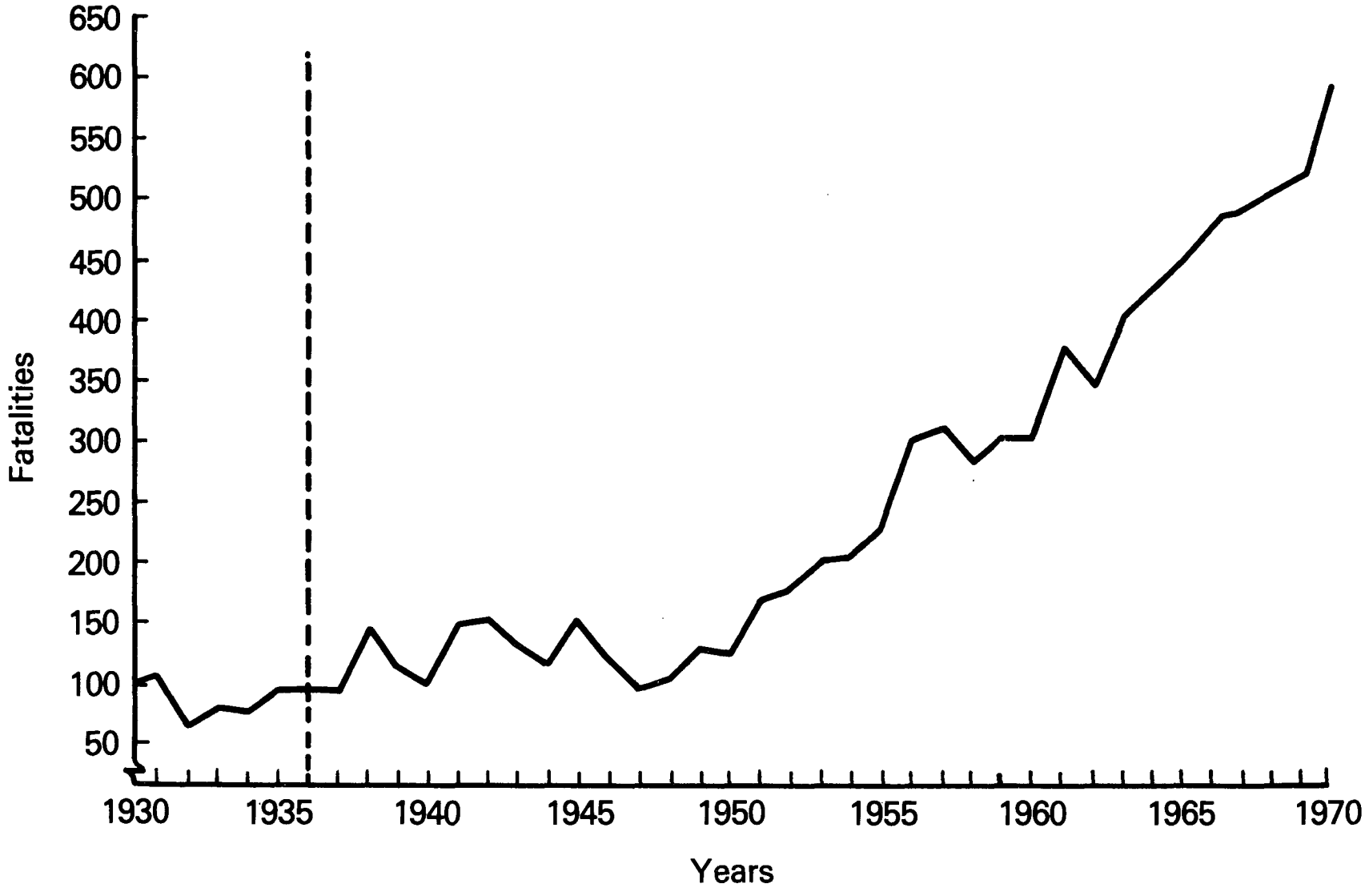
Votey's studies also fail to address the question of whether the Scandinavian laws provide greater deterrence than would classical laws. His studies claim to find that in Sweden and Norway, over time or across districts, a greater input of law enforcement results in fewer crashes. However, his time-series data do not cover any period during which the laws were classical, and his cross-sectional studies likewise are irrelevant to what law-enforcement might accomplish under a classical law. Votey's work is relevant to the question of the effects of law enforcement and not to the effects of the particular features of Norwegian and Swedish legislation.

Interrupted time-series analysis offers an apt tool to analyze the results of legal interventions where the change in the law is large and abrupt and where routine observations of dependent or effect variables exist over a long period of time. Application of this sort of analysis to traffic fatalities in Norway and Sweden shows no change in the series corresponding to the 1936 and 1941 introductions of the fully-developed Scandinavian laws (Ross, 1975). The data previously reported in my 1975 article are presented in Figures IV-1 and IV-2. Correction of the data for changing exposure over time does not change the conclusion. In my previous publication I noted that the conditions for the use of interrupted time-series analysis in evaluating these laws were not ideal: the data series in both countries were rudimentary, lacking in detail that might permit isolation of hours and days where greater alcohol influence could be expected, and based on a very small data base. Because prior to World War II these countries had not assimilated the culture of the automobile and had not developed




Source: Ross, 1975, p. 300.

***Figure IV-1. Fatal Crashes in Sweden.***




Source: Ross, 1975, p. 306.

***Figure IV-2. Motor-Vehicle Fatalities in Norway.***

modern highways, the contribution of alcohol compared with other factors in crashes may have been minimal. The Swedish law was passed during the early years of World War II, an unfortunate time for analysis. Moreover, as Andenaes has emphasized in his recent article (1978, p. 40-41), these laws were not at the time considered to be major innovations. Although they fundamentally redefined the drinking and driving offense, they were adopted in legal systems that already had license suspensions and prison sentences for drinking drivers, and that already used medical examinations including blood tests in processing those accused of drinking and driving. Even more important from the viewpoint of the deterrence model:

> In striking contrast to what occurred in England in 1967, little publicity was given to the Act of 1936 and its coming into force. During the passage of the Bill through the Storting the spokesman concerned expressed surprise over the fact that there had not been more discussion of the matter in the press, although a step was now being taken that had no precedent in the legislation of any country. And a perusal of the country's two leading motoring journals of the period... yields the surprising result that neither the Act nor the practice to which it gave rise are mentioned at all either in 1936 or 1937. It is possible that knowledge of the law and the practice only gradually percolated through to drivers (Andenaes, 1978, p. 41-42).

These considerations may mollify disappointment with the fact that the interrupted time-series analysis finds no evidence of a deterrent effect for the Scandinavian laws. The causal changes may have been too small, and the effect measures too inaccurate, to yield any evidence one way or the other.

In sum, review of the accumulated evidence concerning the deterrent effectiveness of the Norwegian and Swedish laws leads to the same conclusion as in my previous work:

> There is no adequate proof for the proposition that the Scandinavian per se laws deter people from drinking and driving. Belief that such proof exists can be termed "the Scandinavian myth." The real basis for the belief is primarily folklore and anecdote... (Ross, 1975, p. 308).

Because this conclusion in my original paper seems to have generated a considerable amount of misunderstanding, I shall expand it somewhat here. There are two important points to make. On the one hand, there exists no adequate evidence for the operation of the simple deterrence mechanism association with the Norwegian law of 1934 or the Swedish law of 1941. On the other hand there exist a variety of facts consistent with the possibility that the Scandinavian countries have achieved some marginal deterrence over the long run. However, some caution is indicated concerning even the latter possibility because of the still disturbing proportions of killed and injured drivers in Norway and Sweden who have high blood alcohol concentrations. Moreover, the actual risk of apprehension for drinking and driving seems to be low in Scandinavia (Persson, 1978) and the public

appears to perceive this fact (SOU, 1970). One Scandinavian study (Norström, 1978) has further found that the perceived risk of detection is not related to the incidence of drinking and driving. In short, the legal threat posed by the laws of Norway and Sweden may not be reaching those who most need to be deterred, possibly the "problem drinkers" of the American literature who are involved in a large share of serious crashes and may be particularly resistant to deterrence through law.

I am convinced that there is nothing more to be learned concerning the effects of the Norwegian and Swedish laws of the 1930s and 1940s through studying historical data. However, interrupted time-series analysis could be of use in studying marginal changes in deterrence produced by contemporary shifts in the certainty, severity or celerity of the threats posed by these laws today. If, as has been occasionally proposed, the routine punishment were reduced, contemporary crash data could be analyzed as a time series to test the hypothesis that deterrence would be reduced. If enforcement resources were raised, time-series analysis could be used to test the hypothesis of increased deterrence. This opportunity is perhaps present in the recent Swedish decision to permit arbitrary breath testing of drivers in the context of planned roadblocks, but I know of no attempts to obtain and analyze the data. A major hindrance to obtaining a scientific understanding of the nature and impact of Scandinavian laws has been the unwillingness of the Norwegian and Swedish governments to make changes in them, especially in the direction of lower severity. This is explained in part by the existence of strong political forces that have a good deal to lose from questioning the matter of marginal deterrence but little to gain from a demonstration of its achievement due to strong popular support for these laws and the (scientifically unsupported) belief in their effectiveness (Klette, 1978). I have tried to argue (Ross, 1978, p. 59) that the imprisonment of thousands of people for many weeks on the basis of a scientifically unfounded belief should be considered dubious social policy, and that humanitarian as well as scientific considerations would be served by careful and controlled experimentation aimed at determining the costs and benefits of changes in the existing laws. That the politics of the Northern countries preclude this experimentation strikes me as most unfortunate.

## V. GREAT BRITAIN

In 1967 the British Parliament adopted the Scandinavian model in legislation affecting drinking drivers. This represented one of the first important adoptions of the model outside the Northern countries, and it furnished the first large-scale example of demonstrated effectiveness of legislation in deterring drinking and driving. The apparent success of the Road Safety Act of 1967 stimulated the subsequent adoption of similar laws in nations all over the world. Unlike the Scandinavian originals and many subsequent laws, the British legislation had its inception at a fortunate time for analysis. The drinking-and-driving problem in Britain was at a chronic rather than an acute level, eliminating the issue of return to normality as a plausible explanation for any decline in subsequent crashes. British statistical series concerning crashes, fatalities, and related matters were of good quality and were available in considerable detail for several years before and after the inception of the legislation. No other important laws promising reduction in crashes were adopted at or near the same time. Particularly important is the fact that the legislation preceded by several years the strong disruption in world traffic patterns occasioned by the 1973 fuel crisis, which has interfered with evaluations of many subsequent traffic safety innovations. Finally, sufficient time has now passed that further experience will have little effect in modifying conclusions concerning the law's aftermath. The book is now closed on the British Road Safety Act of 1967.

### 1. The national experience.

Again, concerning the British law I shall summarize and update previous work that I have reported in more detail elsewhere (Ross, 1973).

Prior to 1967 British law concerning drinking and driving took the form of modified classical legislation. The chief foundations were the Road Traffic Acts of 1960 and 1962. The former had defined the violation as being "unfit to drive through drink or drugs," and the latter as driving when the "ability to drive properly is for the time being impaired". The Act of 1962 had been adopted partially under the goading of the British Medical Association, which viewed drinking and driving as a health problem and which was impatient with the inefficacy of legal controls in the matter. In particular, the Association was appalled by the difficulty in obtaining convictions of drivers charged before juries (Ross, 1973, p. 13), though problems of identifying and appraising drinking drivers by police and magistrates were also noted. Compared with its predecessor the 1962 Act took steps towards increasing both the certainty and severity of legal threat against drinking drivers. From the viewpoint of severity, an important contribution was to specify a year's mandatory license suspension for serious motoring offenses, a category in which drinking and driving was included. From the viewpoint of certainty, the Act introduced the use of chemical tests for blood alcohol and required that a court should:

> have regard to any evidence which may be given of the proportion or quantity of alcohol or of any drug which was contained in the blood or present in the body of the accused, as ascertained by analysis

> . . . of a specimen of blood taken from him with his consent by a medical practitioner, or of urine . . .; and if it is proved that the accused when so requested by a constable at any such time, refused to consent to the taking of or to provide a specimen for analysis . . . his refusal may, unless reasonable cause therefore is shown, be treated as supporting any evidence given on behalf of the prosecution, or as rebutting any evidence given on behalf of the defense, with respect to his condition at the time (Ross, 1973, p. 14).

Experience following the Act of 1962 did not lead to a conclusion of deterrent effectiveness. The blood test data merely proved what had been suspected before: that drivers with very high blood alcohol concentrations stood a good chance of escaping conviction because of jury sympathy and the inherent vagueness of a classical definition of the offense. The 1962 Act did not provide a fixed level of blood alcohol for conviction, nor was there any legally compelling way of relating the blood test data to the criterion of "impairment". The blood test data were usually translated before the court into estimates of actual consumption of beverages according to a highly conservative table of equivalents. Furthermore the 1962 legislation placed no penalty on a driver for refusing a blood or urine specimen other than that the fact could be noted in court.

The British Medical Association was discouraged by the demonstrated inability of the 1962 law to convict drivers with high blood alcohol concentrations, and was prodded to make further efforts by newly available research concerning the increased crash risk of drinking drivers (Ross, 1973, p. 15). As a result, the Association put its full weight behind a proposal embodying fixed blood alcohol limits, compulsory blood tests and random stops by police for screening purposes. It recruited the Minister of Transport, Mrs. Barbara Castle, to work for enactment of this legislation.

The principle of "random" or arbitrary police stops to test for alcohol, though clearly compatible with deterrence principles, was at the time unprecedented, even in Scandinavia, and it was so strongly resisted in Britain on civil libertarian grounds that the Government withdrew this provision from the proposed law. Instead, permission to demand a screening test was made contingent on the accused being involved in an accident, a moving traffic law violation, or giving reasonable cause to a police officer to suspect that he has alcohol in his body. As noted by Mrs. Castle in Parliament, the retreat from random testing was not complete:

> What we have done is to concentrate the operation of the random principle so that those who can now be required to take a roadside test are more likely to include offenders . . . It will be apparent to hon. Members that these tests will still be random in a very important sense. Accidents can happen to all of us (Ross, 1973, p. 19).

Although the press and Parliamentary debates noted other points of disagreement with the proposed law, including impairment of the relations

between police and the public, undesirable denial of discretion to judges, undue severity of the punishment (license suspension) for borderline cases or those whose living depends on driving, possible harassment of ordinary social drinkers at pubs, and possible errors in testing, no other important changes were made in the bill, which received Royal Assent on May 11, 1967, to become effective on October 9 of that year.

The Road Safety Act of 1967 brought two major changes to existing British legislation on drinking and driving. First, it created the offenses of driving or attempting to drive and being in charge of a motor vehicle on a road or other public place "having consumed alcohol in such a quantity that the proportion thereof in his blood, as ascertained by a laboratory test for which he subsequently provides a specimen . . . exceeds the prescribed limit", which was set at 80 mg./100 ml. Second, it permitted the police to demand a screening test of breath under the conditions noted above. Failure of the breath test or unreasonable refusal would subject the accused to the requirement of a second breath test at a police station and eventually the withdrawal of blood for the evidentiary test. Refusal to take part in the tests was punishable as though the tests had been failed.

It is worthwhile to note that the Road Safety Act of 1967 did not increase the severity of the penalty for drinking and driving. The most feared punishment was the year's license suspension ("disqualification"), which had been enacted in 1962, and in practice the courts added little in the way of additional punishment, other than nominal fines, for violation of the 1967 Act.

That the Road Safety Act of 1967 was controversial before and after its adoption is, in my opinion, a crucial fact. The widespread initial hostility to the proposed legislation, based largely on the provisions for random testing, has already been mentioned. Although this hostility sufficed to eliminate the random test provision in part, it was unable to deflect the Government from enacting the remaining provisions. However, opposition continued strong for months and years subsequently. Antipathy to the legislation was common even among police and judges. The former applied the law in a sparing and restrained way that surprised the Government, which had to throw out hundreds of thousands of screening breath test devices that had passed their expiration dates without use. The latter produced a wealth of decisions favoring defendants on the basis of technicalities, following the ruling in Scott v. Baker that the validity of the blood test in court depends on the prosecution's strict adherence to the required procedure in every detail. This rule allowed defense counsel to search through a complicated procedure for substantively unimportant but technically valid objections to police activity, creating a crisis in police morale and suggesting to the government that yet further legislation would be needed (Ross, 1973, pp. 50-62). In one case, the Divisional Court ruled that a person arriving home while hotly pursued by the police had ceased to be a driver within the meaning of the Act and could not legitimately be asked for a breath test. Likewise, a person stopping temporarily, as to make a telephone call, to visit the toilet, or to talk with a passenger was also held to be not driving. The provision that the test be made "there or nearby" was also narrowly interpreted. When the arresting policemen was without his test kit, a voluntary walk by the accused of 160 yards towards a

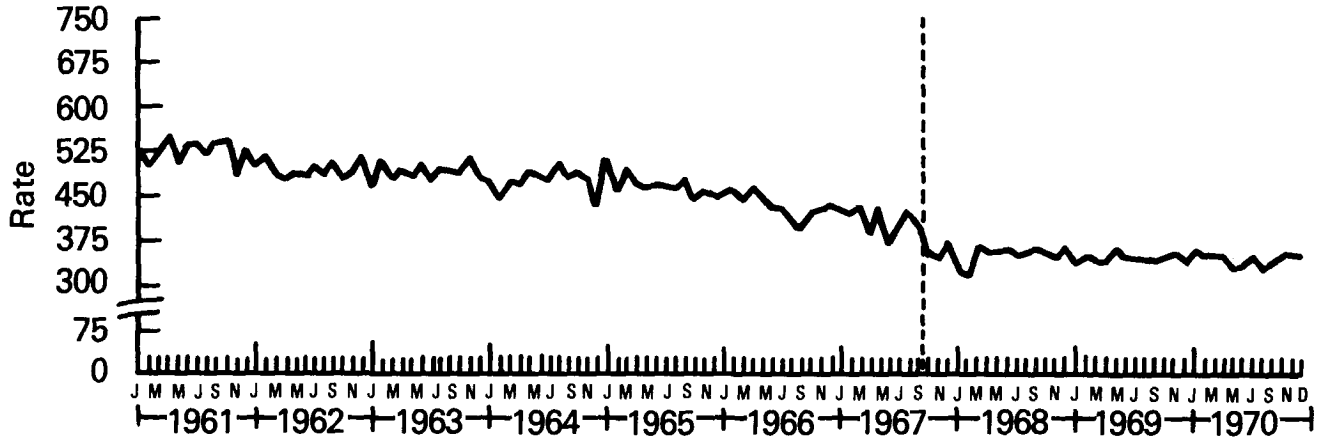
police station was held to violate this provision of the law. These cases were finally overruled, and the legislation "saved," by two favorable decisions in the House of Lords, R. v. Jones and D. P. P. v. Carey. However, several "loopholes" remained, including the famous "hipflask" defense in which the suspect consumed additional liquor "to calm his nerves" after being involved in an accident and before the arrival of the police.

From the viewpoint of the Government these difficulties were sad testimonials to the intransigeance and stubbornness of officialdom, sabotaging virtuous legislation aimed at saving lives. But perhaps from the viewpoint of the deterrent mechanism these difficulties were an unforeseen and essential boon. The Road Safety Act was news!

At the inception of the Act the Government had spent £ 350,000 on a publicity compaign, including preparing and circulating a leaflet on the law and publicizing its provisions with television and other media. However, this campaign was limited in duration, and although surveys at the time showed that people were made aware of the law it is not clear that official publicity alone could have created and maintained the impression of a certain and severe threat. In my opinion it is very likely that continued attention to the law, in large part because of the difficulties mentioned above, helped achieve and maintain a perception of increased threat. This is particularly likely in view of the relatively modest activity of the British police. The number of tests per month went from the neighborhood of 3000 in 1967 to around 7000 or 8000 by early 1971. In all of 1970, approximately 70,000 breaths tests were given in Britain. This contrasts with 48,000 in Sweden in the same year, with a population less than one-sixth as large, or 93,000 in Los Angeles County, with a population of 7 million compared with the 58 million in Britain. It is likely that the threat posed by the Road Safety Act was considerably magnified, for an extended period of time, by the newsworthiness of its loopholes and failures.

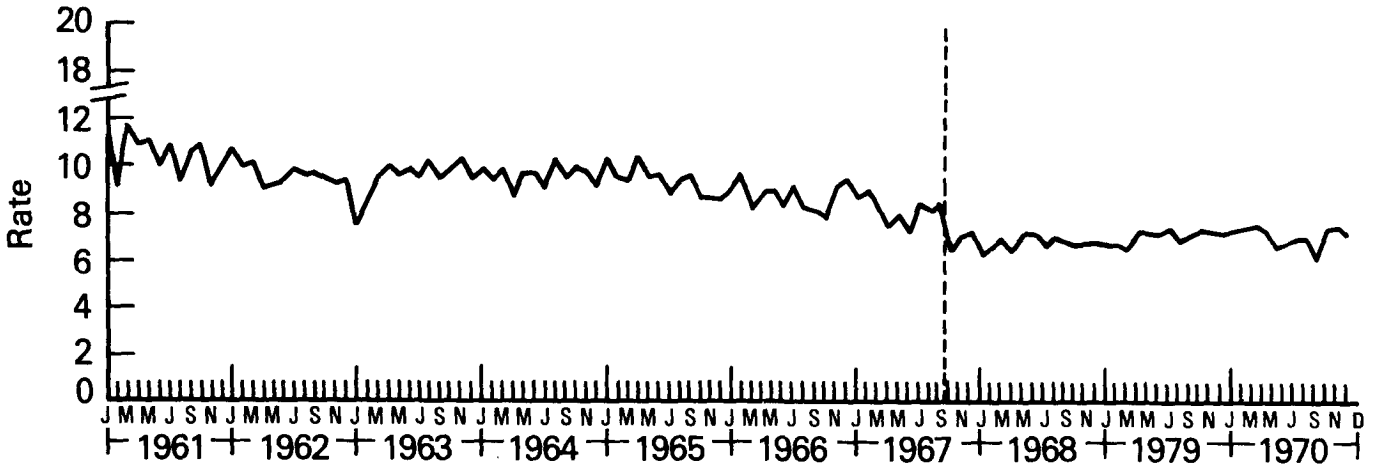
Road casualities declined impressively in the months subsequent to the inception of the British legislation. Officialdom, in a properly restrained manner, implied that the drop may well have been due to the Road Safety Act. More involved parties, such as the temperance movement, were less restrained in their claims. One writer was willing to conclude that the experience of five days surrounding Christmas 1967, compared with the previous year, "provided sufficient proof" that the law was justified (Ross, 1973, p. 21). Such claims are scientifically irresponsible, for they ignore possible differences in weather and similar factors, the possibility of random variation, and other methodological problems noted in my previous discussion. However, unlike the case in Scandinavia, application of adequate methodology to a longer series of data from Great Britain does strongly support the idea that the Road Safety Act of 1967 had a deterrent effect on drinking and driving.

Some of this evidence is diagrammed in Figures V-1 and V-2, which present crash casualty and fatality rates, adjusted for mileage, during the period




Source: Ross, 1973, p. 30.

***Figure V-1. Total Casualties Per 100 Million Vehicle Miles in Great Britain, Corrected for Month and With Seasonal Variations Removed.***

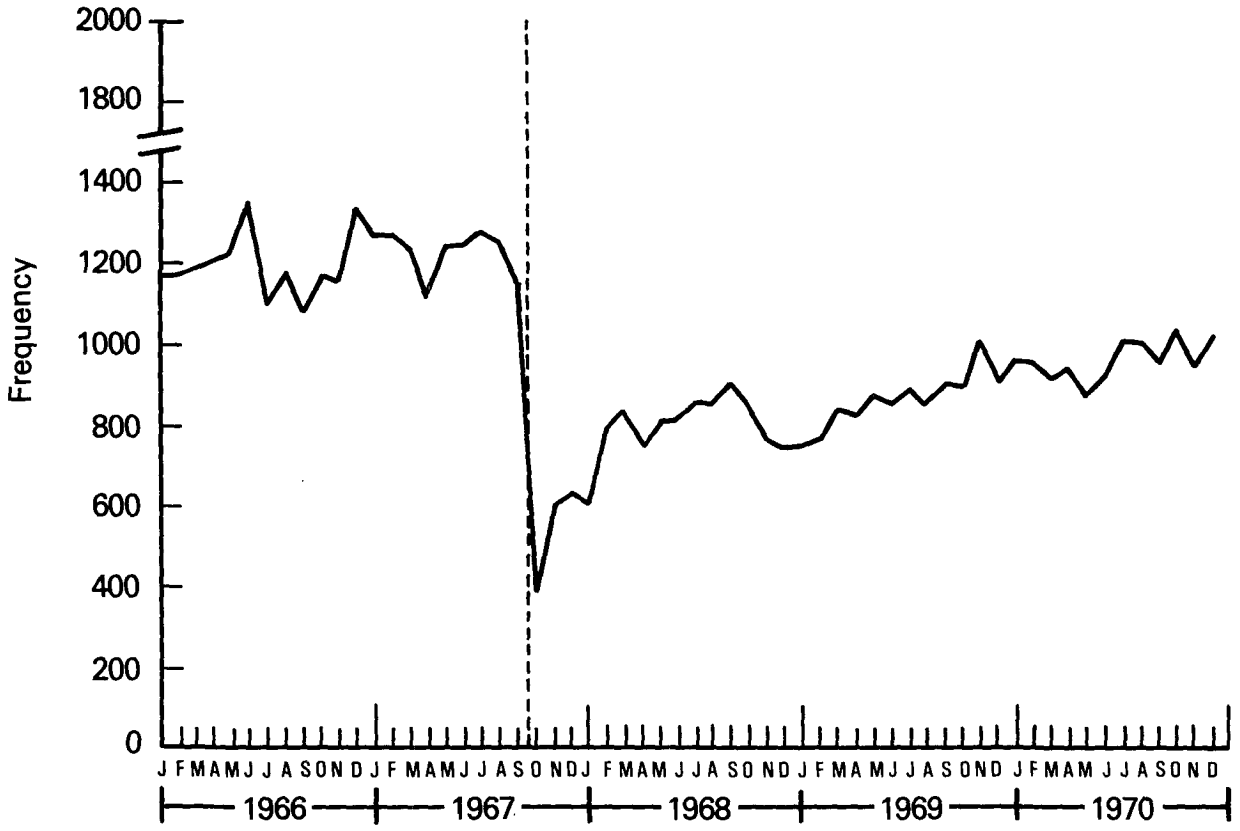



Source: Ross, 1973, p. 31.

***Figure V-2. British Fatality Rate, Corrected for Month and With Seasonal Variations Removed.***

1961-1970. (These data have been corrected for the number of days in the month and a marked seasonal variation has been removed by an averaging process; see Ross, 1973, p. 30.) Although the scale of these figures does not highlight the change in October of 1967, the drop is visible and appropriate statistical tests show it to be significant, i.e., they imply that it was not a mere random change in the level of the curve. The fact that the drop is greater in Figure V-2 than in Figure V-1 supports the interpretation that the drop was due to the drinking and driving law, for independent research shows that alcohol is more involved with fatal crashes than with crashes in general.

Further evidence that the change was due to the law rather than to some simultaneous historical event is presented by the data, in Figure V-3,

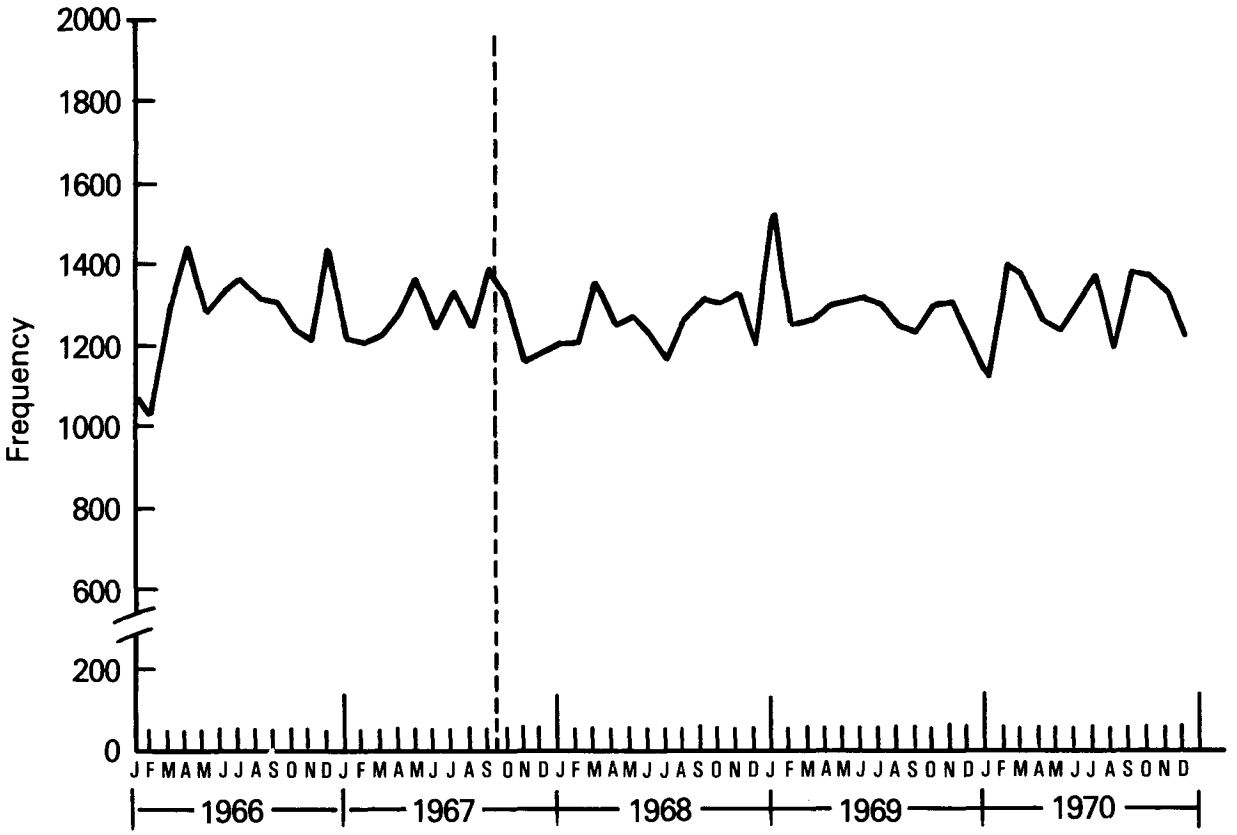



Source: Ross, 1973, p. 33.

***Figure V-3. Fatalities and Serious Injuries in Britain, Combined for Friday Nights, 10 P.M. to Midnight; Saturday Mornings, Midnight to 4 A.M.; Saturday Nights, 10 P.M. to Midnight; and Sunday Mornings, Midnight to 4 A.M.; Corrected for Weekend Days Per Month and With Seasonal Variations Removed.***

Figure V-3

concerning fatal and serious injury crashes on weekend nights. (Corrections for weekends per month and seasonality have also been made in these figures, but because mileage figures specific to the hour of the day are not available these graphs are in terms of incidents rather than rates.) Alcohol is much more commonly involved in weekend night crashes than at other times, rendering series like this more sensitive indicators of drinking and driving. The effect of the Road Safety Act is clearly visible here. The September-October drop is 66 percent, an unprecedented and highly significant decline. This series may be compared with Figure V-4, which presents similar data for weekday commuting hours, when alcohol is relatively rarely involved in




Source: Ross, 1973, p. 34.

***Figure V-4. Fatalities and Serious Injuries in Britain Combined for Mondays Through Fridays, 7 A.M. to 10 A.M. and 4 P.M. to 5 P.M., Corrected for Weekdays Per Month and With Seasonal Variations Removed.***

Figure V-4

crashes. That curve shows only a small and nonsignificant drop, easily attributable to chance. The comparison of the curves strongly supports the interpretation that the reduction in casualties generally is largely explained by a reduction in alcohol-related casualties, which would be predicted if the Road Safety Act operated through the mechanism of simple deterrence.

Additional data are available to support the deterrence interpretation of these findings. No change was found in the number of miles traveled coincident with the Road Safety Act, nor in the sales of alcoholic beverages. However, a comparison of results from surveys of drivers in September 1967, before the Act took effect, and in January 1968, after the Act had been in force for three months, reveals that there was a decline from 60 to 48 percent in the number of drivers admitting to combining drinking and driving. There was also an increase in the number of people reporting walking to their drinking places. The change was largest for drinkers in pubs. Prior to the Act, 49 percent reported returning from the pub by car, whereas after the Act the percentage was 37 (Ross, 1973, p. 65).

Another line of evidence comes from blood alcohol statistics based on tests made of samples of all drivers killed in crashes in England and Wales. The sampling appears to have been fairly complete (Ross, 1979). From December 1966 to September 1967, prior to the inception of the legislation, 25 percent of the victims had illegal blood alcohol concentrations. This declined to 15 percent in the corresponding period of 1967-68. These independent data lend support to the interpretation that the Road Safety Act of 1967, through its effect on perceived threat of punishment, caused people to separate drinking and driving, resulting in the saving of many lives (Ross, 1973, p. 66).

Although the evidence is strong that the Road Safety Act was initially effective, it is also now clear that this initial effect dissipated within the period of a few years. One source of evidence for this conclusion appears in the close study of Figures V-1 and V-2 above, which found evidence of the initial effectiveness of the 1967 law in the simultaneous drops in crashes and fatalities. The curves show not only a change in level in October 1967, but also a change in slope. The curve of total casualties fell less steeply after 1967 and the curve of fatalities actually changed direction from decline to an increase. Both of these changes are statistically significant (Ross, 1973, pp. 30-32). Extrapolation of either curve predicts that, without further change, the initial casualty savings would disappear over time. This same prediction can be made of the curve based on more specialized data in Figure V-3.

No further research has been reported using precisely the data underlying these curves. However, British sources have confirmed the conclusion of diminished effect using related data series: the proportion of casualties during the main drinking hours of 10 P.M. to 4 A.M. (on all nights) and the blood alcohol levels in drivers killed in crashes. Table V-1 reports the former percentages through mid-1973 (Sabey and Codling, 1975, p.75):

Table V-1. Percentages of British casualties in the main "drink" hours (10 P.M.-4 A.M.)

| | 1966-67 | 1967-68 | 1968-69 | 1969-70 | 1970-71 | 1971-72 | 1972-73 |
|---|---|---|---|---|---|---|---|
| Killed | 28.3 | 21.3 | 22.5 | 24.3 | 25.0 | 25.7 | 26.2 |
| Injured | 21.2 | 15.6 | 17.1 | 18.1 | 19.0 | 19.1 | 19.8 |

Table V-2 reports the percentages of drivers with illegal blood alcohol concentrations through 1976 (Sabey 1978, p. 192):

Table V-2. Percentage of fatally injured drivers with blood alcohol concentrations exceeding 80 mg./100 ml.

| 1967 (to Sept) | '68 | '69 | '70 | '71 | '72 | '73 | '74 | '75 | '76 |
|---|---|---|---|---|---|---|---|---|---|
| 32 | 20 | 25 | 23 | 27 | 30 | 33 | 36 | 38 | 38 |

On the basis of these data, British officialdom has come to the flat conclusion that: "In short, the effect of the Act is wearing off" (Saunders, 1975, p. 845).

One can look, as did Saunders, for the origin of this loss of effectiveness in terms of such larger social trends as increasing alcohol consumption due to changes in the real price of alcoholic beverages, changes in the size and distribution of national income, and other factors. However, inspection of data from the early years of the Act indicates that deterrence was being accomplished without a decline in alcohol consumption, apparently because drinking was being separated from driving. There is no reason why the same phenonemon could not take place even with an increase in alcohol consumption. In contrast, consideration of the deterrence model in the context of the British experience provides an alternative and, to my mind, plausible explanation for the long-run failure of the Road Safety Act of 1967.

The deterrence model suggests that British drivers separated their drinking and driving following passage of the legislation because they feared that there was now a realistic likelihood of being punished. There is no empirical evidence concerning the development of this belief, but it

is reasonable to infer in the light of the historical events detailed above. However, the real chances that a drinking driver would be caught, charged and convicted in Britain, though much increased, never reached a very high absolute level. The gap was not in the matter of conviction -- the vast majority of those charged were convicted (Saunders, 1975, p. 851) -- but rather in the probability of being charged. I calculated that in 1970 the probability of being breath tested in Great Britain was about one for every two million vehicle miles driven. Although the number of breath tests administered since that time has increased, the chances of being tested are still on the order of one in a million, more or less. (Of course, since the tests are selectively administered the chances of a drunk driver being tested are probably higher.) Although there is insufficient evidence to evaluate the certainty of the legal threat with any precision, it appears to be very low by any reasonable criterion.

The initial publicity campaigns and newsworthiness surrounding the Road Safety Act made the legislation very well known. They also very likely gave a grossly exaggerated picture of the certainty of apprehension that might be expected by a drinking driver in Britain. I believe that it was this exaggerated perception of certainty, coupled with a severe punishment, that resulted in the impressive deterrent effectiveness of the Act. It seems to me reasonable to ascribe the subsequently rising curves of casualties and of alcohol-related deaths to the gradual learning by the British driving population that they had overestimated the certainty of punishment under the new law. The obvious benefits of drinking and driving -- inexpensive and convenient transportation in connection with a "normal," alcohol-related, social life -- overwhelmed the deterrent efficacy of the British legislation.

2. The Cheshire "blitz".

The ability of the British "breathalyser law" to deter drinking and driving was demonstrated on a local level in the course of an enforcement effort decreed by the Chief Constable of Cheshire, Mr. William Kelsall. The success of Kelsall's policy gives further evidence for the interpretation offered above concerning the achievements and difficulties of the Road Safety Act of 1967 on a national level (Ross, 1977).

Although British police, unlike the American, are a national organization, there rests considerable discretion in the various constabularies in the manner of enforcing the law. The Chief of the Midlands county of Cheshire exercised this discretion to increase greatly the number of tests and also of prosecutions under the breathalyser law. In 1975, concerned with the apparent falling off of the law's effectiveness, he decided to conduct an "experiment . . . to go as far as we could within the law to breathalyse all people driving between 10 at night and 2 in the morning." He required that policemen under his authority administer the tests in the course of all investigations of crashes and of traffic law violations during these nighttime hours for one week during July. There resulted 284 breath tests during the "experimental" period, compared with 31 in the same period of the previous year. Moreover, 38 drivers were found to have illegal blood alcohol concentrations, compared with 13 in the prior year. Although testing in the normal year was proportionately more likely to find positive results, it appeared that numbers of alcohol-influenced drivers had been

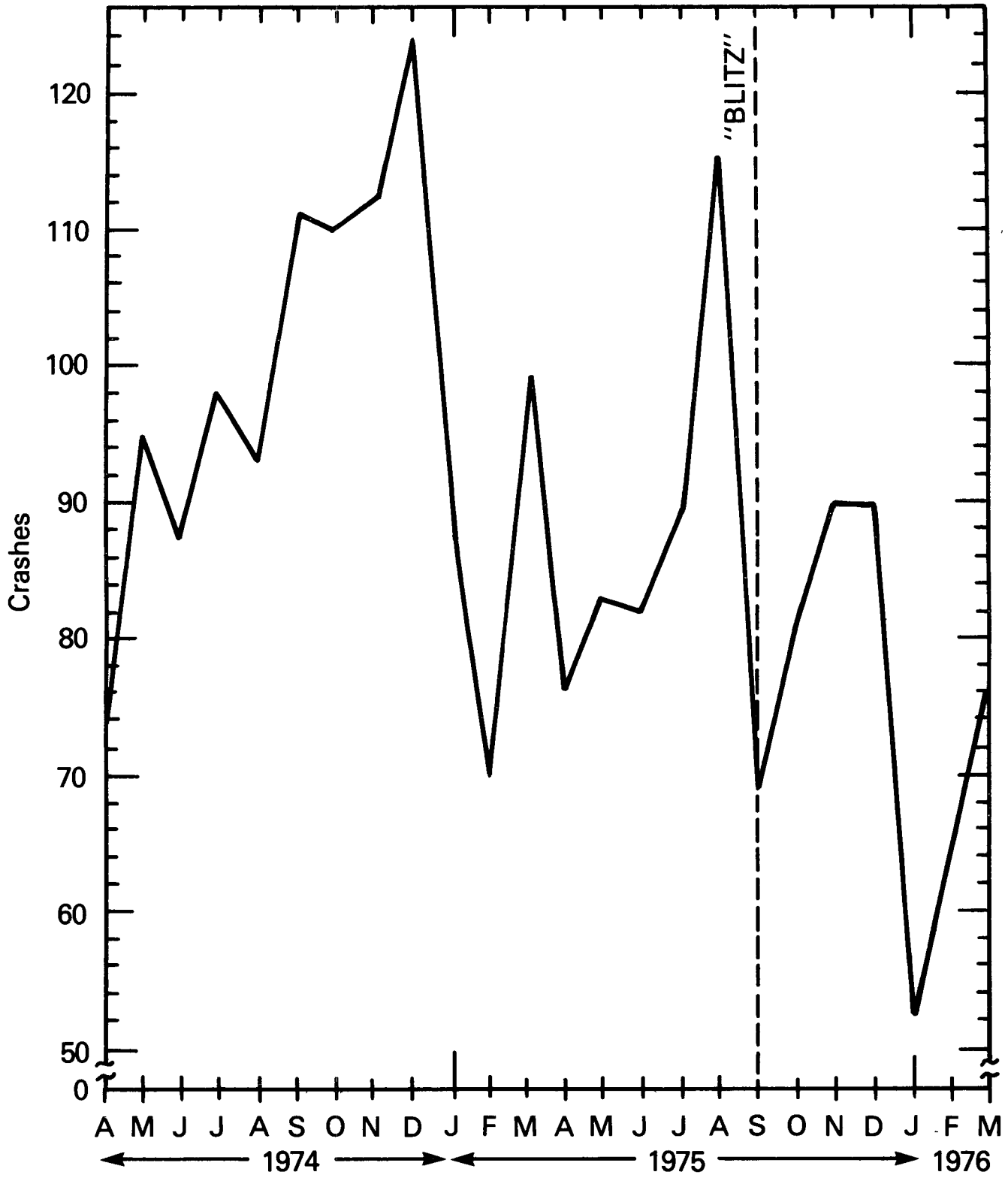
escaping detection even though having become involved in a law violation or a crash and susceptible to the requirement of a breath test.

Chief Kelsall decided to expand the "experimental" period to the hours of 9 P.M. to 4 A.M., to obtain a "control" sample from the hours of 2 P.M. to 5 P.M., and to maintain the effort for virtually the entire month of September 1975. However, on this occasion word got out, and the Chief was the object of vehement protest by representatives of automobile clubs and by local political figures, who claimed that the effort was equivalent to random testing, which Parliament had specifically eliminated from the Road Safety Act. Kelsall refused to yield to this pressure as a matter of principle, and his support was sufficient to enable him to complete the month's effort, which then took on the characteristics of a visible and even notorious enforcement campaign.

As with the Road Safety Act of 1967 at its inception, the Cheshire "blitz" was associated with a diminution in serious crashes which was officially interpreted as an effect of the enforced law. Interrupted time-series analysis of fatal and serious injury crashes supports the interpretation, even though the method is less powerful in dealing with the smaller data base and less detailed statistics available for Cheshire than with the national data. The figures for all serious crashes are presented in Figure V-5. There is a drop in September of 1975 that is statistically significant (and, incidentally, no drop in July when the increased enforcement was not publicized). The inference of a deterrent effect for the September campaign is reinforced by the evidence in Figure V-6 concerning serious crashes during drinking hours. The decline in this figure does not quite reach statistical significance because of the great variability of the number of crashes in this small data base, but it can be viewed as strongly suggestive, especially as the curve for low-alcohol-consumption hours (not shown) shows no such change associated with the "blitz".

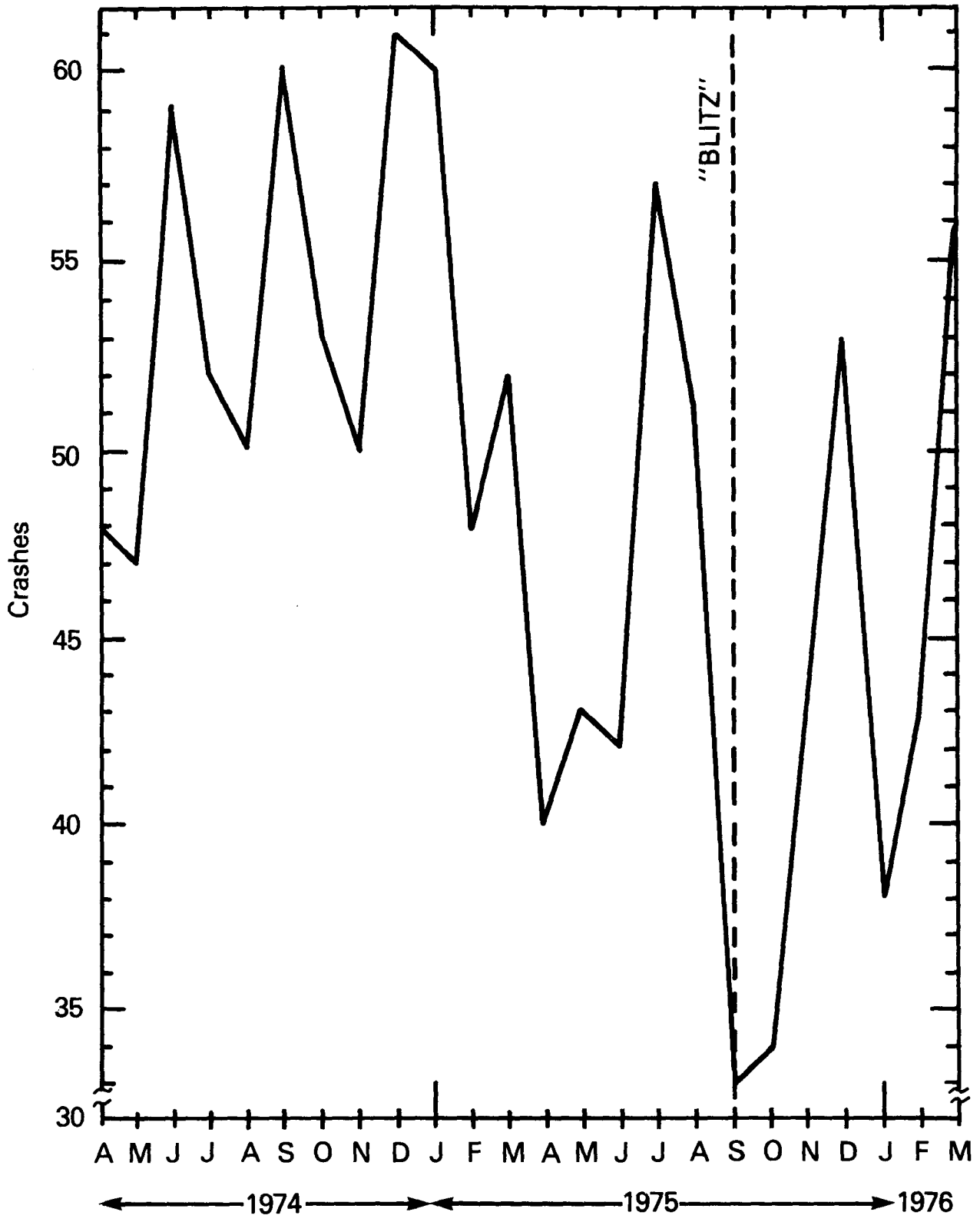
During the course of the Cheshire breathalyser "blitz" the level of breath testing in the county rose to six times the national average. Whether such a level is necessary to obtain the achieved results, whether it would be sufficient to maintain an effect over the longer run, and how the actual enforcement interacted with its newsworthiness to produce a decline in drinking and driving are among the important but unanswered questions relevant to this experience.

In sum, although the nationwide deterrent effect of the British Road Safety Act of 1967 appears to have largely dissipated within a few subsequent years, this effect was regained in the course of a limited local increment of enforcement and (inadvertent) publicity.




Source: Ross, 1977, p. 246.

***Figure V-5. Crashes Producing Serious or Fatal Injuries in Cheshire, England.***




Source: Ross, 1977, p. 247.

***Figure V-6. Total Crashes During Drinking Hours (10 P.M. to 4A.M.) in Cheshire, England.***

## VI. NEW ZEALAND

### 1. The compulsory blood test law of 1969.

New Zealand legislation in the matter of drinking and driving closely followed the model of the British Road Safety Act of 1967. The Transport Amendment Act of 1966 had established a procedure for taking blood samples of accused drivers, and in 1969 the status of a blood alcohol concentration of 100 mg./100 ml. was changed from a rebuttable presumption of alcoholic influence to an absolute limit and cooperation in furnishing blood samples was made compulsory. Although other modifications of the law took place subsequently, the 1969 change is considered the most substantial and it has furnished the basis of the principal published evaluation (Hurst, 1978).

The 1969 legislation provided that a police officer could demand a screening breath test of a driver if the officer had "good cause to suspect an alcohol offence" (Hurst, 1978, p. 288). (In 1974 it became necessary only to suspect the driver of having consumed alcohol.) Failure of the initial test led to a second test 20 minutes later, and failure of the second breath test resulted in the requirement of a blood test. Cooperation with the screening tests was not mandatory, but noncompliance rendered the blood test compulsory. Refusal of the blood test led to the same penalties as its failure. These penalties included a minimum license suspension ("disqualification") of six months, except in "special circumstances," in addition to fines and possible prison or "detention". Hurst reports that typical sentences since the 1969 law included fines of $50.00 to $400.00 and a license suspension averaging twelve months.

In the first full year under the new law there were nearly 5000 drinking-and-driving prosecutions in New Zealand, a rate (based on vehicle registrations) approximately three times that in Britain under the Road Safety Act of 1967, and by 1975 the rate had more than doubled, after which it stayed relatively constant. Furthermore, the proportion of prosecutions ending in convictions reached between 96 and 97 percent.

Hurst's evaluation of the New Zealand legislation uses a variety of official measures of effect. His overall conclusion is negative:

> It is concluded that the 1969 law did not have the kind of immediate effect that was achieved in Great Britain in 1967. There may have been a more gradual effect, but one cannot be confident that such a effect occurred. The difference in impact was almost certainly due to attendant circumstances and the quite different types of publicity given the alcohol campaigns in the two countries. It was clearly not attributable to differences in the statute's content or in its enforcement, which has always been relatively active and has increased over the years (Hurst, 1978, p. 287).

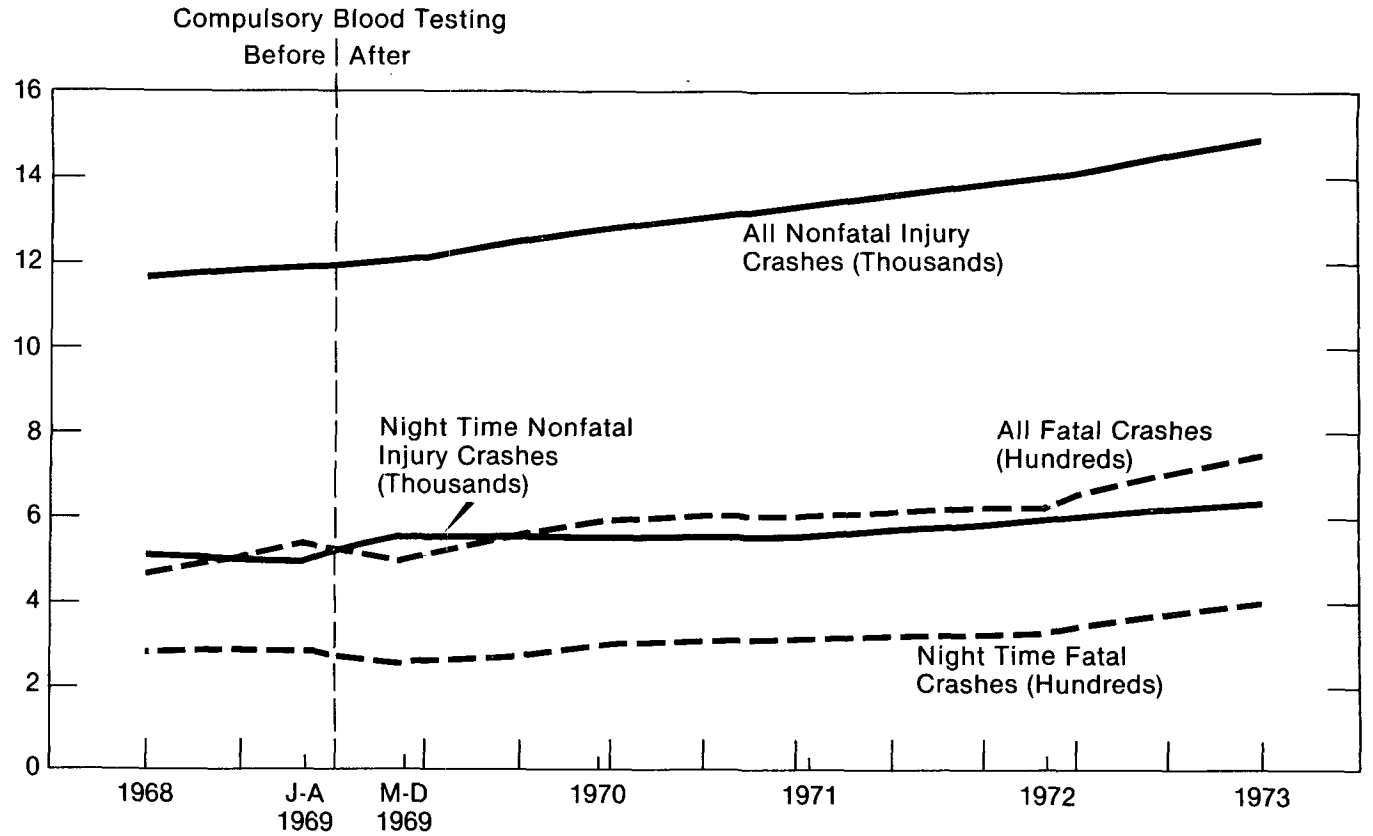
Hurst's negative conclusion seems to be overly pessimistic. I believe it results in part from reliance on inappropriate data -- police estimates

of alcohol involvement, which are an inadequate base for scientific evaluations -- and, in part, from his anticipation of larger and more permanent results than warranted from the nature of the law. I interpret the small changes in the data series as supporting the conclusion that the law did have an immediate effect, though not a lasting one. The data are not sufficiently precise to render a firm or dependable basis for estimating the effect, and it is not possible to quarrel with Hurst on statistical grounds. However, this umpire would call the game differently.

The first criterion used by Hurst is "reported alcohol involvement in accidents". This takes the form of only very brief time series because data from before 1968 were not available and the manner of reporting crashes changed radically eight months after the change in the drinking-and-driving law. Hurst finds that the proportion of fatal crashes reported to have involved alcohol went from 23 percent in 1968 to 21 percent in the first four months of 1969, before the change in the law, to 25 percent in the balance of the year, following the legal change. Reported alcohol involvement in injury crashes was 8 percent, 12 percent and 11 percent in these time periods. Clearly the changes are small, very likely nonsignificant, and in the case of fatal accidents unfavorable to the hypothesis of a change. However, for reasons presented in the discussion of evaluation more generally, police conclusions concerning alcohol involvement are not scientifically acceptable. I would place little weight on conclusions drawn from these data.

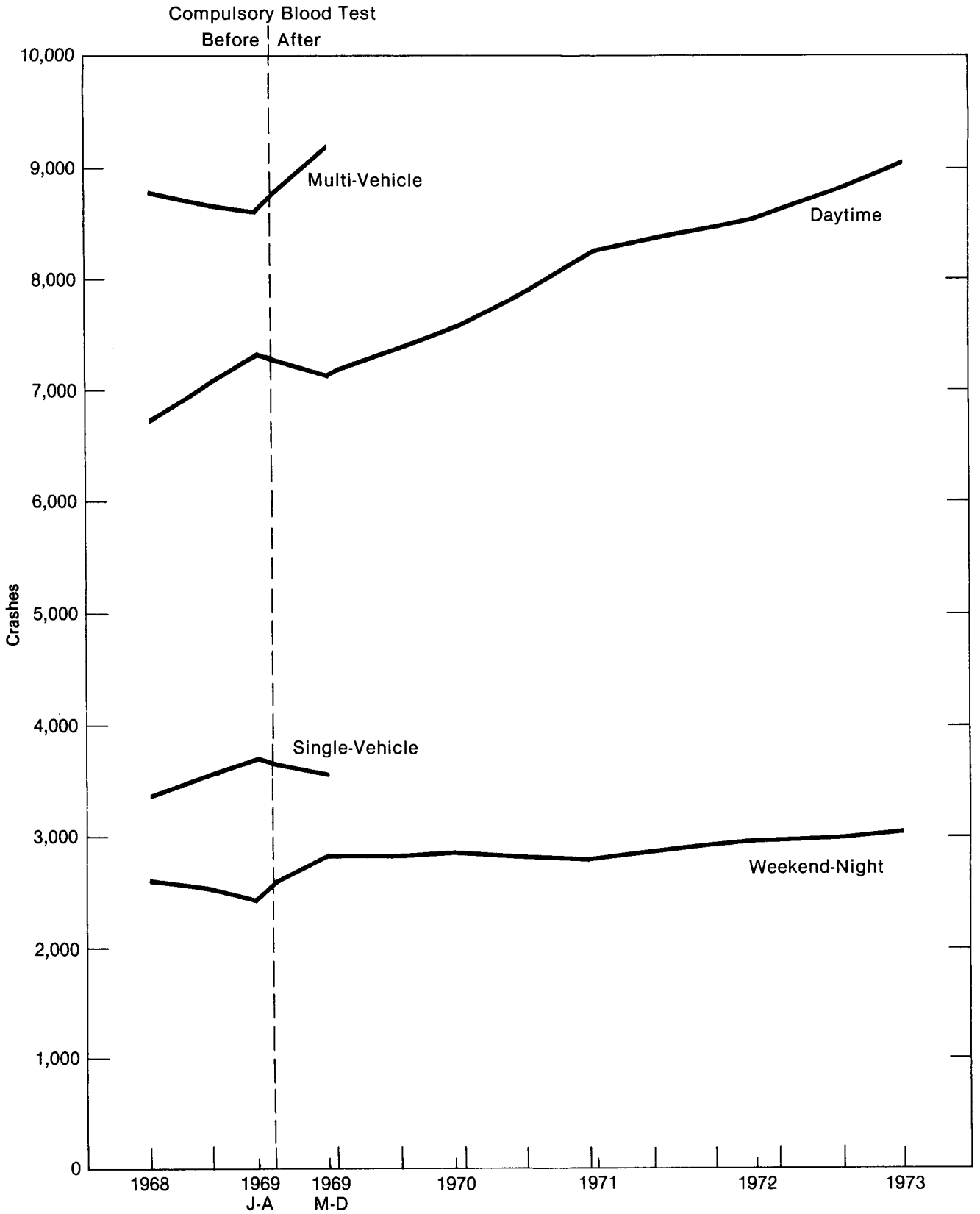
Data on fatal crashes as a whole are available on a more extended basis, and are reported on an annual basis from 1968 through 1973 (though separately during 1969 before and after the legal change). These data appear as the upper dashed line in Figure VI-1. There was a 6 percent decline in fatal crashes during the post-intervention period of 1969. Hurst acknowledges this change but notes that "the numbers involved are too small to prove that anything beyond chance was operating . . ." (p. 289). Non-fatal crashes, diagrammed in the top line of Figure VI-1, did not decrease. However, the increase in the post-intervention period was the smallest in the series. Again, Hurst points to the nonsignificance of the difference. Nighttime fatal crashes, the bottom line in the figure, dipped proportionately even more; indeed, the decline in total fatal crashes is entirely explained by the nighttime decline. Non-fatal crashes showed no apparent indication of change in mid-1969.

Additional relevant data appear in Figure VI-2 . Weekend crashes (combining fatal and non-fatal) did not vary as suggested by theoretical expectations; however, the contrast between the role of alcohol on weekends (all hours) and weekdays is not as meaningful as that between nights and days, and data for fatal crashes alone were insufficient for analysis. A further comparison, three-point series of single-vehicle and multiple-vehicle crashes, does conform to expectations based on the hypothesis that alcohol involvement in crashes was reduced by the legal change. Again, without a basis for estimating random variation, Hurst is correct in concluding that statistical significance is lacking.




Source: Hurst, 1978, p. 290.

***Figure VI-1. Fatal and Injury-Producing Crashes in New Zealand.***




Source: Hurst, 1978, p. 291.

***Figure VI-2. Fatal and Injury-Producing Crashes in New Zealand by Time and Type.***

The official New Zealand data, as presented here, are indeed far from ideal measures for investigating the effect of the 1969 law. The series are very short, and although several years are covered, in most of them the lack of monthly breakdowns severely limits the number of observation points. Nonetheless, three of the four comparisons, though not statistically significant, do support expectations based on the deterrence model. If a deep and long effect were expected, the results must be considered disappointing. If, on the other hand, a 6 percent decline in fatal crashes is meaningful and if expectations include a possible return of matters to the status quo ante in a relatively short time, the New Zealand experience is arguably one of confirmation for the deterrence model.

It is possible that monthly data pertaining to the series presented by Hurst may yet be available, and that a reanalysis of the series based on those data may provide more support for an effect of the law than his analysis yields. In the absence of such data, I offer an interpretation that seems as reasonable to me as does that of little or no effect, and which accords with experience in a variety of other situations examined in this report. If the curve of fatal crashes in Figure VI-1 is compared with the comparable one in Figure V-1 above, the difference between the British and New Zealand experiences does not seem fundamental. New Zealand data were not adequate to attempt a replication of Figure V-3, which so conclusively supports deterrence in the British case.

It is worthwhile noting in any event that the New Zealand law was perhaps not favored with publicity as strong as that which, apparently, helped the British law in creating the impression of threat for violators. The New Zealand publicity is not described in detail in Hurst's article, but the discussion section notes that:

> . . . publicity emphasized social values and the need to reduce the accident risk from drinking. There was no great attempt to frighten potential offenders, and the "due cause to suspect" provision was not only explained but advertised. It may be that these efforts toward public enlightenment blunted the edge of the law (p. 295-296).

Furthermore, the 1969 amendment to the New Zealand Transport Act does not appear to have been a matter of national news, as was the British Road Safety Act of 1967.

Hurst also suggests that a second reason for the "failure of New Zealand to match the British experience" lies in the greater novelty of the alcohol testing provisions in British law. He is mistaken on this point: Britain, like New Zealand, had blood test provisions in its earlier law (the Road Traffic Act of 1962) and the relative novelty of the two legal changes strikes this observer as about the same.

2. The New Zealand "blitzes".

A more optimistic view of the effectiveness of the New Zealand drinking-and-driving law, modified by further amendments in 1971 and 1974, is contained in a second evaluative study (Hurst and Wright, 1980). This report concerns the results of two intensified enforcement campaigns in 1978, probably spurred by reports of the effectiveness of the Cheshire Constabulary's campaign. The campaigns are described as follows:

> The nationwide blitz began at noon of 15 July (a Saturday) and continued through Monday 31 July. It was heralded by a week's advance publicity taking the form of media announcements. These were followed by paid advertisements in radio, television and newspapers which began on 17 July and continued until 5 August, five days after the end of the enforcement campaign.
>
> The motorist, who had been told when the campaign would begin, also knew what tactics might be employed. . . He had reasons to believe that, if he were stopped by an enforcement officer, there was an increased chance of being breath tested (on suspicion of having recently been drinking). He also knew that there was an increased chance that he would be stopped by an enforcement officer, especially during the popular drinking hours.

Concerning the second campaign:

> A publicity campaign commenced on 4 December 1978 with advertisements in newspapers, and on radio. It was aimed to reach the late teen - early twenty group. A traffic officer was featured in a half page newspaper advertisement presenting a rather threatening message and image. . . .
>
> One additional factor that reinforced specific blitz publicity was that the New Zealand legislature, on 1 December 1978, passed new legal provisions aimed at the drinking driver. The main provisions were a raising of the monetary maximum for conviction from $400 to $1500, the lowering of the blood alcohol limit to 80 milligrams/100 millilitres and the introduction of an absolute breath alcohol limit of 500 micrograms per litre. At the same time, evidential breath testing was introduced, although the availability of testing devices was limited.

Both "blitzes" involved increased police activity. The number of screening tests was quadrupled in the first effort and doubled in the second. Moreover, in the second campaign the publicity announcement generated some public consternation and the Automobile Association complained that random alcohol checks were being made under the pretext of vehicle equipment checks, situations reminiscent of Cheshire and likely to enhance the effect of the paid publicity through media attention.

The evaluation of the New Zealand "blitzes" seems to have been more effectively guided by methodological principles than the evaluation of the 1969 law, and there was greater success in obtaining appropriate data series.

Unlike the prior publication, this one "did not consider the officially reported rate of alcohol involvement, considering this to be worse than useless at a time of dramatically increased concern over the drinking driver."

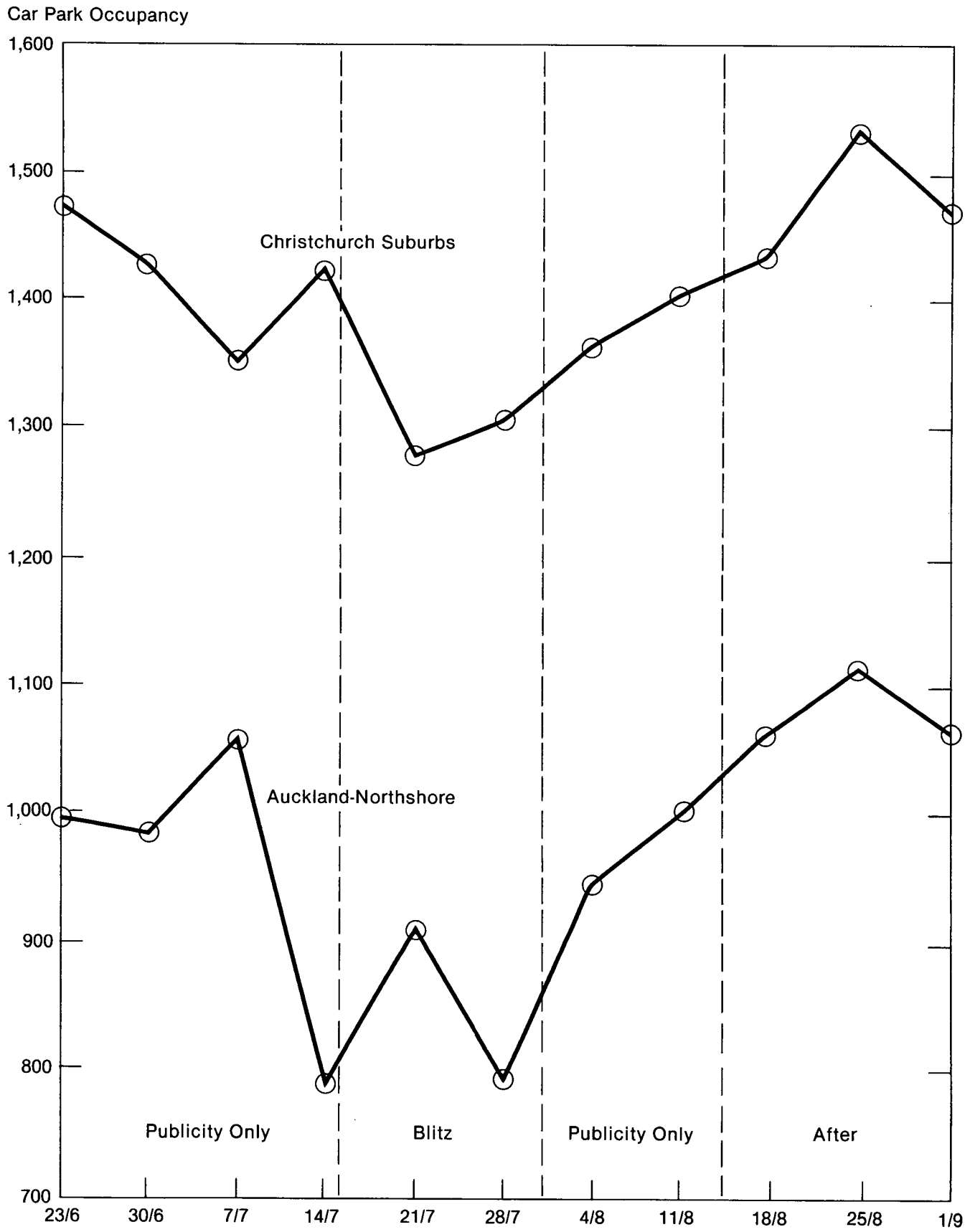
The evaluators present observations of liquor consumption in two rental ballrooms in Auckland for 11 evenings prior to the first blitz, 9 during the blitz and 17 afterwards. Average millilitres of absolute alcohol consumed were 75.8, 67.8, and 82.7. In the absence of prior years' data to indicate seasonal variations they do not test these differences for significance and regard the differences as merely suggestive of a deterrent effect. Another unobtrusive evaluation measure is carpark occupancy at selected hotels and taverns in Auckland and Christchurch late on Friday evenings. The results in Figure VI-3 are again reasonably in accord with predictions from the deterrence model.

A drop also appeared in road injuries reported by 20 cooperating hospitals during the first blitz, shown in Figure VI-4. The second blitz was evaluated with similar data furnished by an initial 23 cooperating hospitals, joined later by three others in Auckland; both data series are illustrated in Figure VI-5. These time-series graphs are in general harmony with expectations, though the interpretations would be more securely based had the series been somewhat more extensive.

Claims filed with the Accident Compensation Commission were analyzed depending on whether they occurred during "main drinking hours" or at other times of the week. The ratio is graphed, with the previous year for comparison, in Figure VI-6 for the first blitz and Figure VI-7 for the second. Due to the presence of prior trends it would be easier to interpret these curves, especially Figure VI-7, if the time series were more extended and if the comparison curve were composed of data from more than one year. However, the results are again supportive, and the cumulation of a variety of fallible data compensates for the weaknesses in any particular demonstration.

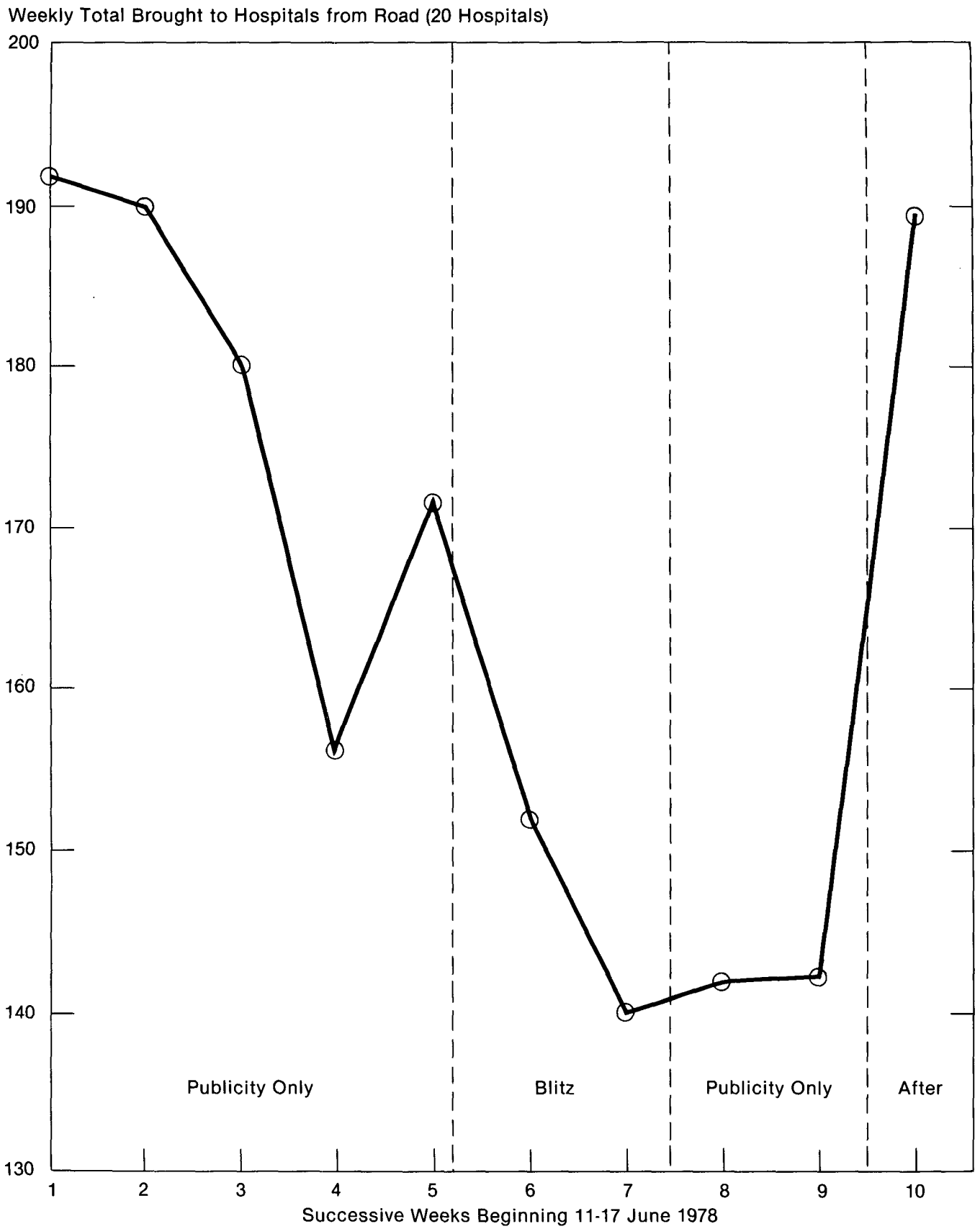
Total serious crashes were analyzed in a variety of ways, one of which is presented in Figure VI-8 which shows the ratio of nighttime to daytime crashes, and seems particularly convincing. Fatalities, graphed in Figure VI-9 did not furnish much evidence for the effect of the first blitz, though the second seems to be reflected in the curves. The only indicator studied that failed to reflect an appropriate change for either blitz was the ratio of single-vehicle to multiple-vehicle crashes.

In the light of the numerous analyses and despite the negative results for single-vehicle crashes, I would not want to quarrel with Hurst and Wright's conclusion that "each of the two enforcement blitzes reduced the road losses that normally accrue from alcohol impaired driving." One might note that no analyses were performed to identify the working of the mechanism, whether through decreased driving, decreased alcohol consumption, or the separation of drinking and driving. One might also note the limited nature of these "blitzes" -- as in Cheshire, they had definite terminations, and all the indices show that either immediately or after a short lag things looked very much as before. No permanent change seems to have been achieved.



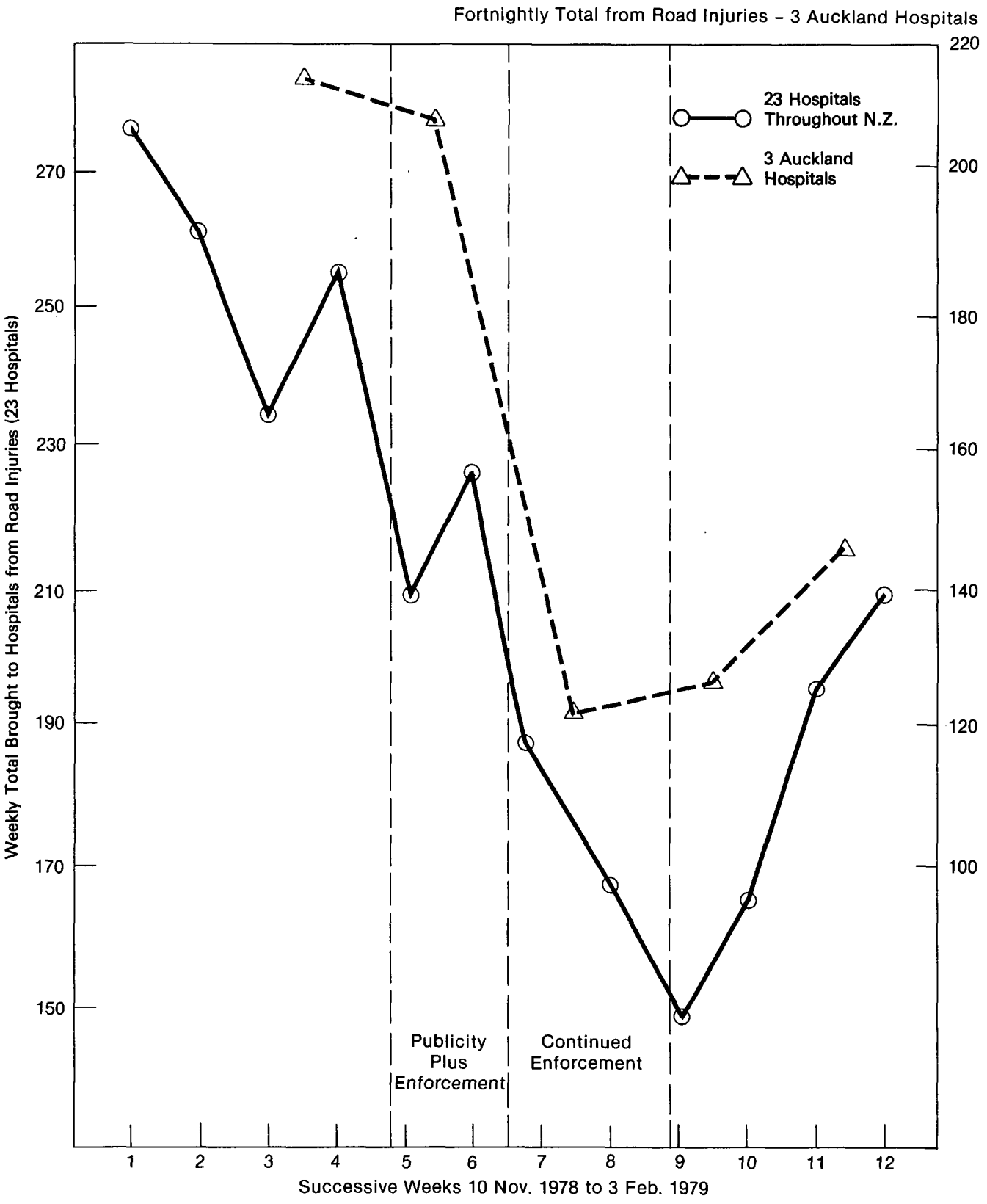

Source: Hurst and Wright, 1980, Figure 1.

***Figure VI-3. Carpark Occupancy for Selected Taverns in Christchurch and Auckland, New Zealand, in the Vicinity of an Enforcement "Blitz".***



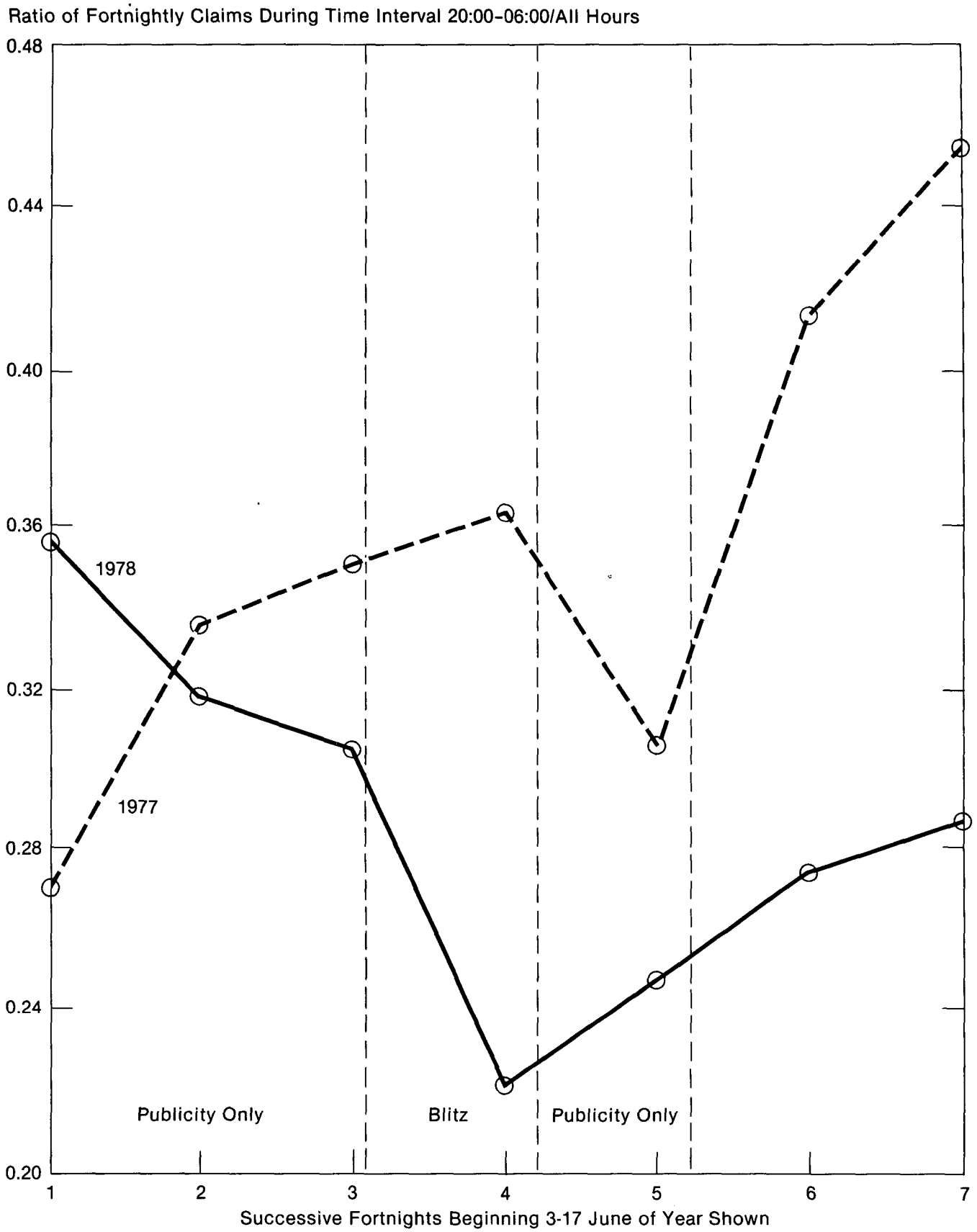

Source: Hurst and Wright, 1980, Figure 2.

***Figure VI-4. Crash-Involved Drivers Hospitalized in Selected Hospitals in New Zealand in the Vicinity of an Enforcement "Blitz".***



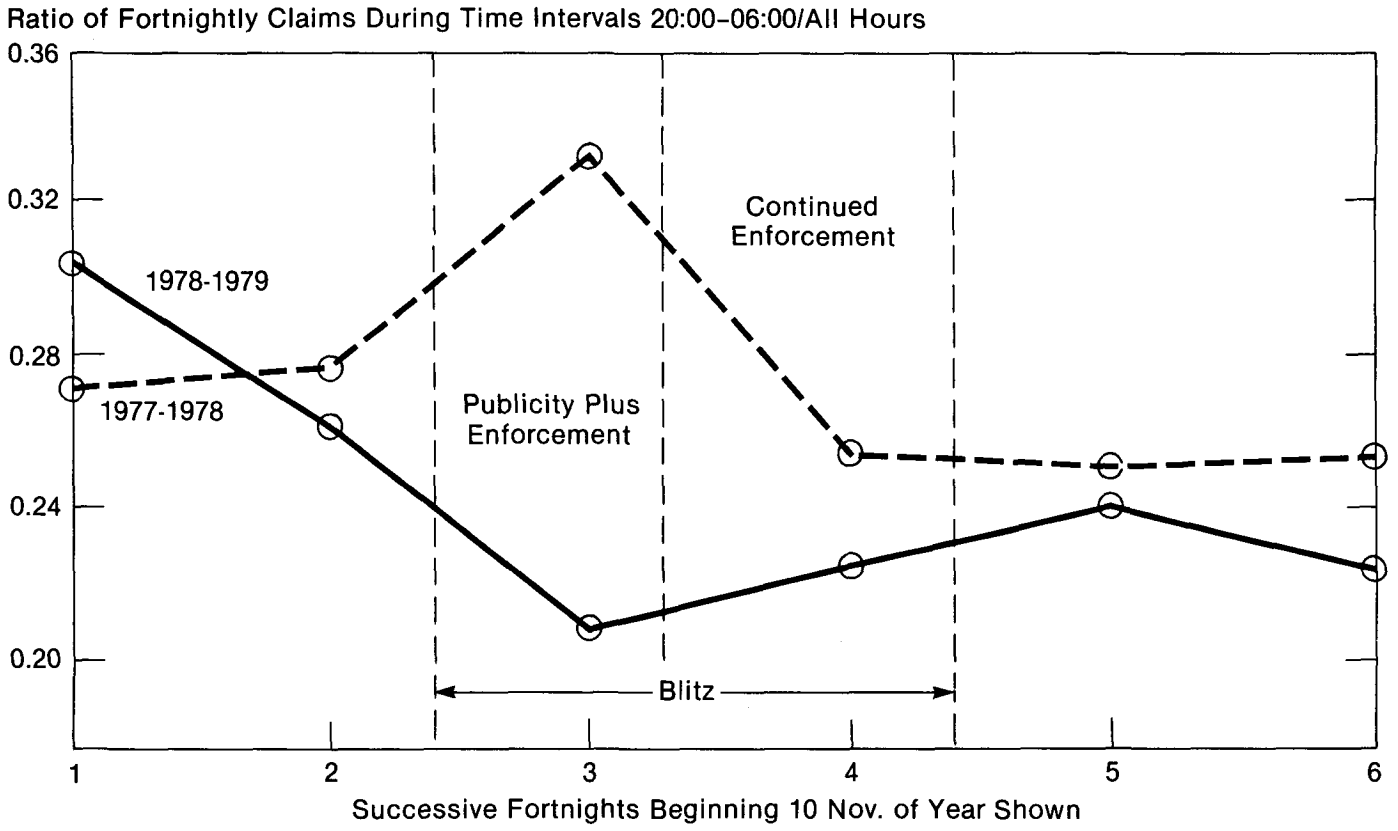

Source: Hurst and Wright, 1980, Figure 3.

***Figure VI-5. Crash-Involved Drivers Hospitalized in Selected Hospitals in New Zealand in the Vicinity of the Second "Blitz".***



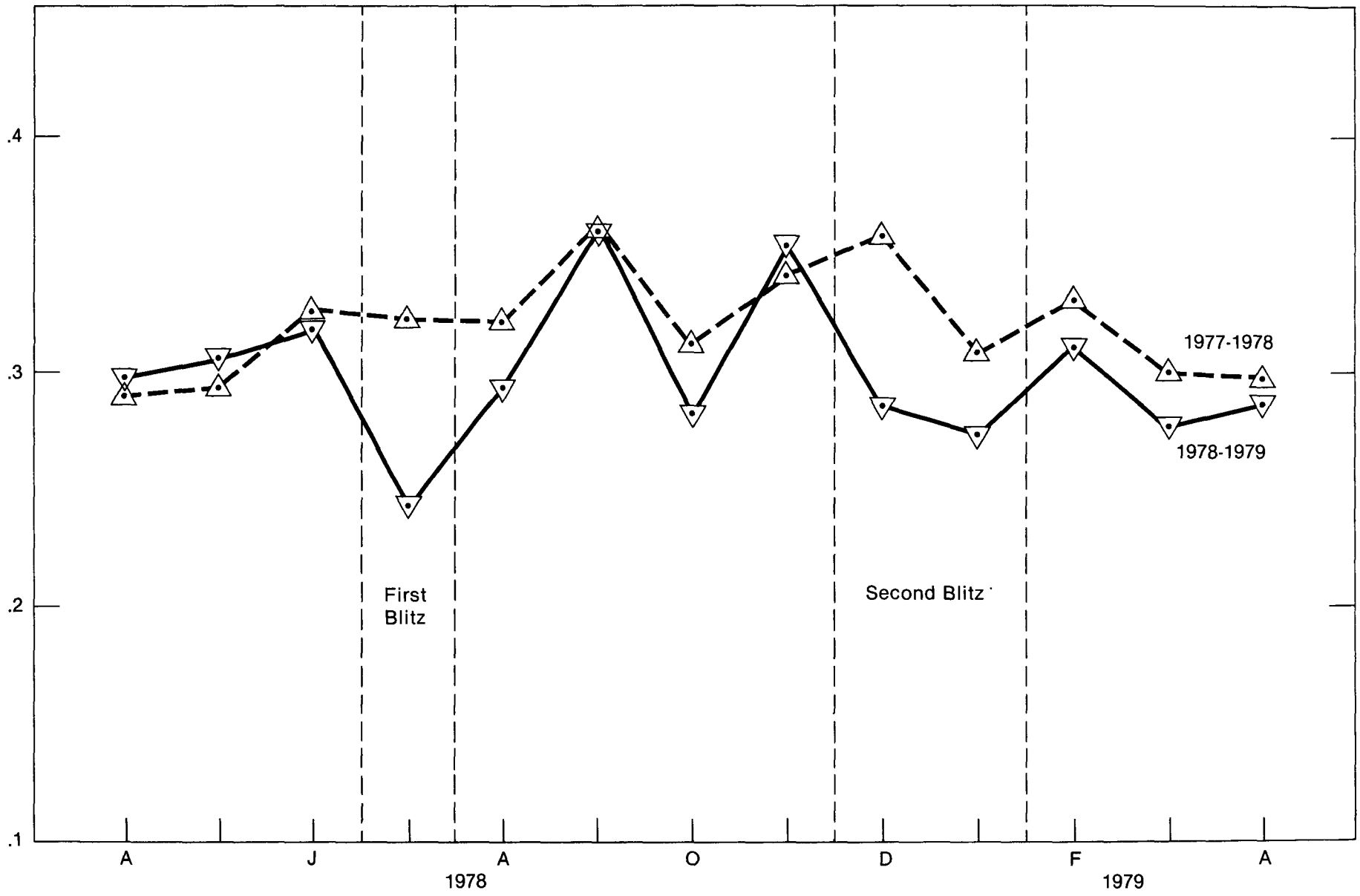

Source: Hurst and Wright, 1980, Figure 5.

***Figure VI-6. Ratio of Nighttime to Total Accident Compensation Claims in New Zealand in the Vicinity of an Enforcement "Blitz".***



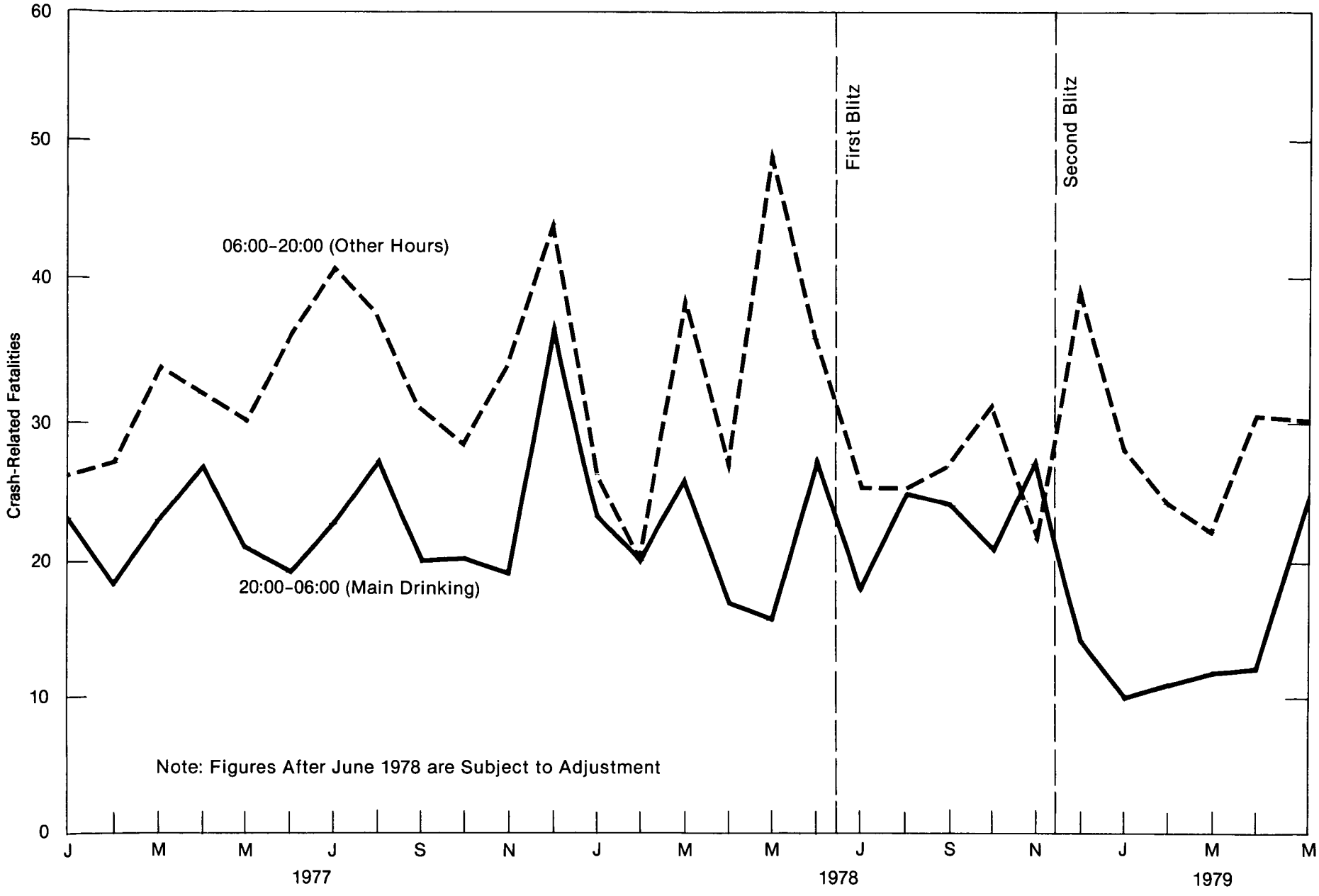

Source: Hurst and Wright, 1980, Figure 7.

***Figure VI-7. Ratio of Nighttime to Total Accident Compensation Claims in New Zealand in the Vicinity of the Second "Blitz".***




Source: Hurst and Wright, 1980. Figure 11.

***Figure VI-8. Ratio of Nighttime to Total Serious Crashes in New Zealand in the Vicinity of the Enforcement "Blitzes".***




Source: Hurst and Wright, 1980, Figure 9.

***Figure VI-9. Crash-Related Fatalities in New Zealand in the Vicinity of the Enforcement "Blitzes".***

## VII. AUSTRALIA

Australia is a federation, and the law of the different federated states concerning drinking and driving is variable. Most international attention has been focused on the state of Victoria, designated as having the earliest and "best" legislation from the viewpoint of deterrence (Jamieson, 1968). Victoria was unusual among world jurisdictions outside of Scandinavia in its early passage of blood alcohol testing and adoption of a law substantially following the Scandinavian model even before the British Road Safety Act.

### 1. The Victoria law of 1966.

Unfortunately, the only known evaluative description of the intiation of the Victorian per se legislation is contained in an unfocused conference paper by a police physician whose principal interest appears to have been in descriptive studies of the distribution of blood alcohol concentrations (Birrell, 1975). That reporter, dismayed by the complex circumstances under which the per se legal provisions were adopted, conveys the impression that their impact is impossible to evaluate and fails to present data on the basis of which an independent judgment could be made.

The Victoria law on drinking and driving began to evolve from the classical model in 1958 with the provision for blood samples given voluntarily by the accused, taken with the aid of a private physician and usable in prosecution only as part of the total evidentiary package. There would seem to have been little incentive for the accused to cooperate with this procedure. In 1961 an evidentiary breath test was substituted for the blood test, and in the following year it was made compulsory, though originally there was only a small fine for refusers. (The circumstances under which it could be requested are not mentioned in the literature.) The penalties for refusal to furnish a breath sample are currently more severe -- license withdrawal for 12 months -- and the refusal rate is a negligible two percent.

The Scandinavian model was more fully adopted in Victoria in 1966, when a per se rule was enacted, proscribing driving with a blood alcohol concentration of more than .05 percent. This rule was proposed as a result of a Royal Commission report on the drinking-and-driving problem. The limit is a relatively low one by international standards, and the legislation was adopted the year before the comparable move in Great Britain. The details of the law of 1966 are not clear in the sparse literature. One commentator states that the penalties for violation of the law were extraordinarily low -- a fine of not more than $100 (Jamieson, 1968). Moreover, the law "received publicity but was not accorded any public education program by the authorities" (Birrell, 1975, p. 777).

The introduction of the Victoria law therefore seems to have been affected by the low severity of penalties provided and by low visibility. However, apprehensions and breath tests did increase: from 1218 in 1961 to 4178 in 1967 and to 10,793 in 1972.

Any attempt to evaluate the Victorian per se law on crashes would be difficult because the enacting legislation included the simultaneous adopion of a change in the closing hours of pubs from 6 P.M. (sic!) to 10 P.M.

Birrell reports merely that "there was a quite remarkable shift in the times of occurrence of serious traffic accidents but virtually no change in the total number of crashes and deaths" (1975, p. 777). Unfortunately, no data are presented. Given the gradualness of the development of the Victoria law, the modesty of its penalties, and the apparent lack of media attention at its introduction, it would seem unreasonable to expect marked changes in subsequent crashes even in the absence of the complicating simultaneous change in hours. The conclusion on the Victoria law of 1966, then, may be that no effects were demonstrated but that the deterrence model was so poorly complied with as to render unrealistic any expectations of change.

2. "Random" breath testing campaigns.

The State of Victoria maintained its early-bird status on the world scene by adopting provisions for "random" testing of drivers for blood alcohol in 1976, the year that Sweden enacted a permanent provision of the same type and two years prior to the French law reform. Testing of drivers without the need to suspect alcoholic influence was permitted in predetermined roadblocks. In the capital city of Melbourne the initial use of this patrol technique was very limited, averaging about 8 hours per week, and one can infer that such patrol was never used in the countryside. In 1977 there were two periods of intensified enforcement, when patrol hours in roadblocks were quadrupled, and in late 1978 there occurred a further enforcement campaign that increased the numbers of roadblock patrol hours to 100 per week. The roadblocks were concentrated in four distinct areas of the city at traditional heavy drinking hours in order to increase their local effectiveness and to render evaluation possible.

The report (M. Cameron et al., 1980) evaluating the effectiveness of these campaigns mentions an unpublished document concerning the initial effect of the provision of "random" tests, which found only "weak evidence" of results on crashes. A previous evaluation of the 1977 campaigns had also been conducted using the criteria of change in crashes said to be alcohol-involved and serious crashes at night, in the tested areas only. (It is unclear how the limits of the tested areas were defined.) Because of the small data base, a comparison was made between the two weeks subsequent to patrol plus the patrol weeks in contrast to the two weeks preceding the increased patrol. A non-significant reduction of 39 percent was noted in the criterion of alcohol-involved crashes, but this should not in any event be considered reliable evidence. A significant reduction of 36 percent was noted with the criterion of serious crashes at night. The significance test is not named or described. These prior findings were considered "highly suggestive" but not conclusive demonstration of deterrence and they led to a more elaborate test for the 1977 and 1978 interventions (M. Cameron et al., 1980, p. 3).

The new evaluation employed the criteria of reductions in crash fatalities, in serious casualty crashes, and in blood alcohol concentrations among driver casualties at night. The questionable criterion of reported alcohol involvement in crashes was (properly) abandoned. The perceived risk of detection for drinking-and-driving offenses was also measured. A control was introduced for historical events that might have affected the metropolitan area as a whole by comparing changes in the patrolled sectors of Melbourne with those in other areas.

Although the authors of this evaluation seem to be more than usually concerned with methodological problems, the evaluation employed somewhat questionable comparisons. Typically, the level of the criterion variable (e.g., night-time fatalities) in the patrolled area was compared with the level in the same area in the prior year, corrected for changes during an earlier "control" non-patrolled period for the same two years. A "net reduction" was computed by deducting the second change from the first. This comparison is perhaps some what better than a mere before-and-after difference, but the use of a single comparison year seems unnecessarily limited and subject to plausible rival hypotheses, for example the possibility of extreme weather during either year. Data on rare events like crashes in small areas such as parts of the city are surely highly variable, and although statistical significance is generally claimed the tests are not described and there is no indication that the authors are sensitive to the possible non-independence of observations in these time-linked data.

To summarize the evidence, taken at face value, significant decreases were found in nighttime fatal crashes and serious casualty crashes and in driver casualties with blood alcohol concentrations found to be in excess of the legal criterion (the latter in single-vehicle crashes only). Perception of the probability of apprehension was measured by surveys of the metropolitan population. Compared with the period prior to the random testing law, that was an increase in the perception of probable apprehension for driving while drinking during the 1977 campaigns. This increase developed further during the 1978 campaign (only where the drinking was specified as "not obvious") and the increase was significantly greater than that occurring for the perception of apprehension for speeding. The metropolis-wide nature of the sample complicates somewhat the attribution of this change to the enforcement campaigns, especially since publicity concerning increased formal penalties for drinking and driving occurred simultaneously with the 1978 enforcement campaign.

As in the case of other studies of "blitzes," it was apparently not expected that the effect of enforcement would last long beyond the end of the campaign. Unfortunately, no data are presented concerning possible long-term reductions in the criterion variables.

The reported evaluation of the Victorian enforcement campaigns concerning drinking and driving, though not as methodologically strong as one might like, yields conclusions that resemble those reached in most other studies of short-term enforcement efforts. Going beyond the other reported studies, the Victorian report yields evidence of a predicted change in perception of risk of apprehension, which is consistent with the deterrence model. It may still not be too late to recapture and extend data to permit interrupted time-series analysis, which would provide a stronger methodology, and to administer further surveys to note subsequent developments in perception following the termination of the enforcement campaigns.

3. "Traffictown" gets tough on drinking drivers.

The literature on Australia offers a glimpse of the effects of localized action to increase the severity of penalties associated with drinking and driving (Misner and Ward, 1975). "Traffictown," a city of 30,000 apparently

in the state of New South Wales, had a local magistrate who obtained notoriety for his "tough" penalties for drinking and driving. He was in fact far more likely than his predecessor or other magistrates in the region to render formal convictions of the accused and to penalize by high fines. An analysis of the results of this campaign found that serious crashes did not appear to drop discernibly but that reported crashes decreased, the average value of insurance claims increased (because small claims were less likely to be made) and the proportions of crash-involved drivers charged by the police dropped significantly. It appears that an important effect of the "tough" judge may have been to shield some of the offenders from experiencing any sanctions at all. These findings are in accord with the literature on severe penalties more generally (Ross, 1976) and suggest caution in the selection of criteria for studying the effects of severity when it is increased to unusual levels. Commenting on the results of a driver survey, Misner and Ward note: "Traffictown drivers considered traffic laws retributive, rather than a deterrent to dangerous driving. Only when traffic violations result in injury were heavy penalties considered appropriate" (p. 679).

# VIII. CANADA

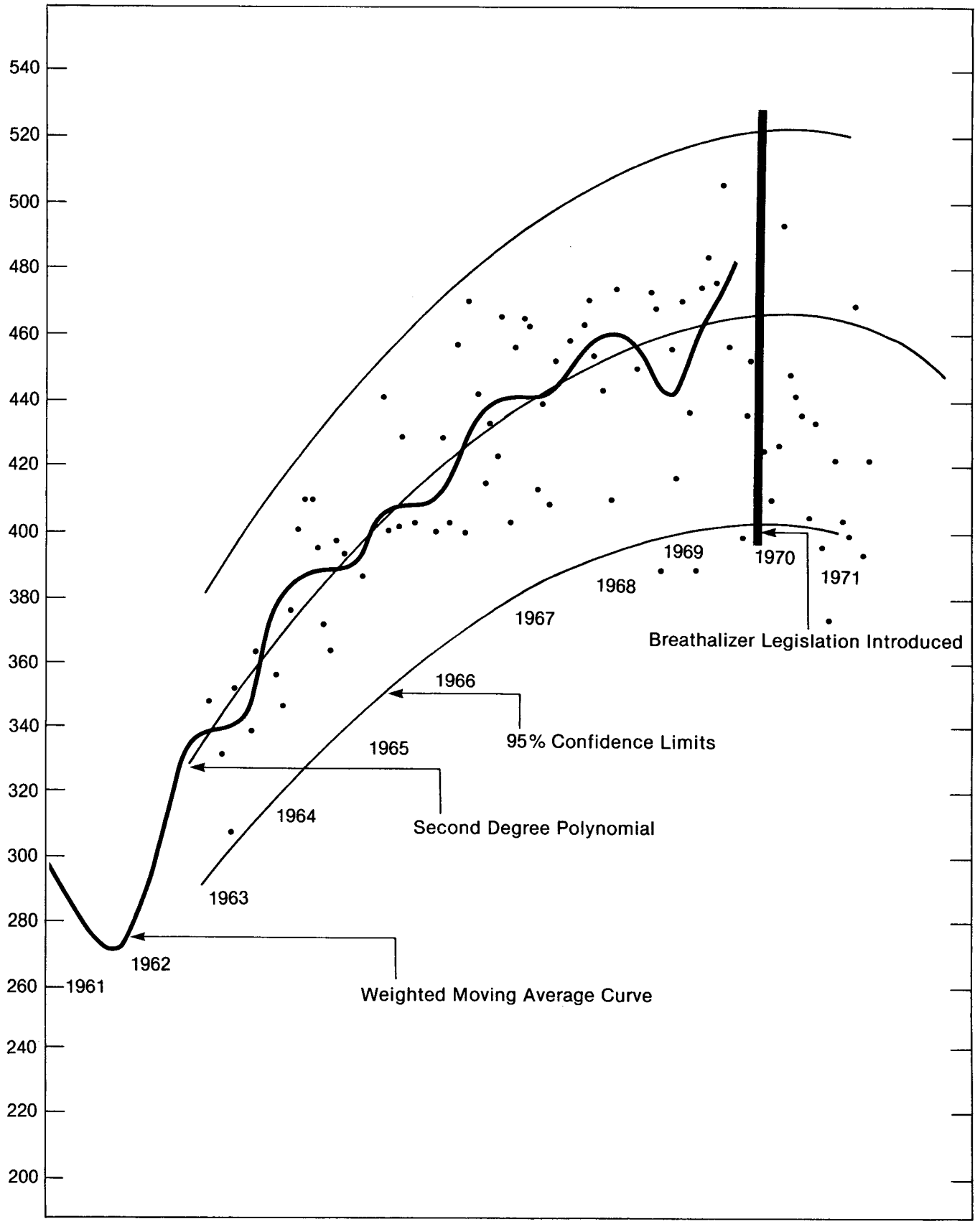
The Canadian Breathalyzer legislation followed closely, in timing and form, the British Road Safety Act of 1967. It has been evaluated independently by two different teams, both of which have reached the conclusion that the Canadian law had a moderate but temporary and evanescent effect upon the drinking-and-driving problem in that country (Carr, et al., 1974, 1975; Chambers, et al., 1976).

In contrast to the Australian case, Canadian policy on drinking and driving is set by Federal legislation affecting all the provinces. The Scandinavian model was adopted in Canada's Criminal Law Amendment Act which took effect on December 1, 1969. The legislation and the subsequent official evaluation reflect the effect of the belief that the 1967 British law was a workable model for other countries in general and Canada in particular. However, at least in retrospect, several differences seem important.

The heart of the Canadian legislation is the empowering of police officers to require breath tests based on "reasonable and probable" grounds to believe that a driver is impaired by alcohol. As in Britain, the tolerated level of blood alcohol is .08 percent. The breath test is mandatory, refusal being punished by fines and imprisonment identical to the penalties for failing the test. The breath test is a quantitative and evidentiary one, not requiring a subsequent blood test but also in practice requiring the use of stationary breath testing equipment located at the police station rather than portable equipment present in the patrol vehicles like the devices used in Britain. Penalties for failing the test include fines up to $1000 and/or prison for up to six months. License suspension is discretionary with the court. Neither of the published evaluations provides information on actual fines and jail sentences or on license suspensions following convictions.

The first analysis of the results of this legislation was published in 1974 and was based largely upon reported crashes through 1971. Data were presented separately for injury-involved crashes and for fatal crashes, and for the Province of Ontario taken separately as well as the country as a whole. The national data on fatal crashes are presented in Figure VIII-1. Their form, though not the statistical analysis, follows the interrupted time-series model. One may reasonably conclude from inspection of the figure that fatalities responded to the Canadian legislation. The Ministry of Transport's conclusions are positive but guarded:

> All four figures show a significant number of points below the trend line . . . indicating that serious accidents have undergone a statistically significant decline, relative to the trend, since the introduction of the Breathalyzer Legislation. In fact, for victims killed in Canada, the average monthly post-Breathalyzer figures are 9 percent below the trend.
>
> . . . [F]atal accidents in the United States [offered as a control] decreased by about 2.1 percent from 1969 to 1970 while comparable figures for Canada show a decrease of 6.3 percent.




Source: Carr et. al., 1975, Figure 2.2.

***Figure VIII-1. Crash-Related Fatalities in Canada, Seasonally Adjusted.***

It may also be noticed that injury accidents in Ontario and Canada are above the trend in early 1971 -- indicating possibly a transitory effect in 1970 that may have dissipated in 1971 (Carr et al., 1974, p. 24).

The conformity to predictions of the time series presented, with a greater response by fatalities than injury accidents, supports the deterrence model. The principal difficulty with a deterrence interpretation of the Canadian legislation in this analysis comes from the failure of nighttime and weekend crashes to show stronger variations. The relevant data are presented in Table VIII-1. Moreover, there was no change in

Table VIII-1. Percentage changes in fatal and serious injury crashes in Canada between 1969 and 1970.

| Period | Changes in fatal crashes | Changes in fatal and injury crashes |
|---|---|---|
| Night: 10 P.M. to 4 A.M. | -10% | -5.8% |
| Day: 4 A.M. to 10 P.M. | -8% | +1.4% |
| Weekends: Friday to Sunday | -10% | -1.3% |
| Weekdays: Monday to Thursday | -6% | +1.3% |

Source: Carr et al., 1974, p 97. No tests of significance are provided.

blood alcohol concentrations among tested crash fatalities; although testing was not complete, the analysts deny that the incompleteness was major or that it is important in explaining the anomalous findings (Carr et al., 1974, p 105).

The second evaluation, by epidemiologists using the same data base but slightly different methods, is more positive and less guarded (Chambers et al., 1976). They find that the total incidence rate (crash-related deaths and injuries on the base of population at risk) declined by 9.2 deaths and injuries per 100,000 population per quarter during the first five quarters of the new law, and the bulk of the saving was during the nighttime hours of 6 P.M. to 6 A.M. The mortality rate was reduced by 7.7 percent during the same period. Changes in the form of reporting during 1971 cut off the possibility of computing the nighttime to daytime crash ratio after the period mentioned. However, the epidemiologists agree with the previous analysts that the deterrent effects of the legislation were of short duration.

Additional information is available concerning the operation of the Canadian law from survey research and from a quasi-experimental study of some arbitrarily selected Toronto drinking places. A large-scale national survey was commissioned, with waves before and after inception of the new law, to determine public knowledge. The survey showed that even before a publicity campaign was set in motion the law was well known; subsequently, it was very

generally recognized. Nearly all drivers surveyed knew that, by the terms of a new law, police could give breath tests and that license suspension was a possible consequence of conviction for drinking and driving (Kates, Peat, Marwick, 1970). The Toronto study (Smart, 1972) included counts of cars in parking lots of four suburban taverns early in the evening (6 P.M.) and later (10 P.M.) during three months prior and three months subsequent to the new law. A sharp decline was noted during the first month of the new law (December 1969), which continued through February 1970 for the later hours but diminished for the earlier hours. No change was found in the average number of occupants of the vehicles nor in the observed alcohol consumption of those who did patronize the taverns. No control was introduced for seasonal variations, which might possibly explain a decline in December even without any effect for the law. Perhaps the following impression concerning December 2 is more persuasive evidence for deterrence than the quantitative data from this study:

> To anyone observing tavern parking lots on the day after the new Canadian law came into force its effects could scarcely be doubted. Parking lots were nearly empty for the first time in three months (Smart, 1972, p. 1126).

Although some effect of the Canadian legislation is generally conceded, the consensus is that it was less marked and less prolonged than the effect of the British Road Safety Act of 1967, after which the Canadian law was patterned. Three categories of reasons have been suggested, with which I cannot disagree. First, the actual threat posed by the law was less in Canada than in Britain. Police were not empowered to test a motorist's breath merely because he was in an accident or had committed a traffic law violation, as in Britain. Moreover, police cars did not carry testing devices, and the demand of a test was thus more difficult and less likely to be lightly made, perhaps, than in Britain. Furthermore, license suspension in Canada was at the discretion of the court, rather than being mandatory as in Britain. (The evaluators for the Canadian Ministry of Transport assert erroneously that license suspension is at the discretion of the court in both countries.) Second, the threat posed by the Canadian law does not appear to have been publicized as well as that posed by the British law. Although the Canadian law was well-known, there is no reason to believe that the publicity for it encouraged fear of apprehension, and there is no report that the legislation was considered particularly controversial or newsworthy. Third, it appears that the actual probability of apprehension and conviction for drinking and driving was negligible both before and after the new law. A Canadian observer writing in 1977 notes that according to official estimates there are 26,000 kilometers of impaired driving for every drinking-and-driving charge in Canada:

> Detection procedures are such that only the worst cases are likely to catch the attention of police. [Detection is] really a chance event (Ennis, 1977, p. 19).

Although there have been some attempts to increase the reality and perception of drinking-and-driving law enforcement in Canada in recent years, the reports are sketchy (Alberta's Check-Stop, cited in Ennis, 1977) or ambiguous (R. I. D. E., cited in Vingilis and Salutin, 1980). There is a report of a publicity campaign in Edmonton, Alberta (Farmer, 1975) designed,

among other things, to increase knowledge of the penalties in the drinking and driving law, which claims a subsequent decline in blood alcohol concentrations measured in roadside surveys greater than that which was measured in Calgary, the control city. This indicates a possible deterrent potential to be realized by increasing the perceived threat of Canadian drinking and driving law.

In summary, the Criminal Law Amendment Act of 1961, though modeled on the prior British legislation, was in fact and perception less threatening. Its penalties were less severe and its enforcement more difficult for the police. Under these circumstances it would be expected to have had a smaller and less lasting effect than the British law, and this expectation is supported by the evaluative studies that have been reported.

## IX. THE NETHERLANDS

To this point this review has focused on Anglo-Saxon countries, which in general were the first outside of Scandinavia to adopt the latter's model for the legal control of drinking and driving. More recently many countries of continental Europe have followed. The presence of several sophisticated evaluation researchers concerned with traffic in the Netherlands has produced some interesting literature on the results of the Dutch adoption of the Scandinavian model in 1974.

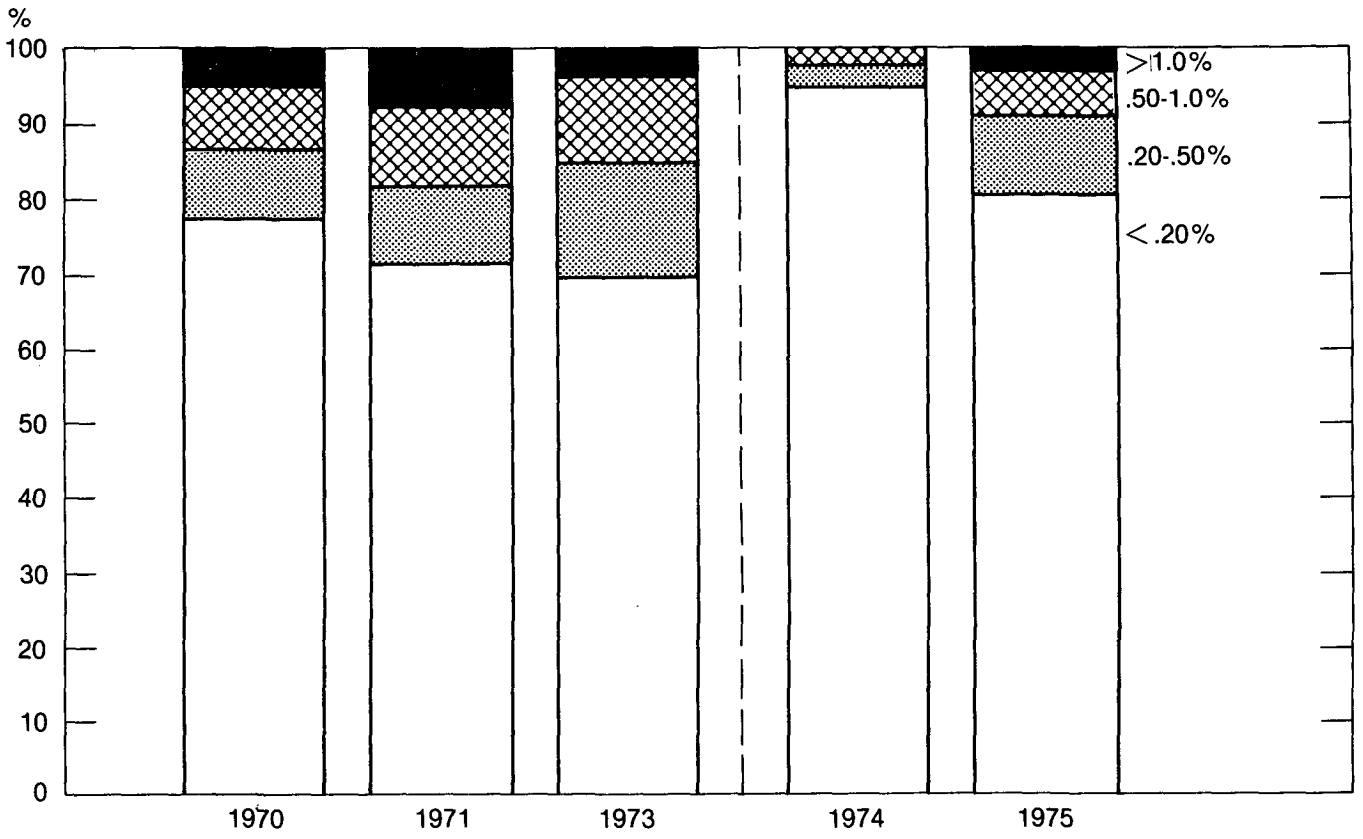
The Dutch law of November 1, 1974 is unique in its details. It appears to be patterned more closely on the Norwegian law of 1936 than on the British of 1967, in its relatively low level of tolerated blood alcohol (50 mg./100 ml.) and in its apparently severe penalties, including fines of up to Fl. 5000 (approximately $2500), license suspensions of up to 5 years, and prison terms of up to three months. Although no data have been reported concerning the financial and license penalties meted out in practice, under the prior law it was reported that unconditional prison sentences were routine for violations in the western, most populated, part of the Netherlands.

As in Britain, provision is made for screening tests with a device calculated at 50 mg./100 ml., but unlike in Britain the police must always have reason to suspect a driver of having consumed alcohol before they can administer the test. The Dutch police participate in roadblocks in the Norwegian manner: if and only if they smell alcohol on the breath may the screening test be demanded. A peculiar feature of Dutch law is that suspects failing the screening test in the field are required to take a second such test at the police station, this one calibrated at 80 mg. A driver failing the first test but passing the second is not prosecuted (though he may be violating the law); however, he is prohibited from driving until his blood alcohol concentration goes down. Only a driver failing both screening tests is prosecuted and required to give a blood sample for analysis which if positive, results in prosecution (Noordzij, 1977; SWOV, 1977).

It is reported that the law was introduced with "extensive" publicity (Noordzij, 1977, p. 454), as might be fitting for this relatively complicated legislation. Following passage of the law prosecutions for drinking and driving rose, more than doubling (to about 20,000 per year) in the first full year subsequently.

A research team from the Netherlands Institute for Road Safety Research (SWOV) had been gathering blood alcohol concentration data from a national sample of sites on weekend nights by means of roadside surveys in 1970, 1971 and 1973. (The 1973 sampling was cut off with the occurrence of the fuel crisis.) With the anticipated inception of the law of 1974, comparable surveys were put into the field beginning with the weekend prior to the change and again two weeks and four weeks later. Roadside surveys were also made by a slightly different though comparable method in 1975.

The basic results of the Institute's evaluation are presented in Figure IX-1, showing the presence and level of blood alcohol in the samples taken




Source: Noordzij, 1977, p. 457.

***Figure IX-1. Blood Alcohol Distributions from Roadside Surveys in the Netherlands.***

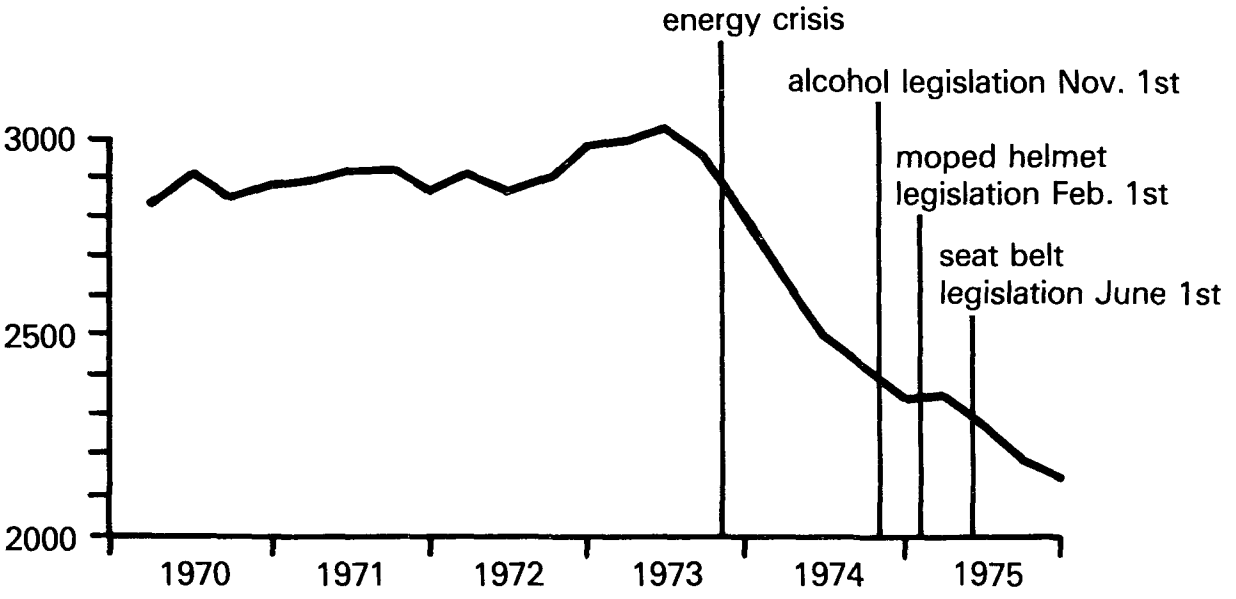
in the five years in question. Surprisingly, the figure does not differentiate the 1974 survey data before and after the legal change, though the accompanying text indicates that the decrease appeared in the October surveys as well as in the November ones. The difference between the years is striking and in the direction predicted by the deterrence model. The 1975 data seem to show some continued but weakening effect, and a small residual effect is claimed for as late as 1979 (Noordzij, 1980). The refusal rate in these surveys ranged up to 18 percent, but perhaps because drivers confused the survey with the expected police operations refusals were only 3 percent in the crucial 1974 sounding. Assuming that refusals in general are more likely from people having consumed alcohol, the differences in Figure IX-1 are expressed conservatively.

Unfortunately, the clear picture presented in Figure IX-1 is muddied by the failure to find comparable effects in the curve of fatalities, shown in Figure IX-2, which is completely dominated by the decline associated with the 1973 oil crisis. Better support for deterrence-based expectations is found in the curves of night-time accidents, Figure IX-3, and of weekends, Figure IX-4, though an inquiry into nighttime fatal crashes found no changes in the ratio of single- to multiple-vehicle crashes, which is usually a good measure of alcohol involvement. Statistics on crashes judged to be alcohol-involved support expectations but, as the reader knows, I counsel against reliance on police judgments in this matter.

Although the evidence is not uniformly favorable, Noordzij concludes that the new law was effective, reducing fatal crashes by 100 or 35 percent for the initial year and reducing total crashes by 5 percent (1977, p. 40). If these estimates are correct, the Dutch law will have been nearly perfectly effective in eliminating the contribution of alcohol to highway crashes. I would prefer to be somewhat more guarded in interpreting this case. The time series of roadside surveys is impressive, but it does not control for history, and the critical year of 1974 is also the one that follows the fuel crisis. Perhaps the greater cost and lower availability of fuel may have had some effect on reducing driving associated with drinking, e.g., people were less likely to drive when going out for an evening's relaxation. The apparent fact that the decline in blood alcohol concentrations was perceived even before the law's inception would also be compatible with an explanation in terms of the fuel crisis. Furthermore, the lack of confirmation of deterrence expectations in crash-related fatalities is disappointing. Although on the whole I think that Noordzij may be right in claiming some deterrent effectiveness for the Dutch legislation I doubt strongly that the law produced so large an effect as he estimates.

The conclusion of a deterrent effect for the Dutch law is supported in a study of alcohol-related crashes resulting in injury as reported by the Rotterdam police (Van Ooijen, 1977). Although the injury criterion helps control some of the possible bias in this indicator, and although the time-series curve presented beautifully supports the conclusion of deterrent effectiveness, I feel that little confidence should be placed in these data because of their basis in subjective judgments.

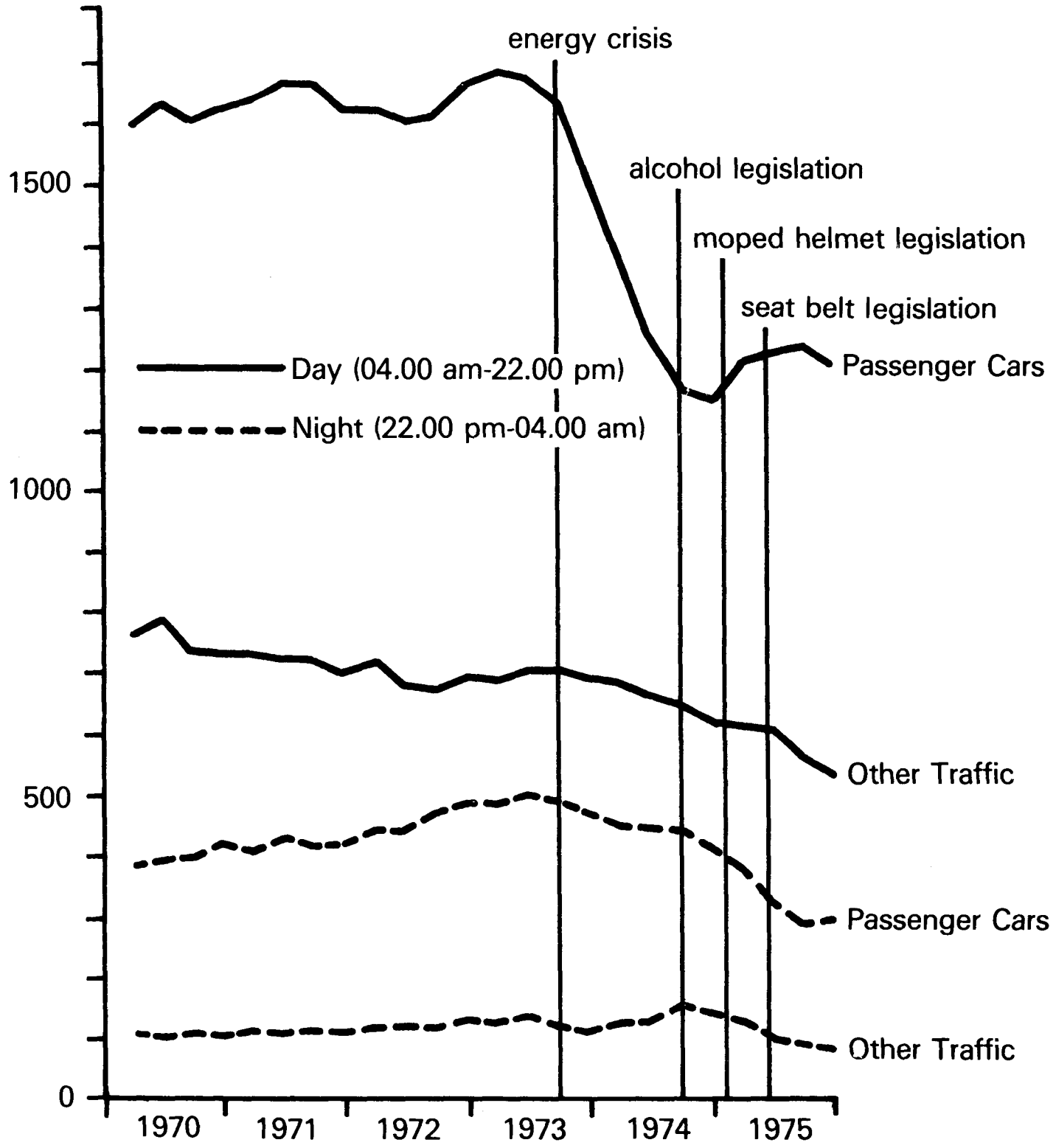
The issue of severity of sanctions in the deterrence model is serendipitously approached by a study of differences in penalties among regions of the Netherlands (Steenhuis, 1977). The study noted that, in the period 1968 through 1973, unconditional imprisonment was imposed in the vast majority of drinking-and-driving cases in representative jurisdictions in the western




Source: Noordzij, 1977, p. 466.

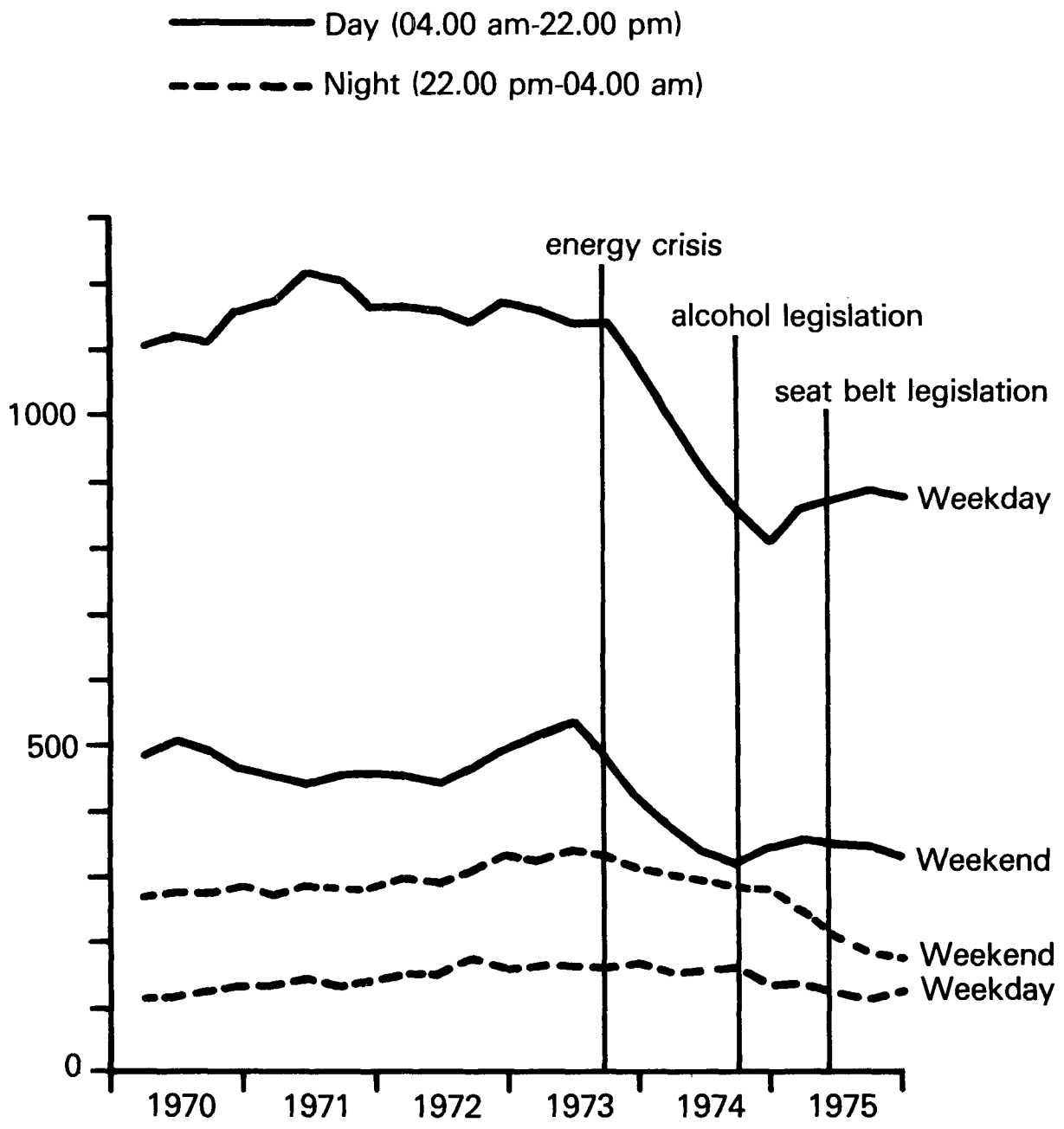
***Figure IX-2. Total Fatal Crashes (12-Month Moving Average) in the Netherlands.***

Figure IX-2




Source: Noordzij, 1977, p. 467.

***Figure IX-3. Fatal Crashes by Type of Vehicle and Time of Day (12-Month Moving Average) in the Netherlands.***




Source: Noordzij, 1977, p. 468.

***Figure IX-4. Fatal Crashes Involving Passenger Cars by Day and Time of Day (12-Month Moving Average) in the Netherlands.***

part of the Netherlands but only in a small minority of cases in the eastern part of the country. Roadside surveys were made on weekend evenings in communities in both parts, and it was found that the blood alcohol distributions were nearly identical (with about one driver in five having more than 50 mg./100 ml.). Moreover, drivers in the western communities, where prison terms were imposed in 83 percent of cases, did not perceive this fact; only 13 percent believed prison to be the most likely penalty for conviction on drunken driving charges. In the eastern part of the country, where prison was in fact imposed in 24 percent of the cases, prison was the expected penalty among only 4 percent of the sample. The difference between regions was in the appropriate direction, but it was much less in the perceptions of drivers than in the practices of judges. The most disappointing finding from the viewpoint of deterrence expectations is that drivers who expected prison for drinking and driving did not differ significantly in blood alcohol measures from those who expected lesser penalties. Indeed, the difference was in the unexpected direction, with one-fourth of those expecting imprisonment having illegal blood alcohol concentrations, whereas less than one-fifth of those expection no imprisonment were so measured. These findings lead to the view that any positive accomplishments of the 1974 Dutch law were very likely more strongly related to perceptions of an increased danger of being apprehended and convicted rather than to changes in the perceived severity of the penalties.

## X. FRANCE

France adopted a fully Scandinavian-style law in legislation of July 12, 1978. In the summer of 1979 I received a grant from the Insurance Institute for Highway Safety to visit France for the purpose of obtaining data in order to perform interrupted time-series analyses related to the issue of the law's impact. Because of difficulties in obtaining all the necessary data and in applying the most recently developed analytical methods the study is not yet complete. This chapter represents the first publication of my interim results. References will be supplied in the forthcoming full report.

France had been moving from the classical model for several years prior to 1978, and the law of July 12 was a reform, not a revolution. Since 1959 it had been illegal to drive "under the influence of an alcoholic state". The testing of breath for blood alcohol was introduced in 1965, in the case of major violations of the traffic law, and breath testing was made compulsory in the case of accidents involving injuries as well as with these violations in 1970 (Law of July 9). The 1970 law also created a per se offence, driving with a blood alcohol concentration in excess of 0.8 grams pro mille (80 mg./100 ml. or .08 percent) the punishment for which could include suspension of the driver's license. Thus, France had very largely attained the Scandinavian model in the drinking-and-driving field as early as 1970. However, no claims were made for effectiveness of this legislation in dealing with the problem and the dissatisfaction that remained concerning public policy on drinking and driving was expressed in a variety of private member bills in the French Parliament during the 1970's proposing changes in law enforcement and punishment of offenders.

The 1978 reform was sponsored by the Interministerial Committee for Highway Safety, which was formed within the French Government as a kind of analogue to the United States' National Highway Traffic Safety Administration and was headed by an energetic young civil servant, Christian Gerondeau. The Interministerial Committee came into existence shortly before the 1973 fuel crisis, resulting in a politically fortunate but scientifically dismaying coincidence of its efforts with the major changes that were being shaped everywhere by recurrent fuel shortages, rising prices for fuel, and influences from a broad range of governmental and private initiatives concerning traffic safety. However, the Committee was able to make credible claims of results for its initial endeavors in the areas of general speed limits (nonexistent in France prior to 1973) and seat belt use requirements. Bolstered by favorable opinions in Parliament and public support as measured in polls, and informed by new research on the role of alcohol among crash fatalities on French highways (Got and Thomas, 1977), Gerondeau, aided by the Minister of Justice, Alain Peyrefitte, acted to strengthen the drinking-and-driving law.

The law of July 12, 1978, had as its major innovations the following:

(1) Any driver could be required to submit to a screening test for blood alcohol, regardless of his driving behavior, in the context of roadblock operations ordered by the region's chief judicial official, the procureur de la République.

(2) Failure to pass the screening test could result in an order to cease driving then and there, until additional breath test results become negative, as well as submission to existing penal sanctions. Moreover, a driver's license could be cancelled as a consequence of his being found guilty of exceeding the 0.8 pro mille blood alcohol concentration, and revocation of the license was mandatory under two circumstances: if the blood alcohol level exceeded 1.2 pro mille, and the accused had caused death or injury, or on a second or further offense where the blood alcohol concentration exceeded 1.2 pro mille, regardless of involvement in crashes. The offender would not be able to apply for a new license during a period of up to three years, and it was expected that he might find it difficult to persuade the authorities to grant him a new license at any time in the future.

The 1978 law also provided for the eventual use of quantitative breath tests to be administered on the highway, but this provision has not been put into effect as of the time of this writing.

As was the case with the Road Safety Act of 1967 in Great Britain, there arose considerable objection to these provisions of the French law on the grounds of civil liberties, both before and after passage of the legislation. The provision for mandatory license revocation, though confined to relatively extreme cases, was found objectionable for removing a traditional source of discretion from the judiciary. The roadblocks, though distanced from full control by the police through the provision that they had to be scheduled by the procureurs, were seen as intrusive and insulting. The following language, from an open letter to the Minister of Justice, is illustrative:

> It is unthinkable that a State which considers itself liberal can treat Frenchmen as potential criminals, forced to justify themselves before witnesses. It is unthinkable that rulers originating from the people can submit the latter to suspicion joined with the violation of personal integrity which gives the operations their humiliating character. The faults of some people cannot justify the end of liberty for everyone. If this be not the case then, little by little, our entire lives will become the subject of police operations.

Opposition to the legislation in practice was maintained in part by a populist movement, Auto-Defense, the creation of a traveling salesman from the provinces, Francis Rongier, whose previous battles had included attacks on speed limits and the compulsory seat belt regulations. Rongier deliberately drove through a pre-announced roadblock and refused to provide the required breath sample on the basis that the legislation was not in force due to a technicality in its promulgation. The real basis for his objection, he noted in a personal interview, was the libertarian belief that "only the presumption of guilt warrants the extreme measure of an attack on the body of the driver."

Another basis of objection to the practice of roadblock operations was the discovery that, although the limit of tolerated blood alcohol was 0.8 pro mille, the screening devices used were calibrated at the lower level of

0.5, without notice to the ordinary police or to the public; presumably, one could fail the screening test and be required to furnish a blood sample without having violated the law. As headlined in Auto-Journal for April 1979, "The Alcotest is a Cheat!" Francis Rongier demanded (without success) the seizure of all Alcotests and cessation of roadblock operations in his province.

In France as in Britain, the opposition to the legislation may have helped disseminate knowledge (and perhaps fear) of its provisions. It soon became one of the best-known of French laws. In August of 1978, 97 percent of a random sample of French adults knew of it, a record for familiarity with new legislation. In October, 66 percent could state the legal limit in response to a survey question. The law was popular in the abstract; its provisions were favored by nearly four to one in a poll in January of 1979. However, 53 percent of the public and 61 percent of drivers surveyed at that time thought that the roadblock operations were infrequent.

Indeed, the roadblocks were relatively rare. The procureurs generally scheduled only one roadblock per month -- the minimum demanded by administrative decree -- and in many jurisdictions, despite the decree, there was complete inactivity for months at a time. In the words of an employee of the Ministry of Justice, in a personal interview, "Thirty thousand tests per month in all of France yields an infinitesimal chance of being caught." Furthermore, the roadblocks seemed to be conducted in a very conservative manner. The Journal Officiel for April 21, 1979 noted that there had been 1091 operations from August 1978 through January 1979, in which 335,449 tests had been applied, yielding only 1416 positive results. Moreover, only 733 of the positive breath tests were confirmed by subsequent blood tests, leading to prosecutions. These figures are but a small fraction of the estimates of illegal blood alcohol concentrations among non-crash-involved drivers provided by independent field studies. In my opinion, based on observation of a single roadblock in operation, it is possible that the results are affected by a pro-defendant bias on the part of the police, who are loath to interpret marginal readings in the Alcotest tubes as positive. Furthermore, during the initial two months of the roadblock operations their efficacy was compromised by being announced in advance (deliberately, for the publicity value). Moreover, there is no evidence that the roadblocks were scheduled for the times and places where drinking drivers were most likely to be found. The relative rarity of roadblocks combined with infrequency of positive results in these operations is to be noted, however.

Again, as in Britain, French officialdom interpreted the initial post-reform data as evidence of a causal effect of the legislation upon crashes. Although the law formally came into effect on July 12 and roadblock operations did not begin until August, the fact that the law was passed and highly publicized during June led to treatment of the period from July 1 onward as subject to the effects of the law. In August, the official "Road Safety Letter" headlined: "First effects of the law on alcohol; Large drop in highway accidents in the month of July; 175 fewer killed than in July 1977". In September: "The decline is confirmed; Fewer dead and fewer injured in the month of August 1978". In October: "Towards a record year for highway safety; Thanks to the Alcotest law, an exceptional summer."

However, in early 1979 the comparison with the previous year yielded less encouraging results. Rather than concede the possibility of a decline in the effectiveness of the 1978 law, the Government claimed (arbitrarily, in my opinion) that the casualty increase in 1979 was due entirely to the declining effectiveness of speed limits.

Data concerning total crashes, fatalities and injuries are available for France through late 1979 and have been graphed as time series in Figures X-1, X-2 and X-3, to document the French experience. These three series do seem to furnish support for the official view that a decline in the casualty figures occurred simultaneously with the inception of the new law. The data have been corrected by removing the seasonal variations in each case. Each figure shows a decline in 1973-74 that can probably be attributed to the effects of governmental seat belt and speed limit measures as well as the fuel crisis, along with a decline in the late 1978 that may well indicate the effect of the reformed drinking-and-driving law. The changes in Figures X-2 and X-3 (though not X-1) are statistically significant, and the effect is estimated to have lasted for approximately one year. Although a more definitive discussion of these data is forthcoming, it is possible to state now that the French law of 1978 had a clear effect on crash-related serious injuries and fatalities and that this effect diminished or was overwhelmed by other events after several months.

Support for this impression is offered by Figure X-4, which presents raw data on crashes during the hours of 9 P.M. to 3 A.M. Unlike the British, French sources were not able to provide data for weekend nights separately. Further, the series is too short with existing data to permit deseasonalization of the measure, so the seasonal variation is seen very strongly. I hope for the more detailed report to be able to secure a longer series from computerized sources so as to be able properly to correct these figures. Without the correction, the data do seem reasonably in accord with expectations based on a deterrent effect on drivers in these more alcohol-influenced hours and with the impression that subsequent developments have vitiated the initial effect of the law.

As in the British case, claims were made by representatives of the beverage industry that the law had unjustifiably interfered with consumption of alcohol not associated with driving. It seems as though the claims were more poignant in the wine-based culture of France, as illustrated in the following communique issued by the National Association of Wine Producers in September:

> These roadside operations aim to provoke progressively profound modifications in the dietary habits of drivers. . . . To wish to transform the dietary habits of Frenchmen is to incite them to drink something other than wine with meals. It is to declare war on their traditional beverage.

The available data do not support this claim. French consumption of wine has been declining on a per capita basis for several decades, attributed by knowledgeable sources in part to the increased role of competitive beverages such as beer, mineral water and soft drinks, in part to changes in the composition of the French population, now including large numbers of

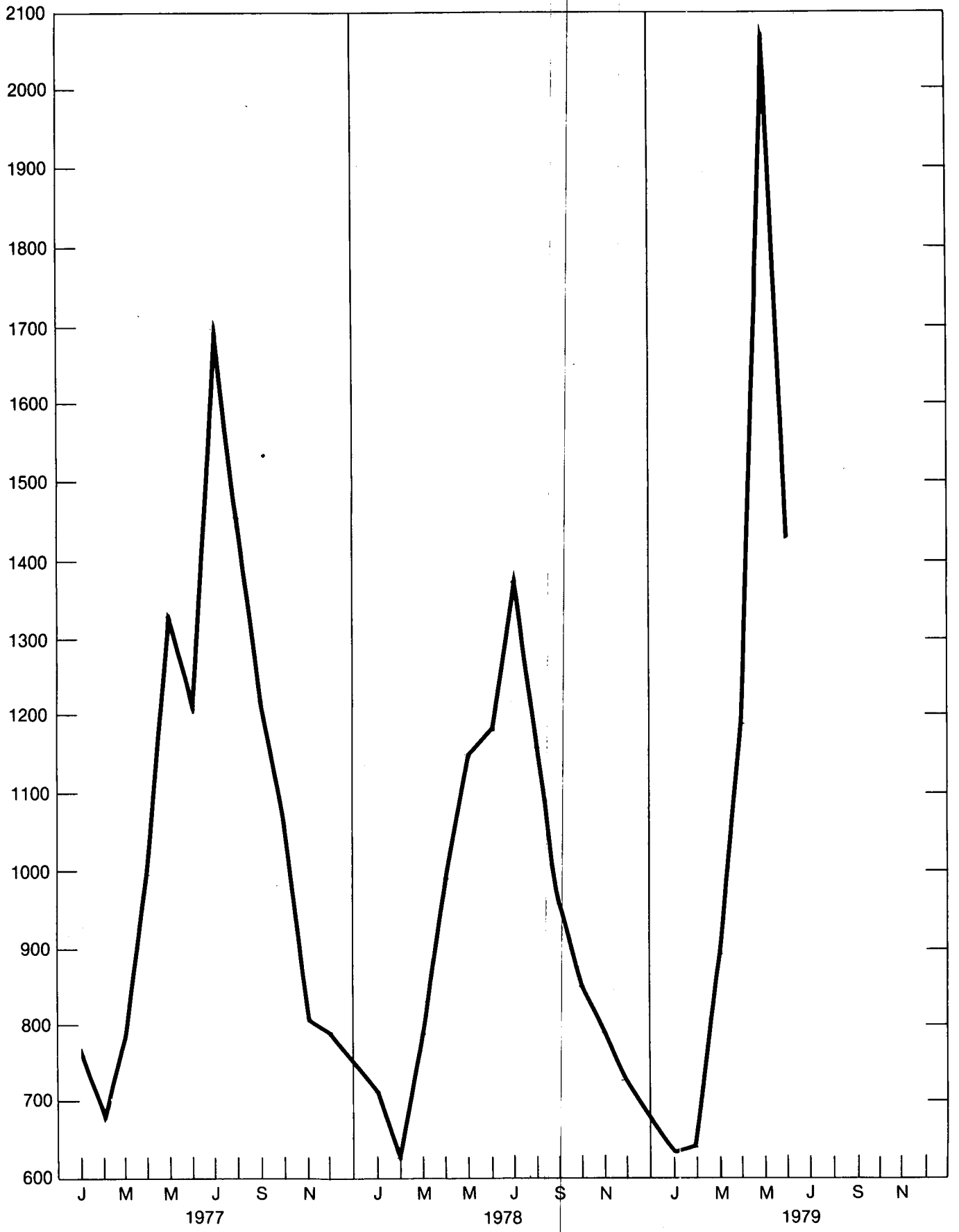



***Figure X-4. Crashes Per Month in France During the Hours of 9 P.M. to 3 A.M.***

non-drinking Moslem immigrants from North Africa, and in part to changes in the class structure, with increasing proportions of the population being employed in white-collar jobs. The data on wine sales show no particular change in the vicinity of 1978. In contrast to wine, no general data are available for stronger beverages but a representative of the largest producer of brandies and spirits reported that sales did not show any sensitivity to the passage of the 1978 law on drinking and driving.

Independent support for the conclusion that the French law of 1978 had a deterrent effect comes from a before-and-after comparison of the proportions of non-crash-involved drivers with illegal blood alcohol concentrations revealed in two roadside sample surveys during selected hours by the National Organization for Highway Safety. This is a research organization independent of direct Governmental control. Studies were made in 10 provinces in 1977 and in 9 of these 10 in 1979. The latter study, though smaller in scale, covered one-third of the points surveyed in 1977, and is believed to be comparable. The only significant methodological change, other than a reduction in scale, was the use of the Alcometer rather than the Breathalyzer as the measuring device. Adjusted estimates of the proportion of violators in the driving population were 3.4 percent in 1977 and 1.7 percent in 1979. Comparable reductions were found at all blood alcohol levels. Although this comparison shares the methodological weaknesses of all before-and-after studies and cannot by itself demonstrate the existence of an effect for the law of 1978, it is a relevant positive fact.

In sum, though results at the time of this writing are preliminary, it would appear that the introduction of a notable and notorious change in the provisions of the French law in 1978 produced a diminution in the extent of drinking and driving as measured by crash fatalities and total crashes, especially in late-night hours. It also appears that this effect was transitory and that it disappeared after several months. In the light of the relatively modest level of enforcement, both in terms of tests and prosecutions, one may speculate that the French experience teaches again that the fear of a legal threat does not long survive experience of its unlikelihood. In the colorful words of one French lawyer, the public has discovered the threat to be a "wooden shoe", which can safely be ignored by potential violators.

## XI. OTHER EUROPEAN COUNTRIES

The research literature mentions what seem to have been adoptions of drinking-and-driving laws modeled on the Scandinavian, with attempts at evaluation, in Austria and Czechoslovakia in 1961 and in Germany in 1966 and 1973. However, the reports are so sketchy that the results are only marginally enlightening. The available information is summarized here. Also noted is the status of drinking-and-driving law in the balance of Western European countries.

### 1. Austria.

What seems to have been a per se law was adopted in Austria, effective January 1, 1961. At an international conference the following it was reported year that crashes had diminished (Breitenecker, 1962). Between 1960 and 1961 accidents were reduced by 26 percent, injuries by 28 percent and deaths by 16 percent. Between 1961 and the first six months of 1962 accidents were reported to have been reduced by 10 percent, injuries by 18 percent and deaths by 26 percent. If the contribution of alcohol to deaths, injuries and total crashes in Austria is at all like that in other countries, these reductions are so high as to be almost unbelievable. The speaker noted, however:

> . . . [A]fter some months there was a rise in traffic accidents. But the incidence of fatal accidents did not reach the peak to which it had climbed before the introduction of the new act. The limit of .08 pro mille had proved its worth from the outset but statistical proof is faced with numerous external obstacles (Breitenecker, 1962, p. 336).

Unfortunately, the report presents no information on the previous law, the origin of the reform, the provisions other than the per se limit, or the manner of application. Lacking this information one can say little other than that in Austria as in many other countries a law with the intent to deter drinking and driving was followed by an initial drop in casualty measures and a subsequent rise towards the status quo ante.

### 2. Czechoslovakia

It is reported that Czechoslovakia also changed its drinking-and-driving legislation on January 1, 1961. "The consumption of alcohol has been forbidden for all drivers" (SWOV, 1969, p. 36). Unfortunately, even less is reported about this innovation than the Austrian. The reporter notes official crash statistics from the Czech Ministry of Interior, but they seem to show no inflection corresponding to the legislative reform. The percentage of these represented by "alcohol accidents" does decline in 1961, and it remains at a reduced level, but in the absence of a definition of this term, I suspect that it refers to police judgments of alcohol influence, which will not be considered acceptable evidence for an effect of the law.

3. West Germany

A manuscript concerning the German literature on alcohol and traffic, in draft at the time of this writing, mentions several changes in the German drinking and driving law (Vogt, 1980). Drinking and driving was first criminalized in 1952. A maximum tolerated blood alcohol concentration of .15 percent was specified in 1953 but without a prescribed level of punishment. In 1966, the level of toleration was lowered to .13 percent, and the commentator notes:

> There has been a major change in the yearly rate of drunk driving cases . . . In respect to severe accidents in which drunk drivers were involved, the rate decreased after 1967, and this development still holds today.

The accompanying data are of declining convictions, which do not furnish a suitable criterion for evaluating the role of alcohol in crashes. Indeed, the legislation would perhaps look more successful with an increase in convictions that suggests realism for the legal threat rather than a decrease, which could indicate, for example, merely a shift in enforcement resources or a lowering of findings of guilt among those charged with the offense.

Another legal change in 1973 lowered the level of toleration to .08 percent, and provided for loss of license for a month on conviction. The accompanying evaluative data concerning this change are figures of drivers "causing injury in accidents" for 24 months surrounding the inception of the law. Again, the measure may be inadequate to test the deterrence model. Admitting it for the sake of the argument, it leads to the conclusion that "the new law influenced drinking-and-driving habits of drivers for only a very short time period." This conclusion would be in keeping with expectations based on experience in other countries.

4. Finland.

The Finnish approach to drinking and driving has until recently been based on classical law with continually increasing penalties. In the 1960s Finland had the harshest penalties in the world, to my knowledge: up to four years in prison for a simple offense and up to eight years where the behavior resulted in a fatal accident. Most sentences were for three to six months in prison, again unusually severe in the world context. Analysis of one of the major increases in Finnish penalties did not yield a clear interpretation for an effect on crashes (Ross, 1975, pp. 303-308). In 1977 a Swedish-style two-tier *per se* law was adopted, and penalties were reduced, bringing Finland into conformity with the Scandinavian model. This reform is only sketchily described in the literature (Takala, 1978) and it has not been evaluated for its effect on crashes.

5. Denmark.

Until recently Denmark hesitated to adopt a formal per se law, preferring to give more discretion to its judges, but the general practice was to take blood tests and to convict those accused under the classical law if the blood alcohol concentration was greater than 100 mg./100 ml. Prison sentences were generally accorded to those exceeding 120 mg. (Ross, 1975, pp. 290-291). In 1976, a two-tier per se law was formally adopted, with limits of 80 and 120 mg. (Waaben, 1978). Conviction of the lesser offense is punishable by fines, with the possibility of license suspension. Prison is a possibility on a second offense. Mandatory license suspension attaches to the more serious violation and prison is a potential punishment, though it seems not to be used routinely until blood alcohol concentrations of 150 mg. and over are reached. Thus, the Danish law appears to be three-tiered in practice. Relative sensitivity to the degree of the offense remains characteristic of the Danish approach, even with the shift from judicial discretion to the Scandinavian model. Danish police are now empowered to require breath tests arbitrarily, as in Sweden. The deterrent impact of the Danish legislation has not been evaluated.

6. Alia.

Brief descriptions of the drinking-and-driving laws in the remaining Western European countries were accumulated by the Australian Law Reform Commission (1976), yielding the following information: Belgium permits its police unlimited authority to test drivers for drinking, and gives them the power to prohibit driving for those found to have blood alcohol concentrations in excess of 80 mg./100 ml. However, drivers are charged with an offense only if they are found to have levels exceeding 150 mg. Switzerland has had a classical law, though the courts have found that blood alcohol concentrations in excess of 80 mg. justify conviction of driving while under the influence of alcohol. Spain has no prescribed limit of tolerance but breath samples are required and the results may be introduced as evidence under a classical law. Italy, which officially and incredibly reports extremely low involvement of alcohol in crashes, permits the testing of drivers for alcohol only with the drivers' consent. No level of tolerance has been established by legislative or judicial authority.

## XII. THE UNITED STATES

Although the Scandinavian model is usually cited with reference to Norway and Sweden or, more recently, Great Britain, insofar as formal rules are concerned it has very deeply penetrated the law of the United States. It is firmly embedded in the Uniform Vehicle Code and, to a varying and lesser degree, in the traffic laws of the fifty states.

The Uniform Vehicle Code, promulgated by the National Committee on Uniform Traffic Laws, serves as a criterion for the laws of the states. Its existence recognizes the need for uniformity in the traffic law in an economically integrated society. It is a flexible document, changing with emerging needs and changed circumstances. Historically, state laws have tended to conform to its provisions after greater or lesser degrees of lag.

The Uniform Vehicle Code (Section 11-902a) prohibits driving with a blood alcohol concentration of 0.10 percent (100 mg./100 ml. or 1.0 pro mille in European notations) or more. Equalling or exceeding this limit is per se a violation. (Note that the prohibition in Britain of more than 0.08 percent is virtually equivalent.) Chemical testing for blood alcohol is mandated (Section 11-902.1). Refusal to provide appropriate samples can be used as evidence in a drinking and driving prosecution (Section 11-902.2), and automatically results in license suspension (Section 6-205). The Code provides for mandatory prison on a first as well as subsequent conviction of drinking and driving (Section 11-902.2), though exceptions are provided to permit diversion to treatment.

The main gap between the Uniform Vehicle Code and the most developed of Scandinavian-style laws is the lack of a provision for pre-arrest testing in the Code. This gap may rule out roadblocks on the Australian or French model, though it is compatible with the practice in Norway or that in Sweden prior to 1974. The subject of pre-arrest breath testing and empowering the police to demand samples arbitrarily is not a settled political issue in the United States. The National Committee on Uniform Traffic Laws has declined to adopt proposals to put these into the Uniform Vehicle Code. There is also a body of opinion that finds these provisions Constitutionally objectionable (Little, 1980). Since they have been adopted in the codes of some states, it is likely that the Constitutional issue will eventually be settled as a result of legal challenges.

A current review of drinking and driving laws in the various states (U.S. Department of Transportation, 1979a) finds that aspects of the Scandinavian model have been adopted in all American jurisdictions. A fixed blood alcohol tolerance level occurs in the law of all states, usually leading to a presumption of alcohol influence but establishing a per se violation in at least thirteen states. The limit is .10 percent everywhere except in Utah and Idaho, where it is .08 percent. The requirement to submit to chemical testing is universal, with the penalty being the loss of the driver's license under the doctrine of "implied consent". In twelve states, prison is the mandatory sanction for a first offense of drinking and driving, with additional states prescribing it on second and subsequent offenses. License suspension is mandatory almost everywhere, though usually for second and subsequent offenses only.

In sum, the formal law of the United States does not differ qualitatively from the Scandinavian model in most features. The differences that are perceived in the legal climate between the United States and countries like Sweden are mainly in the matter of the informal law or law in action. It is generally felt that the American laws are not vigorously applied (see Chapter XIII, below).

The American studies relevant to the deterrence of drinking and driving, then, are not concerned with changes in the formal law but are rather centered on discrete enforcement campaigns. Of these, the largest in scale by far have been the Alcohol Safety Action Projects, sponsored by the United States Department of Transportation, in 35 cities, counties and states during the early 1970's. The evidence on these will be reviewed here, along with material from other enforcement campaigns that have received public and scholarly attention in recent years.

1. The ASAPs.

One of the first activities of the newly-formed United States Department of Transportation was to undertake a study of the relationship between alcohol and highway safety. The report of this study (U.S. Department Transportation, 1968) made politically visible the fact that even moderate drinking and driving was associated with strongly increased crash risk, and that heavy drinkers played a major role in the problem. The Alcohol Safety Action Projects were launched in response to this definition of the problem.

It is to be noted that the ASAPs were not conceived as embodying radical changes. Each of the 35 programs utilized principally existing community agencies -- police, courts, schools, etc. -- but were meant to coordinate their efforts in a "systems" approach to drinking and driving, were fortified with additional resources (more than $200 million in public funds was spent on these efforts), and were centered on the task of using the legal system to identify "problem drinkers" and to refer the latter to appropriate treatment facilities.

From the viewpoint of the deterrence model, the principal change associated with the ASAPs was increases in drinking-and-driving patrol and improvements in the efficiency of processing drinking drivers in the courts. In other words, the change was in the direction of increased certainty of apprehension and conviction, along with increased celerity of the latter. No effort was made to increase penalties for drinking and driving; rather, the penalties were de facto reduced due to the provision for diversion of large numbers of offenders from routine punishment to treatment.

With few exceptions, the ASAPs were successful in providing major increases over prior efforts in the actual probability of apprehension of drinking drivers. This was achieved partly by the use of special ASAP-financed police patrols and partly by increases accomplished in the sensitization of regular patrols to drinking drivers. Arrests for drinking and driving were increased many times over. The typical project increased arrests by a factor of 2.5, and in one case the increase was by a factor of 44 (U. S. Department of Transportation, 1979b). Of course, some proportion of those arrested could have been drivers who previously would have been

apprehended but charged with a violation other than drinking and driving, perhaps one easier to prove in court. However, even a shift in the legal label from a less serious to a more serious offense could be expected to have some positive deterrent results, and there is no question that many of the drinking drivers apprehended during the ASAPs would not have been noticed under conditions of patrol prevailing before the projects.

The ASAP experience provides an opportunity to study the deterrent effect of increased law enforcement on drinking and driving because the other intended goals of the project, including treatment and education of apprehended drinking drivers, would most likely be achieved, if at all, only over the longer run. Moreover, drivers with ASAP contact would be relatively few in the total mix of drinking drivers so that important changes in the general statistics could not reasonably be attributable to the achievement of these other goals.

The ASAP experience has been termed a "lost experiment" (Zimring, 1978) because it has received so little attention from the social science community interested in deterrence, despite the wealth of data that have been gathered. One reason for this, in addition to the low esteem in which all studies on traffic law seem to be held by academicians, is the great difficulty of reaching firm conclusions on the basis of the data accumulated by the ASAPs. Perhaps because of haste and lack of forethought, much of the opportunity to learn from the program was "lost" in their design.

One source of interpretive difficulties is the heterogeneity of the ASAP programs and sites. The programs were united in their general approach to controlling drinking and driving, but the specifics were highly diverse. At the same time, the differences were unsystematic and unhelpful in control for analytical purposes. For political reasons, among others, the sites were chosen in a manner that for evaluation purposes must be described as haphazard. The implementations varied enormously in quality.

Moreover, the initial plan to obtain evaluations of each program failed to produce useful products. The caliber of individual reports was generally poor: of 30 analytic studies submitted in 1973, only 6 were judged to be based on "strong" analyses, along with 9 of 21 reviewed the following year. (In general, the better studies were less supportive of pro-ASAP changes.) According to the Department of Transportations's final evaluation (1979b, p. 9), there were commonly problems of inconsistent reporting of crash series, inadequate or improper testing for statistical significance, failure to consider competing explanatory hypotheses in the analyses, and conflicting ultimate performance measures in a given site.

The inadequacy of the site-by-site evaluations planned led the Department of Transportation to attempt its own summary evaluations of the projects as a whole. Although initial attempts at overall evaluation were flawed (Zador, 1976), the final evaluation is informative.

The final ASAP evaluation inquires merely into whether a change in drinking and driving was achieved during the ASAP operational period. It is unconcerned with post-operational influences, and no attention seems to have been paid to the possibility of initial changes followed by reversion to the

status quo during the period of operation. Properly abjuring reliance on police-reported alcohol influence data (though this criterion was frequently used in the individual project reports) the main focus of the overall report is on nighttime crashes, which are compared in a multiple time-series design with daytime crashes in the same communities, with experiences in matched control communities, and with a "national" trend. The control series are crucial, for the ASAPs had the misfortune to span the 1973 fuel crisis which, it would appear, had a much greater influence on the crash picture than anything reasonably to be expected from interventions like the ASAPs.

With corrections to eliminate the effects of seasonality, the fuel crisis and the 55-mile speed limit, data from 12 of the 35 individual projects showed statistically significant declines in nighttime crashes. Although this seems a relatively unimpressive fraction of the projects, the evaluators credibly argue that sites with very low initial crash rates faced considerable difficulty in achieving large reductions. (They should probably not have been selected in the first place.) In addition, sites with growing populations tended to show less ASAP effect. Although the reason for this is not spelled out in the report, it could be due to an increasing traffic count yielding numbers of crashes that would have occurred in the absence of any intervention. Of the thirteen sites with 3 or more nighttime fatal crashes per month and a growth rate of less than 10 percent, eight showed significant reductions in nighttime fatal crashes, a much more impressive fraction. It was also the case that a correlation between the level of enforcement and the reduction in nighttime fatalities was visible only in the thirteen high-crash, low-growth sites.

Surveys of blood alcohol concentrations among non-crash-involved drivers in selected hours were conducted prior to ASAP or early in the initiation of the programs and again during full operations at 27 sites. There was a significant difference in the proportion of illegal blood alcohol concentrations, changing from 53 to 46 per thousand drivers during operations.

The final evaluation of the ASAP is a salvage operation on what, with more initial time and thought, might have been a much more informative experiment in deterring drinking and driving. In my opinion, although the post-hoc selection of control communities weakens the quasi-experimental design of the final evaluation, the analysis is well done under the circumstances. It supplies evidence supportive of the proposition that some programs including increased certainty of a legal penalty under American law could, in the short run, produce declines in drinking and driving and in associated casualties. The analysis is too approximate, and the negative cases too prominent, to conclude much beyond this.

2. Experiments in the military.

An often-cited demonstration of the apparent ability of law to affect drinking and driving, as measured by serious crashes, was the Lackland Air Force Base experience in the late 1950s (Barmack and Payne, 1961). Although it was designed as a public health approach to the problem, the stigma of mental illness among military men renders the Lackland experience relevant to the deterrence literature. The program was stimulated by the findings in

interviews with servicemen involved in injury-producing crashes that nearly two-thirds had been drinking prior to the crash, many of them heavily. (Drinking was found in only 6 percent of a control group matched for time and place of driving.) A countermeasure was devised and put into effect for a year during which all servicemen driving in injury-producing crashes would have their service records reviewed. The possibility of referral to a psychiatrist was specifically communicated, partly in an effort to create a linkage between the idea of drinking and driving and the idea of mental pathology. Appropriate educational materials were devised and circulated in the base newspaper. The criterion for effect was reported lost-time accidents, crashes involving at least 24 hours' absence from official duties due to injury. During the countermeasure year, there were 19 such crashes reported, compared with 40 in the previous year, and this was opposed to national, state, and local trends as well as trends at a comparable military base nearby.

The Lackland experience is notable partly because of its early recognition of the drinking-and-driving problem and the unusual nature of the "penalty." It is likely that the possiblity of suspicion of mental illness was as punitive for young American airmen as the possibility of imprisonment for Scandinavian workers. The authors also show commendable sophistication concerning the need for controls in assessing their experience. The principal weakness of the Lackland study is its reliance on reported crashes. The authors defend this reliance on the basis that serious crashes are less likely to go unreported, and they also interviewed various sources such as the military police and found no evidence of any change in reporting practices. However, to the extent that the seriousness of the "penalty" may have deterred drinking driving it may also have deterred the willingness of the airmen to take time off for injuries of minor to moderate seriousness. The extent of the reported effect is too great, in any event, to attribute it entirely to deterrence of drinking and driving, and the data base is so small that a reasonably effective deterrent, properly measured, would probably be very difficult to detect. However, the demonstration if taken at face value is impressive and even discounting for possible methodological problems it provides encouraging evidence for the possibility of a cost-effective deterrence measure. One wonders why the Lackland policy was discontinued, and what its further long-range findings might have been.

Also frequently cited as relevant to the deterrence issue is the Camp Lejeune study, in which police increased their interaction with vehicles identified as registered at the Marine base for the avowed purpose of administering questionnaires but for the real purpose of increasing the perception of surveillance on the part of military drivers (Irby and Jacobs, 1960). Those drivers suspected of driving under the influence of alcohol were taken into protective custody. The study reports a 42 percent decline in the accident rate. However, in addition to the problem of instrumentation one may note that the statistical test used is suspect because of the time-series nature of the data and apparently arbitrary selection regarding the period of effectiveness. Moreover, there was no control for the effect of seasonality, and the period of claimed effects turns out to have been mid-winter. In my opinion, in contrast to the Lackland study, the Camp Lejeune study lacks credibility.

3. The Chicago crackdown.

A "natural experiment" concerning the effect of severity in penalties for drinking and driving can be found in the effort of Judge Raymond Berg to increase the penalties actually received by convicted drinking drivers. As Supervising Judge of Chicago's Traffic Court, Berg decreed that during the Christmas season of 1970 all people convicted of drinking and driving would receive an automatic seven-day jail sentence. The program was subsequently extended because of its claimed successes. A "remarkable automobile safety record" was claimed from comparing Christmastime of 1970 with previous years on the criterion of (police-reported) fatalities and injuries "involving alcohol" (Field, 1971).

Submission of Chicago crash data to interrupted time-series analysis (Robertson, et al., 1973) led to the conclusion that the lower rate following December 1970 could not be distinguished from chance variation. Moreover, data from Milwaukee, chosen as a comparison city because of comparable climate and location but no change in law enforcement, showed a greater decrease than Chicago, though again the decrease was not significant. Official files showed that in fact the jail sanction was not frequently applied and it is possible that the public, despite extensive publicity, either did not know or did not believe the crackdown, or that the known and believed severity lacked an important deterrent effect. It is interesting to note that convictions for drinking and driving declined during the crackdown for those drivers who had not been chemically tested (accused under the classical law) but not for those for whom blood alcohol data were available (accused under Scandinavian-style provisions).

4. Other experiences.

The conglomerate nature of American law is particularly evident in the traffic field, where the basic law is that of the states. The law is even further fragmented in action because of the independence of local police forces. The level of police activity and its focus in the matter of traffic may vary every few miles in the United States (Gardiner, 1969). Given the recent interest in controlling drinking and driving (due in large part to the success of the United States in addressing other and more manipulable factors associated with crashes) there appear to have been numbers of discrete local attempts at vigorous enforcement and other measures based on the deterrence model. The cumulated experience of American jurisdictions would doubtless be useful and interesting for this review, but they are unfortunately not easily accessible. Most are reported, if at all, only in local media, where they are not systematically described. Furthermore, very few have ever been competently evaluated.

An example of a relatively well-designed local study is the Stockton, California Increased DUI Enforcement Program (Hause et al., 1979), which utilized Federal funds to train police in enforcing drinking-and-driving laws and to pay for increased patrols on weekend nights. The patrols were deployed in different sectors of the city in an experimental manner, and evaluation was facilitated by the gathering of blood alcohol evidence in roadside surveys before and during the enforcement effort. The additional police patrol did increase the risk of apprehension for drinking and driving

on weekend nights, and knowledge of the campaign was fairly widespread. Although the evaluation procedures yielded ambiguous evidence, a variety of suggestive comparisons supported the impression of deterrence. The proportion of illegal blood alcohol concentrations found in the roadside surveys, for instance, showed a statistically significant decline during the season of the experimental period comparable to the season of the control data. Reported collisions declined during the initial experimental year. The contrast of experimental and control areas within the city and the comparison of Stockton with four pre-selected control cities yielded ambiguous results. The greatest limitation on confidence in the deterrent achievements for the Stockton study lies in the extremely short pre-intervention blood alcohol series, which does not provide sufficient data to estimate previous trends, nor does it provide a control period for which seasonal variation can be corrected.

Interesting declines in fatalities were reported as a result of the FARE program of 1973 (Voas et al, 1976), which provided $10 million in Federal funds for state and local police agencies to increase enforcement in critical locations. Of the 47 reporting projects, 44 found fatalties to be reduced. However, as noted in the report, the lack of control sites and the focus of the FARE enforcement on high-accident locations raise the competing explanation of regression or return of extreme situations to normality. Moreover, some of the enforcement apparently overlapped the 1973 fuel crisis, suggesting a possible historical explanation as well.

These examples of state and local programs stand out in part because of the presence of Federal funding. It is likely that similar or better programs have been undertaken elsewhere but have not entered the accessible literature.

# XIII. CONCLUSION

In this final chapter I shall review the findings of the literature survey concerning law and the deterrence of drinking and driving. I will attempt to interpret these findings as they address the validity of the deterrence model, indicate the progress that has been made and the gaps that remain in our knowledge, and suggest some possibilities for improving the ways in which legal policy addresses the problem of drinking and driving.

## 1. A "lost" literature on deterrence.

In discussing the evidence on deterrence to be gained from the Alcohol Safety Action Projects, Franklin Zimring refers to a "'lost experiment', a program invisible to the social science community concerned with deterrence" (1978, p. 155). I believe that Zimring underestimates the extent of loss by commenting only on a single set of experiences and data. The traffic law literature is indeed a vast mine of comparable experience and information, one that is almost untapped by the academic community even in these latter days of enormous concern with the abilities and limitations of law in influencing behavior. This is especially to be regretted since the floods of correlation analyses based on official statistics, victim surveys, and similar data on "conventional" crimes have been largely relegated to the dust-heap after recognition of their inherent methodological problems (Blumstein et al., 1978; Cook, 1977).

Traffic law innovations have been neglected by established criminology partly because much of the reported research is applied research. It often originates in agencies that are primarily mission-oriented and are interested in the resolution of specific questions arising from local circumstances. The search for answers is sometimes marked in this area by "quick and dirty" procedures and, what is worse, it is not uncommonly tainted by the need of officials out on a limb -- "trapped administrators" -- to find positive results that support their existing investments and commitments (Campbell, 1969). The field is also prone to self-serving conclusions on the part of vested interests other than the traditional political ones. Builders of highways and vehicles are eager to see the "blame" for crashes laid squarely upon the "nut behind the wheel," while those charged with control of this dangerous deviant are not entirely opposed to this characterization in order to obtain more adequate resources for their often underfinanced programs.

Related to this point is the additional one that some traffic law research is of poor quality, based on inadequate measures of haphazard samples, only tenuously supporting overdrawn conclusions. Many people with a strong interest in traffic policy are inadequately trained in methodology and statistics. They thus lack both appreciation of their own limitations and access to the knowledge needed to capitalize on research possibilities that their administrative powers might permit. It is also the case that the proliferation of proceedings of meetings and unrefereed journals in the field, along with the keen interest of policy-oriented officials in nearly any scrap of information that might be useful in tackling their tasks, has led to an accumulation of large numbers of weak studies bearing the name of traffic safety research.

Even granting these points, the total disinterest of the academic criminological community in the results of research in traffic law seems regrettable. The opportunities provided uniquely in this field have increasingly been attracting trained researchers who have produced results measuring up to high standards of social science competence, including methodological sophistication and policy neutrality. I refer not only to the isolated academicians in the field, but to organizations such as the California Department of Motor Vehicles and the safety research centers at the University of Michigan and the University of North Carolina, not to mention the redoubtable Insurance Institute for Highway Safety which, by virtue of its fierce criticism of the products of the "safety establishment," has been forced to produce studies capable of withstanding critical barrages.

Not only is there now a quantity of scientifically acceptable research in traffic safety; it is undertaken in an area of policy where often a unique potential exists for understanding the operation of the legal system. One source of this potential is the very peculiarity of the traffic law area: in much of its domain the traffic law is virtually the only important social control influence present. Traffic law violations are the quintessential mala prohibita: acts which, in the absence of law, would violate no other social norms. Thus, the area offers the possibility for isolating the effect of legal factors from the customary and moral factors that so generally accompany them and interfere with clear attributions of cause and effect. Another source of the unique potential of traffic law research is the presence of large volumes of data, sometimes of exceptional validity and reliability as social data series go. Fatal crashes furnish a good example. They are relatively clearly defined and relatively well measured, over time and across jurisdictions. Differences in their definition can often be minimized by application of empirically-derived correction factors. Although in small jurisdictions fatal crashes can be quite variable due to the size of the data base, they can be related to more massive data bases such as injury-producing crashes for confirmation. The statistical agencies responsible for traffic gather crash and other statistics routinely and in considerable detail, and with advent of computerized files they are able to produce complex and precise indexes. (The Department of Transportation is currently engaged in programs designed greatly to increase the quality of data on both fatal and nonfatal crashes.) For instance, drinking and driving can be indexed rather well by looking at refined crash series like those involving single vehicles during the nighttime hours. A further matter to note about research on the traffic law is that the area generates numerous policy innovations, permitting close and detailed studies of legal change in a variety of situations. Replication and cumulation of research are possible in this area as in few other areas of legal studies. Furthermore, the moral neutrality and penal "triviality" of some parts of traffic law have made possible studies with classical experimental designs, in an area where these are exceptionally rare because of ethical and practical difficulties (Blumenthal and Ross, 1973; Ross and Blumenthal, 1975).

I believe that these considerations point to the suitability and importance of attention to the traffic law research on the part of general criminology and especially of students of deterrence. After conceding some

of the problems and inadequacies in much of the literature, I believe that omission of the balance is due partly to ignorance -- unfamiliarity with a somewhat obscure literature -- and partly to bias -- a sharing in academic circles of the lawyer's view that traffic violations are trivial, traffic courts are corrupt, and traffic bureaucracy is incompetent. Contempt on the part of lawyers, trained and paid as they are, for problems that are individually small though significant in the mass, is understandable. This view ought not to be adopted by a social science that is concerned with explaining ordinary and everyday behavior.

Drinking and driving is conceded to be a major social problem in the light of the experimental and epidemiological work of the past few decades, and its study is unquestionably worthwhile from the viewpoint of policy formation. I would like to argue that it is a particularly apt field in which to study the abilities and the limitations of law in affecting behavior, and the deterrence model in particular. The keys to its importance are the numbers of policy innovations permitting evaluation and the existence of many available data sources that index the prevalence of drinking and driving, especially fatal crashes and more refined series like crashes on weekend nights. The routine nature of the data gathering enterprise protects the series against problems of instrumentation in the usual case, and makes powerful interrupted time-series analyses and other quasi-experimental studies feasible at very little cost. With the growing availability of appropriate computerized statistical models for these studies, the promise of this area of research for advances in the study of deterrence is very bright.

The current review covers an international literature of varied quality. Some of the innovations, such as the Norwegian law of 1936, are problematic because the data gathered at the time were not up to comtemporary standards in terms of completeness or detail. Some innovations were introduced at unfortunate times for the purpose of analysis; this includes the Victoria law and the American ASAPs, in addition to the Swedish law of 1941. In nearly all cases there is some reason to doubt the extent to which the law in action was affected by the formal policy innovations, and even many of the formal innovations appear less radical in retrospect than they seemed at the time. However, a review of these many similar policy innovations in a wide variety of settings has the benefit of cumulation of knowledge. In a sense, these policy innovations may be seen as replications of a basic legal reform that achieved its reputation in Scandinavia and a definitive demonstration of effectiveness in Britain. Although all have their methodological weaknesses, these repeated studies of administrations of similar policies lead to some conclusions that I propose can now be accepted as highly plausible scientific generalizations.

2. Verified generalizations.

I believe that in this survey I have covered the entire available literature on policy innovations aimed at reducing drinking and driving through increments in the threatened legal punishment where these have been accompanied by reasonably competent evaluations. I have also attempted to

note many additional innovations reputed to have been effective even where I judge the evidence to be scientifically flawed. I believe that this information justifies the following conclusions:

First, changes in the law promising increased certainty or combined certainty and severity of punishment reduce the amount of drinking and driving. The British experience in 1967 remains the best demonstration of this generalization, as it resulted in a statistically significant decline in serious crashes that was shown to be particularly strong in drinking hours and not apparent in non-drinking hours. The extent of this effect also seems to have been greatest in Britain among the well-reported cases. The British law was the most newsworthy and notable of those studied and therefore most likely to achieve changes in perception of the threat, though there is little direct evidence available concerning public perceptions. Apparently less effect was achieved in some cases where the formal legal change was greater but public notice was less, as at the inception of the New Zealand legislation. However, the British law does not seem to have been an isolated exception. The Netherlands, Canada and France offer evidence for the generality of the deterrent effect of laws following the Scandinavian model. Even the more negative reports, such as those from Australia and New Zealand, may have been discouraged more by the disappointingly small size of changes in the effect measures than by a complete absence of favorable evidence. And in these cases a combination of gradual formal change and low visibility furnish explanations for a reduced effect consistent with the deterrence model. Moreover, there is strong support for the proposition that highly publicized enforcement campaigns are able to diminish fatal crashes. Again, Britain furnishes an excellent example, but others are found in Australia, New Zealand, and if one chooses to accept the final analysis, the American ASAPs.

Second, changes in behavior resulting from changes in the level of threat, on the order of those achieved by policy innovations to date, are evanescent. The reductions in the indicators of drinking and driving disappeared after a few months or years, in the case of programs intended to be permanent, and either immediately or in a few weeks in the case of programs intended to be temporary. Loss of effect for the British breathalyser law was formally proclaimed by official sources after a review of various data series including nighttime fatalities and blood-alcohol levels among drivers killed in crashes. Similar diminutions of effect are clear in all other studies that have reported long-term post-intervention data. Some studies of limited campaigns fail to report post-campaign data but there is no reason to believe that they would have come to different results.

Third, those innovations confined to manipulation of the severity of the legal punishment, without a concomitant change in its certainty, produce no effect on the apparent incidence of drinking and driving or its aftermath in crashes. In places like "Traffictown" and Chicago the situation regarding drinking drivers did change, but in unexpected and undesired ways. These changes can be interpreted as the result of instrumentation (change in the measurement of drinking and driving), e.g., underreporting violations or shifting of arrests to a different category, rather than as changes in the

actual amount of drinking and driving. It appears that increased severity of the prescribed punishment results in changes that lessen the certainty of its application, which may in turn even reduce the deterrent effectiveness of the law. It also seems, from the Dutch experience, that differences in actual severity are barely perceived and that, with low certainty of apprehension, marginal differences in perceived severity have no effect upon the threatened behavior.

Fourth, in the study of the applicability of the deterrent model to drinking and driving, as with traditional criminality, there is virtually no evidence one way or the other concerning the effect of celerity. Although there has been some concern in policy circles with increasing the celerity of punishment, e.g., the ASAPs' attempts to deal with bottlenecks in the processing of accused drinking drivers, celerity has never in the reported innovations been manipulated in the absence of changes affecting certainty and severity.

3. The abilities and limitations of Scandinavian-type law.

My purpose in this section is to offer a more detailed interpretation of evidence summarized in the preceding generalizations. At this point it is necessary to engage in more speculative thought than in the balance of the report, due to the nature of the reported evidence. Typically, we know that a program was undertaken to increase severity or certainty of the legal threat for drinking and driving, and we may have evidence that it was put into effect. We also may know that some effort was made to publicize the innovation, though information is often lacking and usually very sketchy. Some few studies provide evidence of the extent to which the program becomes known in the jurisdiction, though very rarely is there any information on the perceptions of the severity and, especially, of the certainty of the legal threat. Again, very rarely is there direct evidence of changes in drinking and driving, as in series of competent roadside sample surveys including breath tests. More commonly, statistics of crashes and of casualties are presented as indirect evidence of drinking and driving behavior. These latter series are, of course, direct evidence of the ultimate policy goals being achieved, and especially when limited (e.g., to fatalities at night) they are good though not perfect indicators of the intermediate goals to which the deterrence model points.

Let us consider the three components of the deterrence model and ask the extent to which their casual influence has been tested and demonstrated in the world literature on drinking-and-driving laws. Before commencing this exercise we would do well to note that the studies being considered furnish instances of marginal increases in one or more of the components of the model, not of the absolute introduction of legal threats. All instances where the drinking-and-driving law assumed the Scandinavian model occurred in legal systems that had previously proscribed and threatened the behavior in question. Indeed, many of the changes appear to have been small steps in a series of changes bringing classical laws into conformity with the Scandinavian model: for example, changing the nature of a specified blood alcohol level from a presumption of alcohol influence to a *per se* violation. Thus, the literature is investigating changes in the level of

the deterrence variables, not their presence or absence, and negative results must be understood as appropriately limited in their implications.

We may begin the exercise by noting that the literature is quite unenlightening in the matter of perceived celerity of punishment. Few programs were established with much concern for celerity -- some of the ASAPs were an exception -- and none have attempted to measure changes in its perception. Moreover, the increases experienced in celerity were invariably associated with other changes relevant to the deterrence model, and would be difficult to disentangle. Of course, the criminologist will recognize this picture in the literature of traditional crime as well. Celerity is an orphan variable in the deterrence model. Although the Scandinavian model for drinking-and-driving law embodies measures that might be expected to increase celerity, notably the administrative lifting of the driver's license before final judgment, its achievements in these efforts have not been assessed.

There is more information on perceived severity of threat in the drinking-and-driving literature, and it is not favorable to this aspect of the deterrence model. Those innovations limited to increasing actual severity of punishment seem to be associated with little or no change in the indicators of drinking and driving, but rather with unforeseen and disturbing changes in the functioning of the legal system. Perceived severity is not often directly studied, but there is some indication that changes in actual severity are only weakly reflected in perceived severity, and furthermore that different levels of the latter are not correlated with the achievement of conforming behavior.

There is considerable positive demonstration of the effect of increments in perceived certainty of punishment due to the introduction of laws and campaigns following the Scandinavian model. Interventions designed to increase the actual probabilities of punishment for drinking and driving seem almost always to be accompanied by corresponding declines in the variables indicating this behavior. However, in the long run the declines are countered by tendencies to return to the status quo ante, whether or not the increased actual probabilities of detection, conviction and punishment are maintained. This fact requires further explanation.

In my opinion, the key lies in the very modest level of real threat that current drinking-and-driving laws are able to obtain. This fact is noted by Jones and Joscelyn as follows:

> Research suggests that a driver in the U.S. would have to commit some 200 to 2000 DWI violations to be caught. After apprehension he would still stand only a 50-50 chance of suffering no more than a relatively mild punishment. Such a threat is apparently acceptable even to most social drinkers, who are able to control their drinking (1978, p. 123).

The estimates of the probability of apprehension given here are based on those of Borkenstein (1975), for the probability of arrest in routine policing, and Beitel, Sharp and Glauz (1975) for the probabilities in

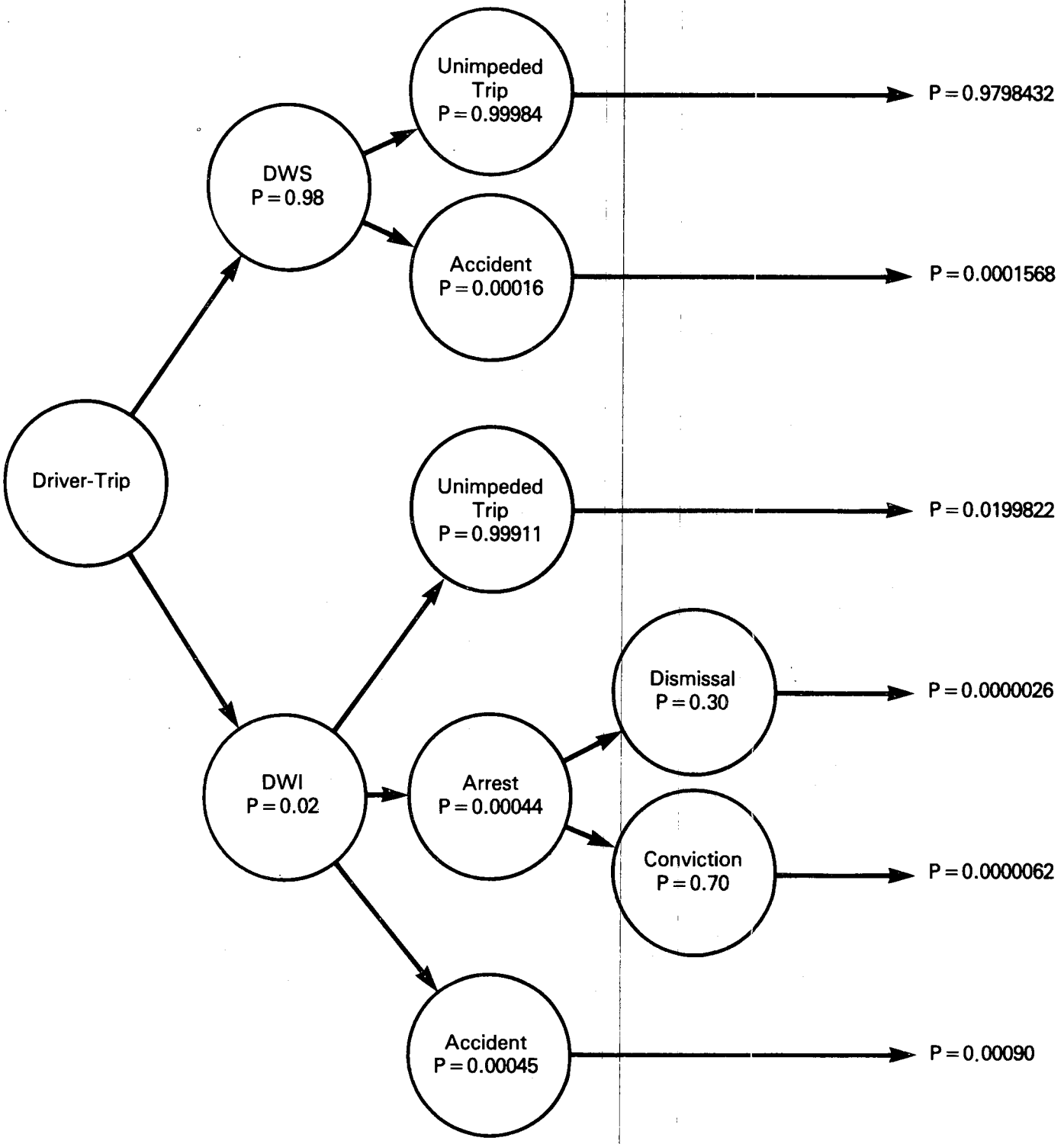
Kansas City during the ASAP while driving on patrolled roads. The same low level of threat has been reported, for example, in Sweden, where:

> A carefully made estimate suggests that the real incidence of [drinking-and-driving] crime is at least two hundred times higher than the reported one. The same careful "initiated guess" for the whole country indicates that during the last years there have probably been not less than three million crimes committed yearly in Sweden (Persson, 1979, p. 112).

Another way to appreciate the level of threat under conditions of normal policing in the United States is suggested by Figure XIII-1, in which Summers and Harris (1978) diagram the conditional probabilities of arrest and accident when driving sober or under the influence of alcohol. It can be seen that the probability of an accident when driving under the influence (0.00045), though three times the comparable probability when sober (0.00016) is nonetheless miniscule. The probability of arrest (0.00044) is of the same order. Otherwise put, the probability of an impeded trip while impaired is still less than 1/1000. To increase the chances of any impediment to the trip to as much as, say, 1/100, would require more than a twenty-fold increase in the probability of arrest.

In ordinary circumstances, the perceived risk of apprehension for traffic offenses is considerably overestimated (Cohen, 1978). It is likely that the introduction of novel laws and campaigns described in this report resulted in even more exaggerated overestimations of the perception of certainty of punishment, and consequently in the declines in indicators of drinking and driving frequently reported subsequently. In the light of the actual changes in enforcement attached to most of these innovations, I find it hard to think of anything other than gross misperception of the threat that would warrant noticeable changes in the subject behavior. Unfortunately, the perception of threat as a function of the interventions is not well documented in the literature, and this interpretation has to be considered speculative. It is supported by its reasonableness in explaining both the apparent response of drinking and driving to the initiation of these laws and campaigns, and the gradual falling off of the apparent effect in those instances where the enforcement change was intended to be permanent. It helps interpret the paradox found in Britain, France and other places of a long-term decline in the deterrent effect of the law simultaneous with continued increase in the actual probability of apprehension as expressed by screening tests, charges, and convictions. In short, it appears to me that the deterrent effect of the Scandinavian-type laws is due to an exaggerated perception of the probability of apprehension of violators. This exaggeration can be explained by the publicity and media attention received by these innovations. The more spectacular the publicity and attention, the greater the reported effect of the law. Those laws that met the most critical resistance, as in Britain, seem to have been the most successful in their initial deterrence of drinking and driving.

These speculations also help to make sense of the data on attempts to increase severity, accepting the negative evidence without necessarily abandoning the deterrence model. Among the reasons for the failure of




Source: Summers and Harris, 1978, p. 10.

***Figure XIII-1. Probabilities of Driver-Trip Outcomes.***

severity of penalty to deter drinking and driving may well be its interaction with certainty. At very low levels of certainty, any amount of penalty can be dismissed. This interpretation helps explain why, beyond the question of legal deterrence, drivers seem willing to accept impressive multiplications of the risks of death and injury by combining drinking and driving. In parallel fashion, one might expect that successful attempts to increase certainty of apprehension would yield no deterrence if severity were minimal.

In sum, a reasonable interpretation of the results of this review is that Scandinavian-type laws deter when initiated due to exaggerated perceptions created through publicity and media attention of the risk of apprehension and punishment. Since they appear to increase the real risks much more moderately, the deterrent accomplishment rests not on a firm foundation but rather on a temporary scaffold that becomes undermined through experience. The driver on the highway learns that, in an unintentional and well-meaning way, his government is engaged in deception when it threatens him through drinking-and-driving laws following the Scandinavian model.

4. Research that is needed.

It is obvious from the speculative nature of parts of this last chapter that more needs to be known about the function of the components of legal threat in affecting the behavior of drinking and driving. A major question, and the center of my speculation, concerns the relation between actual and perceived certainty, severity and celerity of punishment (Gibbs, 1975). I find it surprising that in all the published evaluations of Scandinavian-type legal innovations there has been virtually no systematic study of initial levels of perceived threat and changes in these levels corresponding with the specific innovations. This would best be approached by periodic polls of successive random samples of the driving population over a prolonged baseline period as well as during and after operations. It could possibly be combined, as in the Stockton study, with roadside testing for blood alcohol, although considerations of possible testing effects suggest that traditional interviewing situations would be preferable.

More also needs to be known about the interaction among the components of the deterrence model, especially certainty and severity. One of the missed opportunities of the ASAP experiences was the possibility of systematically varying increments in these in order to test for joint and interactive effects. Short of such a major operation, it would be worthwhile dividing future implementations of increased threat into phases and introducing changes in certainty and severity at different times. This would permit interrupted time-series analyses of marginal increases in one component accompanied by stability in the second, followed by a period of their joint increase. (The timing and order of component changes should of course be varied from case to case.)

The question of a threshold for the operation of certainty of threat is important for policy as well as for theory. The practical issue is limited by the amount of enforcement resources that are likely to be given to the deterrence of drinking and driving, and by any undesirable side-effects that an intensive patrol for drinking drivers might carry with it. Perhaps the

crucial experiment here would be to raise the level of actual certainty of apprehension to the bounds of political and financial possibility and hold it there over a reasonably long time, to see whether the return to the status quo ante found in all the reports surveyed here can be avoided, at least in part. The situation should be studied as well for the effect of the actual change on the perceived change, and to learn about any unintended and perhaps undesired effects of this innovation upon the existing legal system.

5. Deterrent approaches to the problem of drinking and driving.

If one poses the question, "Does deterrence work, in the area of drinking and driving?" the answer must be different, assuming present levels of threat and in the present state of knowledge, depending on whether the short term or the long term is meant. This review of the literature shows fairly clearly that deterrence works, in the short term. Adoptions of Scandinavian-style laws and enforcement campaigns based on such laws provide many convincing examples of the ability of legal threat to control behavior in this area, and to achieve the ultimate policy-relevant result of a decline in casualties. Regardless of the fact that many drinking drivers may be problem drinkers, and that some observers have posited that problem drinkers are not deterrable, the deterrent efforts studied here have had effects. Furthermore, and again in the short run, it may well be that the savings attained have exceeded the costs of these programs.

However, the long-run prognosis for achieving marginal increases in deterrence through modifications in existing law seems bleak. Even the most successful of deterrent interventions appears in the course of a few years to have lost its entire beneficial effect. My interpretation of these facts is that the level of threat in fact achieved in adoptions of the Scandinavian model is too low to maintain important deterrent effects over the long run. Moreover, we do not know what level, if any, of certainty and severity of threat will suffice to maintain deterrence of drinking and driving through law. Surely research is needed to vouch for the possibility of long-run deterrence and, what is more, to give a clearer indication of its price, not only in police cars and salaries but also in the freedom of the population from an oppressive surveillance. As Little notes in his discussion of motorcycle helmet law repeal (1980, p. 288), traffic casualties may be "an acceptable price of freedom." I am not willing to accept this conclusion as established for Scandinavian-style drinking-and-driving laws in the present state of knowledge, but it is a real possibility that applied research should be exploring.

Deterrence over the long run may be a feasible and cost-effective legal policy. Present knowledge provides some guidance as to how we might achieve maximum effects with a deterrent strategy, and if crucial experiments (from the policy viewpoint) are to be done, the laws to be investigated should be guided by this knowledge. A first point to be made is that very likely existing levels of severity should not be increased. Indeed, the mere retraction of driver's license for a few weeks might be a noticeable and presumably effective threat in an automobile-dependent society. Recourse to heavy fines and mandatory jail sentences seems likely to encourage deformations in the legal system: police leniency or even

corruption, plea bargaining, and increased findings of not guilty. These adjustments may have the unintended effect of reducing the certainty of punishment and diminishing rather than increasing the total deterrent effect of the law. It may be true that many drivers continue to drive illegally with suspended licenses, presenting a challenge to the authority of the legal system that could well meet with heavy penalties; however, the question from the general deterrence viewpoint is whether license suspension is feared and not whether it works well as an incapacitative device.

The major concern raised by the accumulated knowledge in this area is to present drinking drivers with a "real", subjectively important, chance of apprehension should they commit the violation. This concern is problematical because of the great difficulty of detecting drivers with high levels of blood alcohol from the vantage point of police patrol. Experience shows that it is possible to increase patrol for drinking and driving and to raise the apprehension rate considerably. Common sense suggests further that patrols should be deployed at times and places where the problem behavior is common, e.g., on weekend nights and on roads with concentrations of taverns and restaurants, and indeed police when left to their own devices select this mode of patrol. Perhaps the most promising innovation on the American scene would be to introduce some convincing threat of probable apprehension for the driver who believes (usually correctly) that he can drink and drive without giving cause for police to suspect him of the violation. Roadblock testing on the French model is one means of accomplishing this, if the roadblocks appear to be frequent. An approximation that may well fare better Constitutionally would be checks of vehicles or papers on the Norwegian model, during which the odor of alcoholic beverages would justify a screening test for blood alcohol. Another approximation is furnished by the British legislation, which makes the occurrence of a traffic law violation or a crash the equivalent of reasonable cause for a policeman to suspect the presence of alcohol and to demand an appropriate screening test. Under this legislation it is possible to engage in a massive testing, as was the case during the Cheshire campaign.

The issue of celerity, though disregarded in research, should receive attention in future legal innovations. One way in which punishment could be made to follow closer upon the violation would be to abandon the criminal definition of drinking and driving, at least in routine cases and for first offences, making it a civil offense to be handled with dispatch by an administrative organization (cf. Jones, Joscelyn and McNair, 1979). Punishments such as imprisonment might not be applicable with this procedure, but for independent reasons these punishments are contraindicated. This change would probably also have a positive effect upon the certainty of the penalty as well. What is more, it would place the routine violation in a fitting legal category; as has been noted elsewhere (Force, 1977), one of the current law's major problems is its treatment of drivers as criminals when they are not believed by the public to warrant that designation. Opinion polls that find drinking and driving to be regarded as a serious offense are probably tapping attitudes that relate to the image of a grossly intoxicated driver who injures and kills as a result of his intoxication (Grasmick and Green, 1980). The fate of routine drinking-and-driving cases before juries indicates that these

attitudes are not found concerning drivers apprehended by patrol (King and Tipperman, 1974). It would be good for the health of the legal system if its actual workings were supported by the citizenry. A variety of commentators have proposed legal modifications along these lines that promise to increase the deterrent effect of drinking-and-driving law (Little, 1980, p. 269). These possibilities should be tried and the results studied.

6. Beyond deterrence.

Although an attack on the problem of drinking and driving by means of legal threat is feasible and promising, it is possible that further research will find that no tolerable level of enforcement can produce permanent improvement, or that the amount of improvement is insufficient to satisfy public concerns. The level of police resources that need to be invested to produce a sufficient effect may be too costly. More important, the manner of enforcement may be too intrusive to be borne in a democracy. As Little notes, the price of legal tools includes a diminution in freedom, and even solid gains against a serious social problem may be judged to be too expensive. As the achievements of a deterrent approach are likely to have limits, and as surveillance has its price (for the police as well as for the public), we might now consider alternative public policies for dealing with the problem at hand.

This perspective will be best understood if the problem is defined, not as drinking and driving, but as the reduction of death, injury, and property damage associated with automobile crashes. Drinking and driving is important only insofar as it is a cause of crashes. Otherwise it should be a matter of indifference to policy -- drinking can be fun and driving is useful, and why should we waste our efforts to prevent the combination? I realize that this is a different approach from that which prevails, for instance, in Scandinavia and in many religious and medical circles elsewhere, but I believe that in the end the differences come down to scientifically unarguable disagreements over values. I expect that most readers will share my values concerning the enforcement of morality, but that fewer may go along with the belief that policing drinking and driving is not necessarily the proper place to attack health problems. I shall not try to convince those who disagree.

If my definition of the problem is accepted, and deterrence and other approaches to affecting driver behavior turn out to be either ineffective or intolerably costly in the long run, I believe we can follow Little to the policy alternative: "to forget about more severe laws and work for a safer environment for drunks to drive in (sturdier cars, safe highways)..." (1980, p. 284). This is a very broad goal, and it has the advantage over dealing with more narrowly-defined problems in being relevant to crashes with any number of causes. A vehicle and highway that are safe for a drunk driver are also safe for the driver who has a heart attack, one who dozes off, one who drops his lighted cigarette into his lap, one who fails to see a stop sign or a vehicle approaching from an unexpected angle, etc. This perspective has marked the efforts of the National Highway Traffic Safety Administration since its founding and has led to such

innovations as seat belts, air bags, removal or modification of fixed hazards on highways, and other programs with clearly cost-effective results. Although these innovations have at times been resisted on libertarian grounds, I believe that they are possibly less intrusive than the operations that a workable and permanent deterrence-based program aimed at drinking drivers might entail.

Moreover, a shift from concentration on the drinking driver to concentration on damage reduction permits reliance on technological devices rather than influencing individual behavior. As stated by Lily Hoffman, in connection with the example of seat belts:

> What technology has uniquely to offer to the solution of complex problems is a kind of option-reducing potential -- the possibility of at least removing the decision from the individual (whom we have failed to change time and time again) to the societal level (1973, p. 101).

One of the general lessons from the social scientific study of law is that effects are much easier to obtain from laws directed at a small, controllable, number of organizational entities than from laws directed to masses of individuals. Desegregation in housing is obtained by edicts directed to housing developers and authorities; taxes are most easily collected through withholding by bureaucratic employers; schools enforce the innoculation of children; and seat belts are installed in vehicles because of rules directed at manufacturers (but lose their efficacy in part because individual-centered rules are needed to guarantee their use). Safety efforts achievable through manipulation of the vehicle or the road form the object of this most efficacious type of law.

If the problem we are facing is that of reducing injuries and deaths associated with crashes, I am tempted to agree with Hoffman that "the safety car concept of passenger packaging can be seen as a kind of ultimate loss reductive solution" (1973, p. 101). However, until such time as this ultimate solution may be generally available, the possibilities inherent in the deterrence of drinking and driving should not be discarded. The accumulated research reviewed here testifies to the achievability of loss reduction through laws following the Scandinavian model, though no evidence is currently available concerning the potential for its achievement over the long run. The review does point to some promising modifications of existing law. In the present state of the world there is every reason to adopt and evaluate these modifications, which may yield important interim benefits while the ultimate solution is awaited.

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