

National Institute
of Justice

Research Report

Synthesizing and Extending the Results of Police Patrol Studies

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- Providing better and more cost-effective methods for managing the criminal justice system
- Assessing the impact of probation and parole on subsequent criminal behavior
- Enhancing Federal, State, and local cooperation in crime control

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Synthesizing and Extending the Results of Police Patrol Studies

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PREFACE

In May 1978 the Police Division of the National Institute of Justice (NIJ) awarded Public Systems Evaluation, Inc. (PSE) a two-year grant for the purpose of analyzing and synthesizing the results of research in police field services. In particular, the study was intended to identify areas of missing knowledge and to facilitate the development of a future research agenda.

Organizing the field services research literature along functional lines (i.e., patrol, investigation, support services, etc.), PSE's research team identified a series of hypotheses whose origins are rooted in the historical assumptions which have shaped field service operations. It was from this hypothesis-based perspective that PSE reviewed a large set of research products and selectively specified a subset for further review, analysis, and synthesis.

Throughout, PSE attempted to be "fair" in its selection of research products. Where significant and relevant research activities concluded subsequent to the review stages of the project, every reasonable effort was expended to acquire such products for inclusion--or, at least, mention. In some cases PSE was unable to acquire the associated reports, but these are inevitable "gaps" which characterize efforts to synthesize broad bodies of written materials. It should be stated that PSE has strictly construed the term "research." As a result, this report disproportionately reflects the patrol discipline, which has been characterized by more formal research--i.e., experimental or quasi-experimental--activities.

Finally, the authors have attempted to be objective in their assessment of the research products by stating carefully the criteria upon which that assessment is founded. However, when strong criticism is justified--for example, in the case of widely cited major studies with serious methodological flaws--the authors have not refrained from expressing their concerns. Their purpose throughout was to expand our future research knowledge base, not to dwell on past individual efforts.

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Finally, and significantly, the authors would like to express their appreciation for the contribution of the project Advisory Panel whose participating members were: Dr. Egon Bittner (Brandeis University), Chief Anthony Bouza (Minneapolis Police Department), Col. Eugene Camp (St. Louis Metropolitan Police Department), Dr. Jan Chaiken (Rand Corporation), Chief Victor Cizanckas (Stamford, CT Police Department), Mr. Calvin Clawson (Seattle Police Department), Dr. George Kelling (Harvard University), James Parsons (former Chief, New Orleans Police Department), Mr. Theodore Schell (U.S. Department of Commerce), and Mr. Thomas Sweeney (Yonkers, NY Police Department). The Board members traveled large distances to attend project meetings and their participation helped to shape and guide our research.

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*We dedicate this report to the memory
of the late Victor I. Cizanckas. His
contributions to the field of police
administration and commitment to the
conduct and assimilation of quality
police research were outstanding.*

I INTRODUCTION

The operations of urban police departments have been observed with interest for many years. Today this general interest in policing is accompanied by a persistent questioning of the effectiveness of police activities. Given the millions of dollars spent on police forces each year, government officials, local administrators, and citizens alike are asking whether or not the police are worth the investment that has been made.

At the center of concern with policing lies the traditional practice of police patrol. This activity has consumed a large fraction--perhaps greater than 50 percent--of all financial, personnel, and technological resources allocated to police departments over the past fifty years. However, the *effectiveness* of police patrol in preventing and deterring crime and in providing general public safety services has been difficult to establish.

It should come as no surprise, then, that police patrol has become the subject of numerous researchers. Since the 1967 Report of the Science and Technology Task Force of the President's Crime Commission (The Institute for Defense Analyses, 1967), literally hundreds of reports, articles, and books have appeared focusing on the issues, merits, and practice of police patrol. The purpose of this particular report is to synthesize the major findings of these researchers and to surface some

of the problems evident in patrol *research* as well as patrol practice.

This report is not the first attempt at summarizing what is known in the field of police patrol. In particular, the following six reports have all presented useful knowledge syntheses relative to their publication dates:*

- (1) An Evaluation of Policy Related Research: Reviews and Critical Discussions of Policy Related Research in the Field of Police Protection (S. I. Gass and J. M. Dawson, 1974).
- (2) National Evaluation Program (NEP) Phase I Summary Report: Traditional Preventive Patrol (T. Schell, D. Overly, S. Schack, and L. Stabile, 1976).
- (3) NEP Phase I Summary Report: Neighborhood Team Policing (W. Gay, H. Day, and J. Woodward, 1976).
- (4) NEP Phase I Summary Report: Specialized Patrol Projects (K. Webb, B. Sowder, A. Andrews, M. Burt, and E. Davis, 1977).
- (5) Task Force Report: Science and Technology/A Report to the President's Commission on Law Enforcement and Administration of Justice (The Institute for Defense Analyses, 1967).
- (6) Police (National Advisory Commission on Criminal Justice Standards and Goals, 1973).

While not deriding the efforts which resulted in the above publications, suffice it to say that the report being introduced is different. In this report we have attempted to let research *hypotheses* (as opposed to complete research studies) form our basic units of analysis. Such an approach allows one to see how the *body* of completed patrol research

* A brief summary of each of these reports can be found in the Appendix.

responds to the dominant issues and questions raised in the study of police patrol. This approach is also useful in uniting previously disconnected literature in a coherent manner.

The report is organized along the following lines. In Part II, we begin with a discussion of the historical background of police patrol and note the simultaneous development of patrol strategies and patrol research in recent years. In doing so, we provide the reader with a brief initial tour of the patrol research literature. Part II concludes with a normative discussion of the structure of patrol research efforts. The model of research developed there provides a useful tool for use in assessing completed research studies.

From our discussion of the goals of patrol and the development of patrol research in Part II, we discern three major categories of research questions. These categories--Preventive Patrol, Response Time, and Alternative Organizational and Manpower Allocation Schemes--are comprised of a number of research hypotheses. A listing and discussion of these hypotheses is provided in Part III.

Part IV contains the results of the major effort of this report: our hypothesis-based assessment of patrol research. For each research question surfaced in Part III, we have attempted to determine both the degree to which current research supports or refutes the central idea being suggested and the credibility of each piece of reported evidence pertaining to this central idea (whether the evidence is pro or con). Our method for assessing credibility is also discussed in Part IV.

The next two sections of the report address collective findings. In Part V, synthesized methodological findings are presented. Much of this section focuses on the methodological problems currently faced by patrol

research, and several reported findings of questionable research merit are discussed. Part VI addresses synthesized substantive findings. The areas of agreement and disagreement among studies with respect to specific research questions are summarized there.

In Part VII we present our recommendations. These recommendations address both methodological concerns with patrol research and specific areas in which future research could be beneficial. The importance of developing an overall research framework by which otherwise independent studies may be related is noted.

Finally, many of the readers may find our appendices particularly useful. The annotated study bibliography briefly describes each of the studies we examined in conducting the study. The full bibliography, which we believe to be quite comprehensive, lists many patrol-related research studies which have been reviewed but are not specifically addressed in this report.

II HISTORICAL BACKGROUND

2.1 GENESIS OF THE PATROL FUNCTION

The activities of police patrol have historically accounted for the major portion of all police work. According to Manning:

The most visible activity of the police, that for which they were conceived and by which they are best known, is preventive patrol. (Manning, 1977, p. 19)

In this brief section, we will examine the historical development of the police patrol function and identify the "stated purposes" of patrol.

Although the origins of policing may be traced as far back as the "watch-and-war" system of the thirteenth century (President's Commission on Law Enforcement and Administration of Justice, Task Force Report: The Police, 1967, p. 3), the first attempts to organize a mobile patrol force occurred in Britain during the mid-1700s. That patrol became a reality in eighteenth century England is not surprising given the high level of street crime existing at that time. For example:

In 1776, the Lord Mayor of London was robbed at gunpoint, and within the decade two of England's great nobles, the Duke of York and the Prince of Wales, were mugged as they walked in the city during the day. (Rubinstein, 1974, pp. 8-9)

One of the first advocates of police patrol was Henry Fielding, a London magistrate of the 1750s. Fielding argued that constables should be ". . . organized to patrol the streets rather than remain at their watch boxes" (Rubinstein, 1974, p. 9). Viewing the people of his time as in need of control, Fielding felt that a patrol oriented towards the

prevention of crime was warranted to supervise London. In this light, he constructed a mounted patrol to protect the highways leading into the city. Fielding created one of the world's first mobile patrol forces with this action.

By the late 1700s the urban crime problem in Britain was staggering, despite Fielding's initial efforts to institute police patrol. As Lee claims:

. . . there is no exaggeration in saying that, at the dawn of the nineteenth century, England was passing through an epoch of criminality darker than any other in her annals . . . and the other lurid crimes which belong to this age, surpass in enormity anything before or since. . . . Such then was the desperate state of the society at the dawn of the century. (Lee, 1977, pp. 67-68)

In 1798, Patrick Colquhoun (also a magistrate) established a patrol force to guard the docks of the East India Company along the Thames River. However, Colquhoun was interested in the application of the patrol concept in general. In his 1796-1806 Treatise on the Police in the Metropolis, Colquhoun wrote:

Police in this country may be considered as a *new science*; the properties of which consist . . . in the *prevention and detection of crimes*; and in those other functions which relate to the internal regulations for the well ordering and comfort of civil society. (In Manning, 1977, p. 73)

Thus, Colquhoun saw in the patrol force a means by which crimes could be deterred before-the-fact; this view of policing was markedly different from the "apprehension and punishment of criminals" model of policing popular at the time.

Though Colquhoun's thoughts on policing were made explicit through his writings, his thoughts were not permanently translated into action until England's Home Secretary Robert Peel began a concerted effort to

establish a fulltime police patrol force in the 1820s. Beginning with a limited one-year 24-man experimental patrol in 1822-23, Peel was able to sell the notion of police patrol to his peers and to the public at large. With reference to Peel, Manning states:

He rationalized his proposal for the police in London not on the basis of control of the masses but because it would be cheap and efficient, helpful in reducing the rising crime rate, a matter of progress (he expressed the opinion that the city had 'outgrown' its police institutions), and a matter of simplification and centralization of function, as changes in enforcement capacities were to be instituted in concert with reform of the criminal law. His aim in the latter action . . . was to increase the deterrent capacity of the police and to substitute more certain enforcement and prevention for harsh penalities. (Manning, 1977, pp. 77-78)

In 1829, under Peel's patronage, England's Parliament passed an "Act for improving the Police in and near the Metropolis". With this act, the existence and functions of police patrol became formal. Peel stated:

It should be understood, at the outset, that the principal object to be obtained is the Prevention of Crime.

To this great end, every effort of the Police is to be directed. The security of person and property, the preservation of the public tranquility and all other objects of a police establishment, would thus be better effected than by the detection and punishment of the offender after he has succeeded in committing the crime. . . . Officers and police constables should endeavour to distinguish themselves by such vigilance and activity as may render it extremely difficult for anyone to commit a crime within that portion of the town under their charge. (In Chapman, 1972, p. 4)

Peel not only stated the aims of patrol, he also proposed a measure for assessing patrol performance:

. . . when in any division offenses are frequently committed, there must be reason to suspect that the police is not in that division properly conducted. The absence of crime will be considered the best proof for the complete efficiency of the police. (In Chapman, 1972, p. 4)

Thus, it was well known after 1829 what the purposes of police patrol were. Peel's formalization of the patrol function based upon his own ideas as well as those of Fielding and Colquhoun survived unchallenged almost until the present day. However, the *strategies* employed by the police to achieve the goals of patrol have changed since Peel's time, so a brief history of patrol methods will now be presented.

The oldest patrol mode is foot patrol. It has already been mentioned that Robert Peel's foot patrolmen (the "Bobbies") constituted the first formal police department. Foot patrol as initially practiced was scheduled along *fixed routes* in assigned territories called beats. Patrolmen would walk singly or in pairs, communicating with each other by blowing whistles or pounding the streets with their batons in time of need. Since each patrol officer had a schedule to maintain, patrol supervisors knew where their officers were. Unfortunately, it was also possible for thieves and other ruffians to learn the patrol routes; this allowed for the occurrence of "well-timed" crimes.

Mounted patrol is probably as old a patrol mode as foot patrol; indeed, Fielding's mounted highway patrol, although shortlived, was established well before the end of the eighteenth century. However, mounted patrol was not suitable for regular street patrol in the city, so most urban patrol forces remained on foot.

From the 1830s onwards, many of the major innovations in police patrol were technological in nature. For example, the establishment of telegraph call boxes in the 1850s and telephone call boxes in 1880 greatly improved the communications between patrol officers in the field and administrative personnel in the station houses. The invention of the bicycle allowed patrol officers to cover greater territory during their tours of duty.

However, the invention of the automobile coupled with the development of two-way radio systems in all likelihood had the greatest impact upon police patrol. The first fully-motorized police force was fielded by August Vollmer of the Berkeley, California, Police Department in the 1920s, while two-way radios were successfully initiated into motorized police patrol in 1929. In 1930, Vollmer declared:

. . . with the advent of the radio-equipped car a new era has come. . . . Districts of many square miles . . . are now covered by the roving patrol car, fast, efficient, stealthy, having no regular beat to patrol, just as liable to be within 60 feet as 3 miles of the crook plying his trade--the very enigma of this specialized fellow who is coming to realize now that a few moments may bring them down about him like a swarm of bees--this lightning swift 'angel of death.' (In Rubinstein, 1974, pp. 20-21)

Recently, a new wave of technological developments has served to further advance the state of police patrol. Some American cities have installed Computer-Aided Dispatch (CAD) systems; others are experimenting with Automatic Vehicle Monitoring (AVM) systems. The potential usefulness of these new technologies is only beginning to surface.

As mentioned earlier, the basic functions of police patrol have remained unchanged over the last 150 years. For example, O. W. Wilson and R. C. McLaren in their book Police Administration state that:

The elimination of the actual opportunity, or the belief in the opportunity, for successful misconduct is the basic purpose of patrol. A thief's desire to steal is not diminished by the presence of a patrolman, but the opportunity for successful theft is. (Wilson and McLaren, 1972, p. 320)

In the final report of the President's Commission on Law Enforcement and Administration of Justice (1967) the principal patrol function is said to be deterrence: ". . . discouraging people who are inclined to commit crimes from following their inclinations" (President's Commission on Law

Enforcement and Administration of Justice, 1967, p. 95). Similar statements may be found in any current reference stating the primary functions of patrol.

While deterrence is seen as the basic goal, other functions such as the *apprehension of offenders*, the *recovery of stolen property*, and the *provision of public services* have been attributed to the patrol force. These stated purposes of patrol have given rise to several intuitive patrol strategies. For example, if patrol does deter crime, then it seems correct to reason that more patrol deters more crime; hence the argument by some for high visibility saturation patrol. Or, if the apprehension of criminals by the patrol force appears to vary inversely with response time, then response time minimization is arguable as an appropriate strategy in light of the apprehension function of patrol.

For many years theories linking patrol strategies to achievement of patrol objectives have remained unchallenged. However, in recent years some have begun to query the wisdom of conventional police patrol as a means for achieving patrol objectives. It was this initial questioning of police patrol's "sacred cows" which has led to the past decade of patrol research. The evolution of patrol research is the topic of our next section.

2.2 EVOLUTION OF PATROL RESEARCH

Though the police have formally existed for over 150 years, *independent* research in police patrol is a relatively recent phenomenon. Indeed, prior to 1967 "research" in patrol was usually an in-house enterprise conducted by police departments for their internal use. For the first half of this century, research in patrol and "doing something new in patrol" were practically synonymous.

It is important to realize that the police community and the academic community held (and to some degree still hold) different views as to what constitutes research. The Webster's New Collegiate Dictionary (1974, p. 984) provides the following definition of research:

. . . investigation or experimentation aimed at the discovery and interpretation of facts, revision of accepted theories or laws in the light of new facts, or practical application of such new or revised theories or laws.

Academics are primarily concerned with the first part of this definition, i.e., the discovery of facts and the revision of theories. On the other hand, police officials are most concerned with the practical application of new knowledge. In the patrol area, this has often amounted to the introduction of new organizational strategies or new technologies into policing, and those responsible for the innovations have become respected as police researchers.

Among the most well known of these early researchers/innovators was Berkeley's Chief of Police August Vollmer. His initial work involved the fielding of a complete bicycle patrol force and the installation of an electronic alarm system in 1905-06. Vollmer's force was also the first to become completely motorized; this occurred during the 1920s.

Quite often, observations accompanying the introduction of new technologies into patrol constituted research. With respect to motorized patrol, O. W. Wilson, a former student of Vollmer, reported in 1929 that:

. . . an effort has been made to render adequate patrol service to outlying business and residential sections by increasing the strength of the mounted [in automobiles!] patrol. On a basis of arrests made for all thefts, the mounted officer is six times as effective as a foot patrolman, and instead of protecting two to four blocks, he covers an area of over three square miles. (In Chapman, 1972, pp. 322-323)

Thus, new knowledge emerged as a byproduct of technological innovations in policing.

New hardware was not the only police research item in the first part of this century; the police were also concerned with the efficiency of their service. August Vollmer was particularly interested in efficient procedures for the deployment of his officers, and in 1933 he stated how such procedures could be derived:

If the assumption is made that patrol work is important and that the patrolmen should be distributed by areas in proportion to the amount of work to be done, it should be possible to state a universal hypothesis. This hypothesis is that the normal expectation of police duties on any beat can be indicated with a reasonable degree of certainty because of the regularity in the occurrence of crimes and of other police duties. The further hypothesis is necessary that time units can be discovered for the routine operations of patrol. If the normal number of operations to be performed and the average time required for each can be determined, the amount of time required to cover a given territory can then be calculated. In other words, it should be possible on this hypothesis to allocate patrol duty so that no patrolman will have an impossible task to perform and all patrolmen will have definite minimum duty requirements. (In Chapman, 1972, p. 317)

Similarly, O. W. Wilson's development of hazard formulas provided the police with a technique for allocating patrol units to beats. Wilson, building on the earlier work of Vollmer, attempted to state explicitly the relative amounts of time required for certain patrol activities compared to others. The end result was a weighting formula which determined the amount of "work" required in each beat; patrol units could then be allocated in proportion to beat workloads.

With the exception of Vollmer, Wilson, and a few others, research of any form was notably absent from most police departments. The majority of American police officials accepted both the traditional functions and strategies of patrol. For example, the common argument that "more patrol

"deters more crimes" assumed that police patrol does deter crime even though such a relationship between police patrol and crime deterrence had never been shown to exist.

In the 1960s urban America faced violent times. The rising crime rate led President Johnson to establish a Presidential Commission on Law Enforcement and Administration of Justice in 1965. The Commission's final report, The Challenge of Crime in a Free Society, appeared in 1967, and a telltale research-related finding emerged:

The Commission found that little research is being conducted into such matters as . . . possible methods for improving the effectiveness of various procedures of the police . . . the criminal justice agencies should welcome the efforts of scholars and other independent experts to understand their problems and operations. These agencies cannot undertake needed research on their own; they urgently need the help of outsiders. (President's Commission on Law Enforcement and Administration of Justice, 1967, p. x)

With respect to police patrol, the Commission's Science and Technology Task Force presented a challenge to conventional thinking about patrol. The usefulness of standard preventive patrol was directly questioned by the Task Force:

Police on 'preventive patrol' cruise the streets to look for crimes in progress. Presumably, this activity prevents crime because it poses a threat of detection and immediate apprehension. However, there is little evidence on how much crime is thereby prevented or on how much would be prevented with alternative patrol tactics. (The Institute for Defense Analyses, 1967, p. 12)

The Task Force researchers estimated that the probability of detecting a crime such as robbery via preventive patrol was so low that an individual patrol officer could expect an *opportunity* to detect a robbery about once every 14 years (The Institute for Defense Analyses, 1967).

Another conventional patrol practice questioned by the Task Force was the equal manning of patrol shifts in large police departments. Such time-independent manpower allocation schemes do not reflect the time-dependent nature of demands for police service, nor do they reflect relative spatial needs for patrol service (e.g., per capita level of crime in different areas). The Task Force outlined some crude yet indicative statistical procedures to deal with this problem.

Limited evidence presented suggested that apprehension probabilities were inversely related to response time; hence, response time minimization on calls for service was seen as a useful goal. However, the Task Force stated that the effects of response time on arrests need to be studied in more detail.

Other suggestions presented in the Task Force report called for the implementation of Automatic Vehicle Monitoring (AVM) systems and the establishment of criteria for priority dispatching of patrol cars. Perhaps the most important contribution of the Task Force Report was not its substantive queries into patrol operations but rather its seed effect on other research. Some of the major patrol-related Task Force recommendations were:

- (1) Undertake studies in large police departments of crimes, arrests and operations;
- (2) Develop computer-assisted command-and-control systems;
- (3) Undertake experiments to improve statistical procedures for manpower allocation.

(The Institute for Defense Analyses, 1967, p. xiv)

Throughout the body of the Task Force report emphasis was placed on the need for *controlled experimentation*. Many of the questions raised by the

Task Force could not be conclusively answered due to lack of available data. It was hoped that through experimentation enough valid data could be generated to answer these questions.

Other relevant Task Forces of the President's Commission on Law Enforcement and Administration of Justice included the Task Force on Police and the Task Force on the Assessment of Crime. Though the Police Task Force did not concentrate on patrol operations as extensively as the Science and Technology Task Force, one key recommendation was that:

Police departments should commence experimentation with a team policing concept that envisions these with patrol and investigative duties combining under unified command with flexible assignments to deal with the crime problems in a defined sector. (President's Commission on Law Enforcement and Administration of Justice, 1967, p. 118)

The major contribution of the Task Force on the Assessment of Crime was the finding that reported crime comprises only a fraction of all crime, that fraction being as low as 35 percent. If the goal of the patrol force is to deter crime, this finding suggests that the use of *reported* crime rates to judge patrol activity is in itself inappropriate. The use of victimization surveys to probe true levels of crime was presented as a statistically more reliable but expensive alternative.

The final reports of the Commission and its Task Forces marked the beginning of a new wave of patrol-related research. Patrol operations, though accepted by the police, became the subject of major inquiry. The little patrol research completed to this point was basically the product of in-house police department studies; the new era of research was to be conducted largely by independent consultants or academics with federal- or state-level funding.

Indeed, with increasing pressure to keep municipal spending down, the concern over the effectiveness of costly patrol operations has resulted in numerous studies of traditional patrol and other alternatives to crime deterrence. Much of this research has taken the form of *program evaluation*, where specific proposals in patrol are empirically tested in an experimental or quasi-experimental setting. A smaller number of studies have concentrated on *operations research*, where police patrol is characterized and analyzed with the aid of mathematical models. It appears that the Commission's suggestion to incorporate "outside" people into police research has been implemented.

When examining the evolution of research in any field, it is interesting to observe the *timing* of relevant studies and the *interrelationships* between studies that develop over time. For example, one may hypothesize a general pattern for the timing of research into any specific issue as follows.

Initially, a few pathbreaking "seed" studies of the issue will be published. After a short time period, the interest generated by these studies will lead to a growth of research in the area. Finally, a small number of *definitive* studies, building on the results of past research, will effectively answer the original research questions and hence end the debate.

There are two pictures associated with this conjecture. First, one may imagine a unimodal frequency curve of completed studies over time as shown in Figure 1. Secondly, an S-shaped cumulative frequency (or "Ogive") curve will result from this theory of the timing of research, as shown in Figure 2.

Now, *patrol research* is a relatively recent endeavor, as mentioned earlier. In Figure 3 the publication dates for patrol-related studies obtained from our bibliography have been used to construct a pair of frequency curves for patrol research. From a rather humble start in 1967,

Cumulative Number of Completed Studies

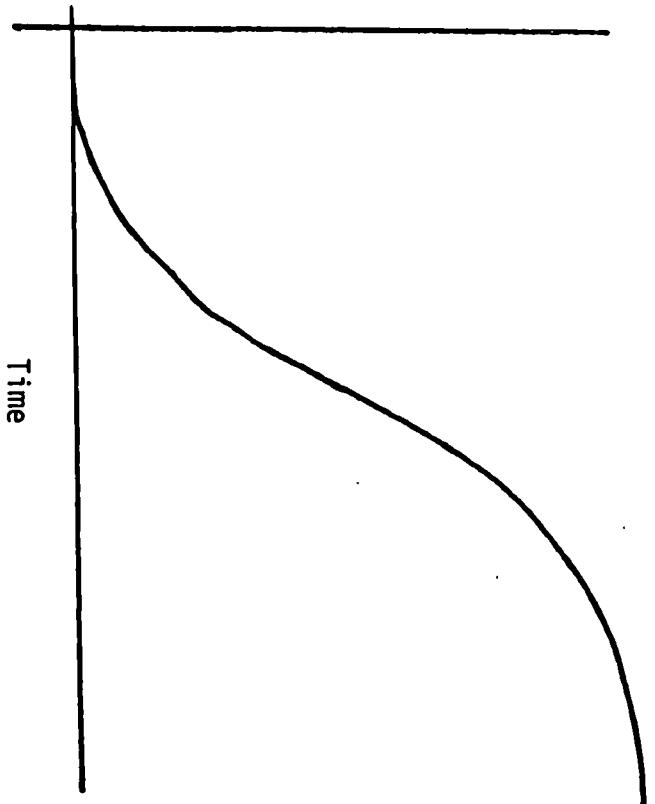


Figure 2
Timing of Research

Number of Completed Studies/Unit of Time

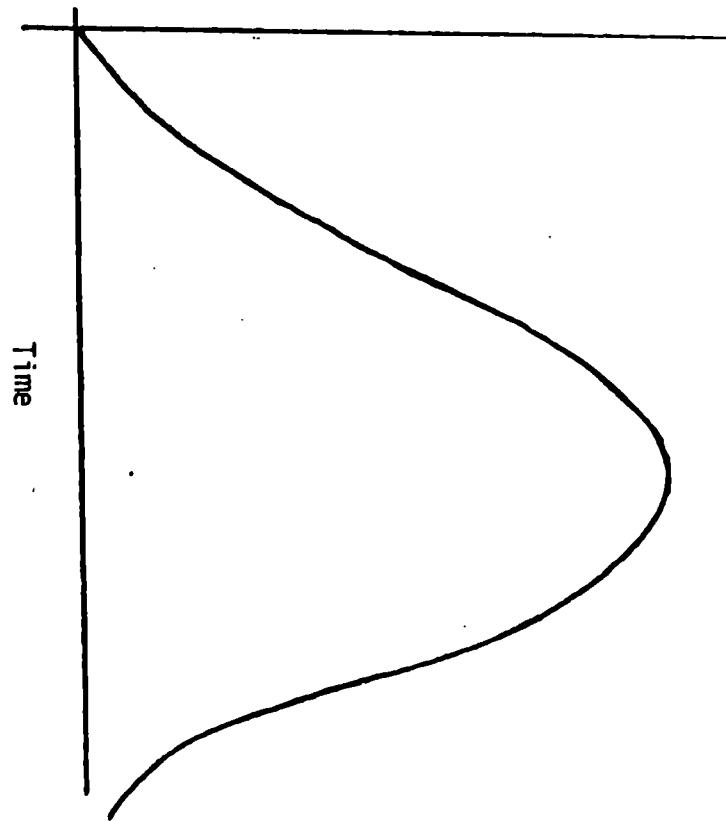
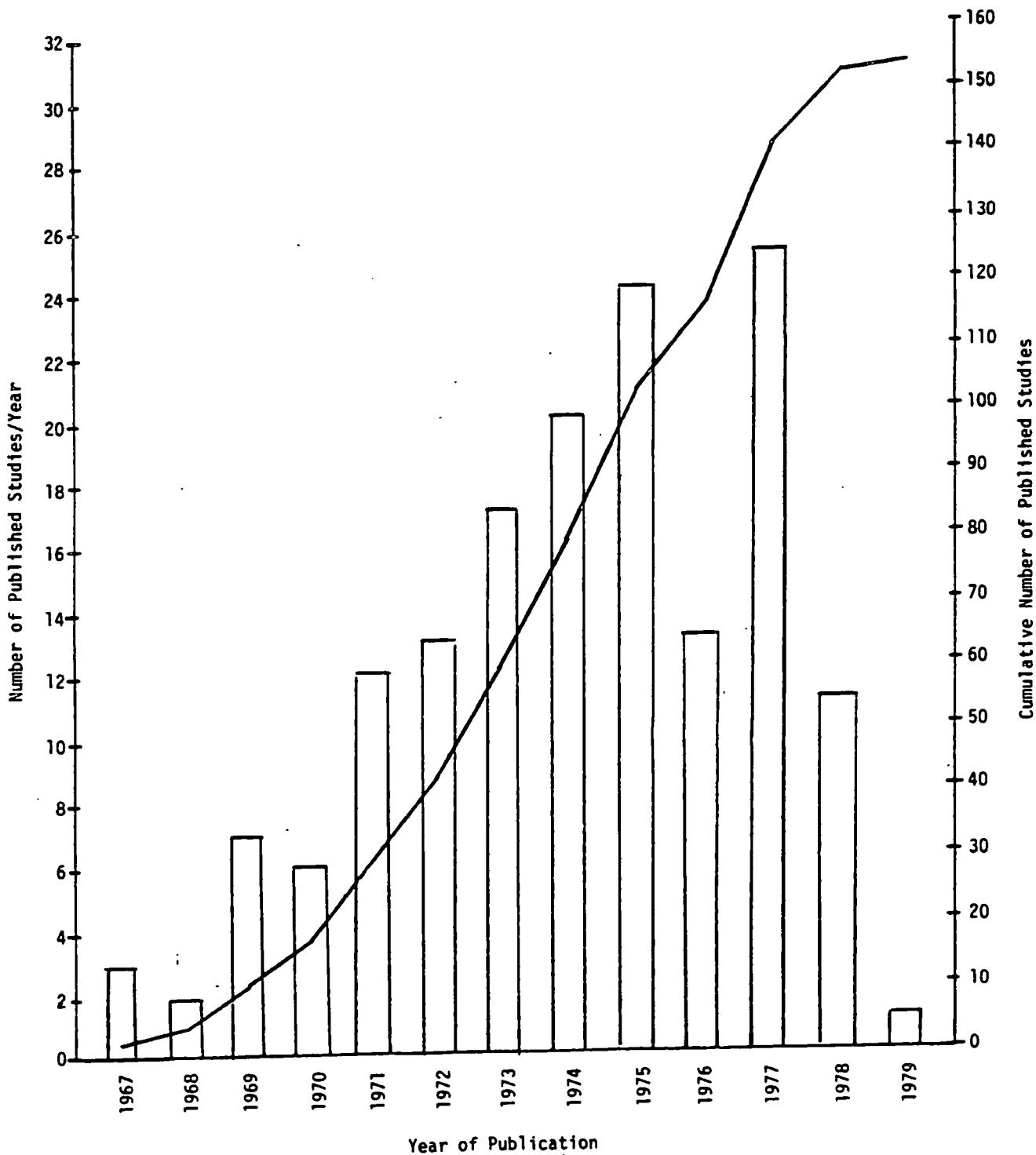


Figure 1
Timing of Research

Figure 3
Evolution of Patrol Research
Timing of Research Studies



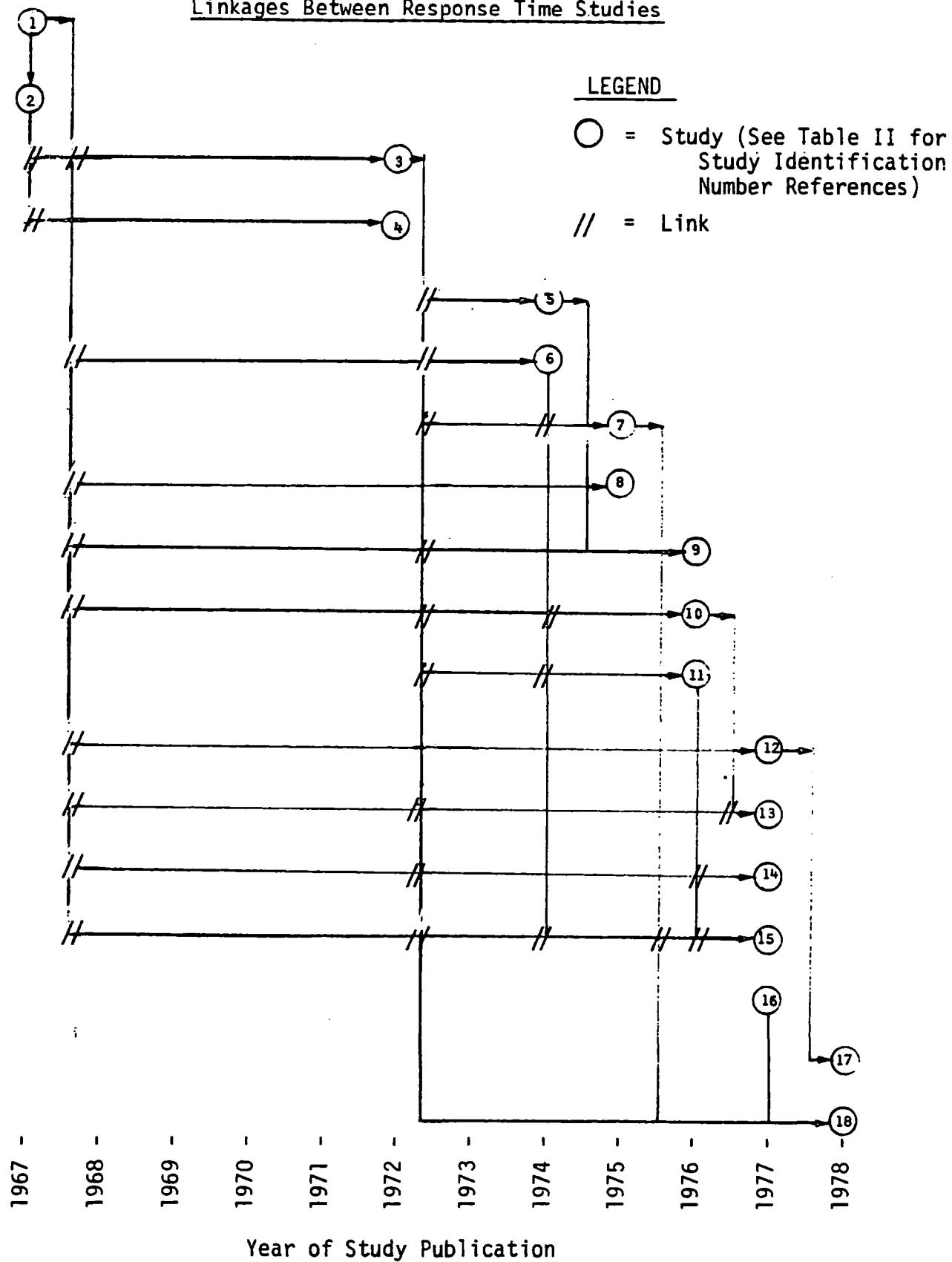
the "modal" or peak stage of patrol research appears to have been reached. Though our observed frequencies for completed studies in 1978 and 1979 have tapered off, this is more likely due to our lack of knowledge of the existence of such studies than to the true nonexistence of such studies. Thus, the state of patrol research at present corresponds roughly to the left halves of Figures 1 and 2, indicating that research in police patrol may be expected to continue, though perhaps at lesser intensity, for some time to come.

With respect to the interrelationships between pieces of research, it should be possible to determine the degree to which certain studies have influenced (or motivated) other studies. In our ideal model, we expect studies to build on the knowledge gained from prior research. In the area of patrol this is not always the case.

As a specific example, consider Figure 4. Here we have attempted to present the interrelationships (or linkages) between representative studies which have examined, among other topics, issues of police response time. The arrows connecting studies indicate that the earlier study was referenced (in a footnote or in the bibliography) by the later study. Table I presents this same information in the form of a *connectivity matrix*. It is particularly interesting to examine the row and column totals in Table I. Two studies, the Science and Technology Task Force Report (The Institute for Defense Analyses, 1967) and Urban Police Patrol Analysis (Larson, 1972b), appear to have been the most influential "seed" studies in this area, at least in the sense that these two studies were referenced more often than all of the others combined. A lesser seed study was the Kansas City Preventive Patrol Experiment's analysis of response time data (See Kelling, Pate, Dieckman, and Brown, 1974).

Figure 4

Linkages Between Response Time Studies



Year of Study Publication

Table I
Linkages Between Response Time Studies*

Study Referenced	Referencing Study																		Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
1	-	1	1	0	0	1	0	1	1	1	0	1	1	1	1	0	0	0	10
2	-	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
3	-	1	1	1	1	0	1	1	1	0	1	1	1	0	0	1	0	1	11
4	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	-	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
6	-	1	0	0	1	1	0	0	0	0	1	0	0	1	0	0	1	0	5
7	-	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	2
8	-	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
9	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	-	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
11	-	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
12	-	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1
13	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	<u>LEGEND</u>																		0
15	1 = Column study referenced Row study																		0
16																			1
17	0 = No reference																		0
18																			-
Total:	-	1	2	2	1	2	2	1	3	3	2	1	3	3	6	0	1	4	37

* See Table II for Study Identification Number References

Table II

A Sample Family of Response Time Related Studies*

- (1) Institute for Defense Analyses, Task Force Report: Science and Technology (A Report to the President's Commission on Law Enforcement and Administration of Justice).
- (2) Larson, R. C., Operational Study of the Police Response System.
- (3) Larson, R. C., Urban Police Patrol Analysis.
- (4) Larson, R. C., "Improving the Effectiveness of the New York City 911 System."
- (5) Lipsett, F. R. and Arnold, J. G., "Computer Simulation of Patrol Operations of a Semi-Rural Police Force."
- (6) Kelling, G., Pate, T., Dieckman, D., and Brown, C., The Kansas City Preventive Patrol Experiment: A Technical Report.
- (7) Larson, R. C., "What Happened to Patrol Operations in Kansas City?"
- (8) Tien, J. M. and Larson, R. C., et al., An Evaluation Report: Worcester Crime Impact Program.
- (9) Brown, W. J., "Response Speeds and Response Times of Urban Police Patrol Cars in Ottawa, Canada."
- (10) Larson, R. C., et al., Evaluation of an Implemented AVM System: Phase I.
- (11) Pate, Tony, et al., Police Response Time: Its Determinants and Effects.
- (12) Clawson, C. and Chang, S., "Relationship of Response Delays and Arrest Rates."
- (13) Reichart, Otto, The Effect of Automatic Vehicle Location on Police Patrol Efficiency.
- (14) Kansas City Police Department, Response Time Analysis.
- (15) Tien, J. M., et al., An Evaluation Report: Wilmington Split-Force Patrol Program.

* For full citations, see bibliography.

Table II

(Page 2 of 2)

- (16) Boydston, John, *et al.*, Patrol Staffing in San Diego: One- or Two-Officer Units.
- (17) Tarr, Dianne, "Analysis of Response Delays and Arrest Rates."
- (18) Kaplan, E., "Evaluating the Effectiveness of One-Officer versus Two-Officer Patrol Units."

One would expect that with the passage of time and the completion of research projects the number of referenced studies per new study would increase. This figure, given by the column totals in Table I, has begun to increase, though it has remained fairly stable over time. The Wilmington Split-Force Experiment acknowledged a larger number of studies than other research projects, though some of these linkages could be related to issues other than response time. Given the low rate of past referencing, it seems that research in response time, like patrol research in general, is far from being complete.

With the arrival of independent scholars on the patrol scene has come a change in the scope and methods of patrol research. The emphasis has been changed from low-key, in-house analysis of police records data to large-scale social experimentation in patrol. Though these experimental studies have encountered certain methodological problems,* they have also served to surface several issues in the patrol area.

Concrete examples of patrol experimentation serve to illustrate the types of methods, hypotheses, and problems encountered in patrol research. Thus, in the following paragraphs, we briefly review eight selected studies which are representative of state-of-the-art patrol research. The intent here is to familiarize the reader with some of the substantive hypotheses which occur frequently in patrol research and the types of conclusions reached by this research. While this quick review does not exhaust the number of studies performed since 1967, the findings presented are indicative of what has been learned from patrol research. A much more detailed assessment of patrol research is presented in Part IV.

* The methodological problems with patrol research will be examined in depth in Part V.

The Crime Control Team Experiment (Elliott and Sardino, 1971)

Beginning in July 1968, an experiment involving an organizational restructuring of the police department was conducted for a one-year period in Syracuse, New York. This project, a joint effort of General Electric's Syracuse Electronics Laboratory and the Syracuse Police Department, utilized various patrol strategies such as:

- (1) The use of one-officer patrol cars;
- (2) The use of *time-dependent* manpower allocation schemes; and
- (3) The use of a mathematical model in an attempt to increase the detection probability of patrol.

The Crime Control Team Experiment was evaluated, and the results of the research included several interesting findings:

- (1) The substitution of two one-officer units for one two-officer unit was shown to increase the apprehension capability of the patrol force.
- (2) The use of systematic patrol procedures (as determined via the use of models and statistics) increased the crime interception rate to about six times the pre-experimental level.
- (3) The new patrol strategies implemented were viewed favorably by citizens of the local community.

The purpose of this experiment was to demonstrate that an alternative (namely, Team Policing) to the traditional organizational structure of the police could be effectively used to combat crime. Although the Crime Control Team Experiment was not able to show conclusively that the program strategies reduced crime rates, it did demonstrate that organizational structures other than those normally associated with traditional police departments could effectively control crime in an urban area.

The Kansas City Preventive Patrol Experiment (Kelling, Pate,
Dieckman, and Brown, 1974)

The results of the Crime Control Team Experiment were available in book form in 1971. While this book was generating interest among police researchers and practitioners, the groundwork was being laid for the most elaborate and well-known police study to date. The intent of the Police Foundation's Kansas City Preventive Patrol Experiment was to determine the effect of varying levels of routine preventive patrol on outcome measures such as the crime rate and citizen satisfaction with the police. Beginning in October 1972, 15 Kansas City police beats were divided into three groups of five beats. Each group of five beats was to receive one of the following three levels of patrol activity for a one-year period:

- (1) Reactive Beats - no preventive patrol was to be performed in these areas.
- (2) Control Beats - preventive patrol was to be carried out as usual.
- (3) Proactive Beats - two to three times the normal level of patrol was to be implemented.

The general finding of this study was that variations in the level of preventive patrol had no measurable effect on the relevant outcome measures. Stated differently, the crime rates and levels of citizen satisfaction found in reactive, control, and proactive beats were not significantly different from each other at the end of the one-year experimental period.

The implication of these results could be far-reaching. Indeed, if it really is true that routine preventive patrol has little influence on the incidence of crime (this was suggested by the Science and Technology

Task Force Report discussed earlier), then perhaps the amount of resources allocated to the patrol function should be seriously questioned. While some took the Kansas City results as an indication that patrol forces could be vastly reduced in number without a concurrent degradation in service, other researchers questioned the experimental methodology and, hence, the validity of the stated results (See Larson, 1976; Davis and Knowles, 1975; Fienberg, Larntz, and Reiss, 1976; and Zimring, 1976).

While the emphasis of the Kansas City Preventive Patrol Experiment was on the relationship between patrol and the crime rate, some positive "side effects" in the area of manpower allocation have emerged. For example, R. C. Larson presents a case for "fluid patrol":

. . . if conditions warrant a change in the spatial deployment of units within a confined region (say a 'precinct', 'district', or 'division'), then if procedures are followed such as those used in Kansas City, such redeployments can be made without suffering marked degradations in either actual or perceived service in the depleted regions. (Larson, 1976, p. 291)

Without doubt, the Kansas City Preventive Patrol Experiment remains one of the most significant pieces of patrol research performed to date. While the experiment did not prove conclusively that preventive patrol does not influence crime rates, the experiment did demonstrate that the relationships between patrol and crime may be much weaker than had been assumed. Further investigation of the relationship between preventive patrol and crime has been a major concern for subsequent research.

Police Response Time: Its Determinants and Effects (Pate, Ferrara, Bowers, and Lorence, 1976)

The Kansas City Preventive Patrol Experiment generated large amounts of data useful for the testing of hypotheses other than those central to the relationship between patrol and crime. In particular, data on response

time and related outcome measures such as arrest rates and citizen satisfaction were collected. A detailed analysis of these data was released by the Police Foundation in 1976, in a study entitled Police Response Time: Its Determinants and Effects.

While the small samples involved in this study render its findings somewhat weak, three separate surveys indicated that there was no relationship between response time and arrest rates (contrary to the results of the 1967 Science and Technology Task Force). Similarly, when examining the impact of rapid police response on citizen satisfaction with the police, researchers found that citizen satisfaction with response time remained at a (high) constant level over a large range of response times, thus demonstrating that citizen satisfaction apparently does not depend on rapid police response.

Instead, the researchers found that citizen satisfaction with the police depended upon the *difference between* observed and expected response times, a difference that was previously not given much thought. If the police were able to respond more quickly than expected, the citizen involved was more likely to be satisfied than if the police responded more slowly than expected.

Kansas City Response Time Analysis (Kansas City Police Department, 1977)

Another major study which examined the merits of rapid police response was also undertaken in Kansas City when, in 1973, the Law Enforcement Assistance Administration (LEAA) awarded a grant to the Kansas City Police Department. Published in 1977, the report Response Time Analysis examined several hypotheses similar to those scrutinized by the Police Foundation's response time study just discussed. With respect to arrests, response

time was shown to be inversely related to apprehension probability, but only marginally so. Also, surveys confirmed the earlier result that most of the population was satisfied with response time regardless of the actual response time involved, though the difference between observed and expected response time was again shown to be a determinant of citizen satisfaction with the police.

This study is important for another reason; it was one of the few studies which attempted to determine the length of the delay associated with citizens' reporting of crimes to the police. This delay was shown at times to be larger than typical response times (including dispatch delays). Based on this finding and the results discussed earlier, the researchers concluded that the minimization of response time is not an empirically justifiable goal.

Unfortunately, some of the analysis upon which these conclusions are based is demonstrably weak. In fact, several of the assertions made by this study are open to question. In Part V we will critically review this study as an example of troubled methodology in patrol research.

The St. Louis AVM Experiment (Larson, Colton, and Larson, 1977;
Larson and Simon, 1978)

While studies examining the effects of response time on various outcome variables were being undertaken in Kansas City, other researchers were focusing on the application of modern technology to police patrol using response time as a performance measure. In July 1974, Public Systems Evaluation, Inc. began an 18-month study of an Automatic Vehicle Monitoring (AVM) system in conjunction with the St. Louis Police Department. The potential gain in efficiency achievable via AVM was expected

to arise from the practice of closest car dispatching, a practice not possible without exact car location information.

A somewhat surprising result of the initial 16-beat Phase I study was the finding that the use of an AVM system did not reduce response time, despite the expected benefits of closest car dispatching. This finding was confirmed in a citywide Phase II effort involving all 135 beat cars.

However, as in the Kansas City Preventive Patrol Experiment, a positive "side effect" was noticed, again in the area of manpower allocation. It was suggested that appreciable improvements in patrol productivity may be obtainable by exercising the potential for improved supervision of the patrol force using AVM. Such a supervisory capability could greatly enhance the possibility of establishing a "fluid patrol" like that suggested by Larson in his review of the Kansas City Preventive Patrol Experiment presented earlier.

The Worcester Crime Impact Program (Tien, Larson, Green, Williamson, Dunlap, and Simon, 1975)

Fluid patrol may be viewed as one alternative to traditional deployment and allocation schemes. A quite different alternative could entail a change in the role played by police officers with respect to the call-for-service response function. In particular, the use of *civilians* to respond to noncrime calls for service offers the opportunity for both a departure from traditional patrol staffing and an improvement in the productivity of the police.

In March 1974, Public Systems Evaluation, Inc. undertook a six-month after-the-fact evaluation of the Worcester Crime Impact Program, whose

main innovative feature was the use of some 41 Police Service Aides. This study demonstrated that for many police calls, a trained civilian can handle the work required at a lower cost without compromising the quality of service provided. In fact, the number of calls handled by a civilian can approach the number of calls handled by a uniformed police officer.

As part of the evaluation effort, researchers were interested in whether or not the response times of Police Service Aides were acceptable to the public. As in the two Kansas City studies discussed earlier, citizen satisfaction with response time was consistently high despite wide variations in response time. While this indicates that Worcester residents were happy with the attention they received, it also indicates that citizen satisfaction is not too dependent on response time.

The Wilmington Split-Force Patrol Experiment (Tien, Simon, and Larson, 1977)

Yet another approach to the utilization of police resources was tested in Wilmington, Delaware. The concept of split-force, which involves separating the preventive patrol and call-for-service response functions of the patrol force, was first tried in St. Louis in 1966 and then in Chicago in 1971. An LEAA-funded test of the split-force approach was conducted in Wilmington in 1975, and Public Systems Evaluation, Inc. performed the evaluation of this program.

The results of this study showed that split-force patrol does increase the efficiency of the patrol force in both the call-for-service response function and the preventive patrol function. This improvement was achieved without decreased effectiveness on the part of the patrol force. Thus, this program was able to demonstrate the feasibility of

split-force patrol as a cost-effective alternative to traditional patrol strategies.

Another interesting result from this study was in the area of response time, where it was *again* found that response time had no effect on citizen satisfaction. In addition to this, a limited number of citizens were formally told that a response delay would occur, and 45 percent of these citizens responded that they "couldn't care less"! Hence, the Wilmington study supports the contention that police response time, when averaged over all types of calls for police service, is *not* an important factor contributing to citizen satisfaction with the police.*

Patrol Staffing in San Diego: One- or Two-Officer Units (Boydston, Sherry, and Moelter, 1977)

When considering the allocation and deployment of police resources, a seemingly simple decision such as whether to staff a patrol unit with one or two officers can give rise to rather complex implications. Traditionally, many police departments have staffed their cars with two officers, primarily for reasons of safety. Those departments which have used one-officer patrol (such as the Crime Control Team in Syracuse) have usually exchanged two one-officer units for each two-officer unit.

In October 1975, the Police Foundation began an experiment in San Diego where only one one-officer unit was substituted for each two-officer unit. It was found that in terms of response time, on-scene arrests, officer injuries, and other performance measures one-officer units performed at a satisfactory level of efficiency and effectiveness. The cost

* As we will argue later, however, rapid response to certain types of priority calls is very important.

implications of this drastic reduction in manpower are clear; if one wished to retain equal-cost staffing options, the potential for increased productivity through the use of one-officer patrol is very great (Kaplan, 1979). Thus, a simple switch in staffing policy may have significant implications towards patrol productivity.

As can be seen from this brief review of eight studies, there are a number of important issues being addressed by patrol research. The main body of this report will examine in depth the substantive and methodological sides of these issues. However, it is first necessary to understand the structure of the typical patrol research effort, as we will be drawing generic research conclusions which in some cases rely on this structure. It is to the mechanisms of patrol research that the next section is devoted.

2.3 THE STRUCTURE OF A TYPICAL PATROL RESEARCH EFFORT

Patrol research may be performed in a variety of modes. For example, research may take the form of a *narrative case study* where certain aspects of patrol activity are observed and described in detail. A *demonstration project* could be undertaken to see if a particular concept in patrol is viable. At the other end of the spectrum, *mathematical models* of operating police patrol systems may be constructed, and suggestions for improvement may stem from insights provided by the models.

Recently, the *social experiment* has become the dominant paradigm adhered to in the patrol area. In general, experiments may be thought of as consisting of the following five steps:

- (1) Selection of *hypotheses* to be tested;
- (2) Selection of *performance criteria* by which to test the stated hypotheses;
- (3) Design of an experimental procedure for testing purposes;
- (4) Execution of the experimental procedure; and
- (5) Evaluation of the experimental results.

Since most of the studies to be reviewed in Part IV are of this type, it is useful to examine the ideal structure of this style of analysis as it applies to police patrol research.

SELECTION OF HYPOTHESES

The relevance of a particular piece of patrol research is to a large extent determined by the hypotheses underlying the research. In selecting hypotheses for research investigation, it is important to keep in mind the potential value that confirming or rejecting the proposed hypotheses holds for police decision makers.

As mentioned previously, many research hypotheses have stemmed from a questioning of the standard methods of patrol as a means for accomplishing patrol objectives. The 1967 Science and Technology Task Force Report was a catalyst in this regard. Also, the Kansas City Preventive Patrol Experiment was designed to test one of the most basic and traditional modes of policing--routine preventive patrol.

Direct questioning of traditional police practice has not been the only forum leading to the formulation of research hypotheses. Recently, we have witnessed research based on emerging themes in the patrol area. One such theme is the utilization of civilians in patrol; the evaluation of Police Service Aides in Worcester serves as an example. Another emerging theme centers around the creative use of technology in the

patrol area; the Phase II evaluation of the St. Louis AVM system may be viewed in this light. In Part III, the major hypotheses which have been researched over the past ten years will be discussed in detail.

We should note at this early stage that the hypothesis-based research approach is not without its problems. For example, the dominant hypothesis-based approach focuses on a so-called "null hypothesis" which is an hypothesis that conjectures that the particular program being studied has no effect. As an illustration, if an innovative police patrolling program is instituted for one year in a particular area of the city, the null hypothesis would be that that program had no effect compared to status quo or traditional policies. The problem with this approach is that the resulting experimental design tends to be conservative in nature and biased toward the null hypothesis. That is, to prove that the new program has a measurable effect, the researchers must disprove the null hypothesis. Such disproving at scientifically acceptable levels of significance (which are typically .05 or less) is difficult to do in many police patrol experiments because of limited time and budgets which in turn limit the sample sizes involved. With small sample sizes it is often very difficult to disprove a null hypothesis of no effect. With the hypothesis-based approach, one should also bear in mind that one never proves an hypothesis; one only fails to disprove it or succeeds at disproving it at particular levels of significance. Surviving or dominant or popular hypotheses are those that have not been disproved in repeated attempts by different researchers in similarly focused studies. An additional concern with the hypothesis-based approach is that it is subject to a subtle form of abuse in that a researcher with preconceptions about patrol can hide his or her own biases by the selection of his

or her own null hypotheses; a set of null hypotheses which reflects pre-conceived biases may be hard to disprove in a study with limited sample size and then can be disseminated as supporting "scientific" evidence that the researchers' initial idea has been validated. Examples of these difficulties exist in the patrol research literature, but clearly they are not unique to that field and virtually any area of social science inquiry is subject to similar concerns.

SELECTION OF PERFORMANCE MEASURES

Hypotheses are often stated broadly (such as "routine preventive patrol represents an ineffective use of patrol officers", or "team policing is better than standard patrol organizational modes"). In designing an experiment to test the validity of such broadly stated hypotheses, one must reduce the broad hypothesis to a set of more focused and measurable specific hypotheses that to the extent possible reflect the true character of the more broadly stated hypothesis. These more narrowly focused hypotheses must be stated in terms of measurable quantities whose values can be obtained and compared both before, during, and after the experiment. These quantities are called experimental *performance measures*. The attitudinal and operational performance measures that are selected should satisfy certain criteria:

- (1) They should truly represent the broader hypothesis or hypotheses being tested and not be subject to deliberate manipulations by those who may want to subvert the experiment.
- (2) The measures should be based on available or collectable data.
- (3) The measures should be understandable to the police, the public, and researchers alike.

Any particular performance measure is subject to its own limitations. As an example, one may pose as a measure of preventive patrol activity the number of patrol miles driven on an eight-hour tour of duty; we have seen instances in which this measure can be perverted by driving the patrol car at relatively high speeds for, say, one hour from 4 to 5 a.m. in a public park and performing virtually no patrol during the remaining seven hours on duty. Thus, to limit the vulnerability of a study to weaknesses in performance measures, one usually wants to select a family of performance measures and to collect data from a wide variety of sources. This usually implies the collection of qualitative, process-oriented data in addition to more "scientifically rigorous" statistical data. These issues will be further discussed in conjunction with experimental conduct and evaluation.

The measures which are chosen for a given patrol research study are of course dependent on the hypotheses being examined. However, for any given class of studies, these same measures almost always appear to surface. Some examples are presented in Table III. It is not clear whether the measures that surface repeatedly do so because of their quality or because of their ease of measurement.

EXPERIMENTAL DESIGN

The key concern with the design of patrol experiments rests with the formation of "experimental" and "control" groups (e.g., beats, squads, districts, staffing rules, etc.). Theoretically, both experimental and control groups should be identical in character. However, while nothing changes from the usual mode of police operation in the control group, an experimental mode of police operation is implemented in the experimental

Table III

Common Performance Measures Found in Police Patrol Research

<u>Type of Study</u>	<u>Associated Measures</u>
Crime Prevention	Uniform Crime Report (UCR) Index Locally, reported crime rates Victimization rates (survey) Probability of crime interception Citizen-perceived fear of crime Citizen-perceived level of safety
Police Response Time	Travel time (with/without dispatch time) Travel distance Dispatch delay Citizen reporting delay Apprehension probability Citizen satisfaction with response time
Patrol Productivity/ Manpower Allocation	Patrol officer workload Patrol officer safety (injuries) Crime/Victimization rates Travel time Frequency of preventive patrol passings Citizen complaints Officer complaints

group. The experimental mode of police operation should be the *only* difference between experimental and control groups. The levels of pre-determined performance measures are monitored over the experimental period (typical experiments in patrol have had durations of about one year), and at the end of the experimental period, the control and experimental groups are compared statistically (this will be further discussed under the evaluation of experimental results).

In many experiments, it has not proved possible to obtain a controlled situation of the type described above. These quasi-experiments rely on less powerful comparison groups and/or before-and-after observations. Some quasi-experiments have managed to incorporate models of the relevant performance measures into the experimental design (e.g., time series models). These models are able to predict levels of the performance measures that would have occurred in the absence of the experimental treatment, and hence serve the same function as that of a control group. Of course, the strength of such designs is largely dependent upon the accuracy of the models involved.

EXPERIMENTAL CONDUCT

In the previous section on experimental design, the importance of obtaining good experimental and control groups was stressed. While actually conducting an experiment, the emphasis shifts towards the *maintenance* of the experimental design, which includes careful monitoring of the experimental and control groups.

While the laboratories of the physicist or chemist allow desired conditions to be prolonged almost indefinitely, the urban environments of police patrol experiments do not even approximate these laboratories. Hence, there is good reason to be concerned about technical problems such

as the contamination of the experimental and/or control groups. The conduct of a successful experiment requires that the general conditions in the control and experimental groups remain the same throughout the course of the experiment. To achieve this, it is necessary to monitor continuously the experiment for the entirety of its duration. This type of process monitoring may take the form of on-site observation, periodic interviews with involved personnel, routine statistical checks on various measures (e.g., number of cars in patrol areas, surveyed crime levels), or continuous time observation (e.g., use of AVM, Tachographs).

The above comments are even more important when the program is of the quasi-experimental type. Without controls, one has an accountability problem with respect to the true determinants of program outcomes: Was it the program or some other environmental condition that caused the observed results? The collection of process information will not guarantee an answer to this question, but such information may surely provide clues not available elsewhere.

Continuous time observation is clearly the most powerful method for ensuring that the conditions demanded by the experimental design are maintained; in particular, the use of AVM technology is promising in the patrol research area. Most studies have utilized routine statistical checks combined with interviews and/or on-site observation.

EVALUATION OF EXPERIMENTAL RESULTS

The evaluation of experimental results in police patrol has relied heavily upon the use of classical statistical procedures. The use of such procedures is predicated on the control group/experimental group design discussed earlier. If it is in fact true that the sole difference between experimental and control groups rests with the presence of an

experimental treatment in the experimental group, then observed differences in the levels of performance measures between the two groups may be attributed to one of two sources:

- (1) Chance; or
- (2) The experimental treatment.

Statistical procedures along the lines of hypothesis testing check to see if observed differences can be plausibly attributed to chance. If plausible attribution to chance cannot be established, then the experimental treatment is assumed to be responsible for the observed differences through the logic of elimination.

Similarly, quasi-experimental procedures utilize statistical routines to compare program performance in the light of comparison groups, "before-and-after" periods, or a reasonable model as discussed earlier. However, as the design of a test program deviates from that of the classic experiment, the rationale behind the use of statistical evaluation devices is weakened. In such cases (which constitute the majority of police patrol research efforts), the collection of process data is extremely important, as such information aids in determining whether or not it was the experimental innovation or some other combination of factors which was responsible for observed outcomes.

This description of social experimentation as applied to police patrol has been the model for the bulk of police patrol research that has been attempted in recent years. While the presentation here has been somewhat normative, this is not meant to imply that patrol research has been problem free. Indeed, the patrol research area as a whole has been fraught with difficulties. Some of these difficulties stem from misapplications of the methods associated with the experimental model, other

difficulties arise from the rigidity of the experimental model, and still others arise from the urban environment itself, which is relatively hostile to the establishment and maintenance of experimental conditions. With these tempering remarks in mind, Part III proceeds to examine the results of several research studies in hypothesis-specific terms; we will return to examine the problematic aspects of patrol research in Part IV.

III PATROL HYPOTHESES

Hypotheses contained in patrol research studies are motivated by concerns for effectively achieving patrol objectives. The attainment of objectives is dependent upon the efficacy of various operational procedures that are designed and implemented in patrol operations. Thus, hypotheses focus on alternative patrol operating procedures, attempting to test their effectiveness in achieving stated goals. Recalling our earlier discussions, the three major purposes of an urban police patrol force are: (1) the prevention and deterrence of crime; (2) the apprehension of criminals; and (3) the performance of certain public services.

Operationally, almost all of these functions are carried out as a result of one of two events: (1) a call for service (CFS) can be received by the police, where the caller is reporting the need for on-scene police assistance; or (2) a patrolling police vehicle may come across the scene of a situation or incident requiring police service. In the first case, it is the police emergency response system that is activated which in turn dispatches one or more appropriate police vehicles to the scene of the reported incident. In the second case, it is the patrolling police vehicle while on preventive patrol or on some other duty that comes upon the incident requiring police service. The police patrol vehicle or unit is most often in either one of two states: either responding to a call for service emanating through the police emergency response system, or

performing some type of preventive patrol. The response state represents the reactive stance of a police patrol force; the patrolling state represents potentially a proactive or preventive stance of a patrol force. It is not unusual then that one can divide the research hypotheses pertaining to police patrol into families; the first corresponding to the merits of police preventive patrol, the second corresponding to merits of the police emergency response system, and the third--whose concerns cross both types of patrol activities, reactive and proactive--focusing on the merits of alternative organizational and manpower allocation schemes. Contained in each of these categories are several specific research questions.

In this section, we will identify the major research hypotheses found in the patrol literature. The findings related to these hypotheses will be detailed in Part IV.

3.1 RESEARCH EXAMINING THE MERITS OF POLICE PREVENTIVE PATROL

According to Larson:

Preventive patrol constitutes touring an area, with the officer(s) checking for crime hazards (open doors and windows) and attempting to intercept any crimes while in progress. By removing opportunities for crime, preventive patrol activity is supposed to *prevent* crime. By posing the threat of apprehension, preventive patrol is supposed to *deter* criminals from committing crimes. But agreement on how to achieve the objectives of prevention and deterrence is noticeably lacking in police circles. (Larson, 1972b, p. 33)

At present, researchers recognize that there is still scant evidence for linking preventive patrol (its amount and tactics) to crime prevention and crime deterrence. Most studies examining preventive patrol and crime have focused on crime deterrence rather than crime prevention. This may be due to the fact that numerous potential targets for crime exist, and

such crime prevention tactics as "target hardening" are more likely to be the responsibility of citizens-at-large (e.g., property owners) than the police. A large number of studies have attempted to answer one of the following two questions:

Does motorized preventive patrol deter crime?

Does foot preventive patrol deter crime?

Indeed, these questions have proved to be a catalyst for modern patrol research. With new studies currently underway investigating the relationships between patrol presence and crime deterrence (Public Systems Evaluation, Inc., 1980), this area of research continues to yield the most controversial results in the patrol literature.

While the police are concerned with deterring crime they are also concerned with citizen attitudes towards crime and towards police. As the police are a public agency, they are expected to maintain a service of high quality. The police have long felt that preventive patrol is an effective crime deterrent, and that patrol presence enhances citizens' feeling of security as a result; hence researchers have been led to ask:

Does motorized preventive patrol enhance citizen satisfaction or citizen sense of security?

Does foot preventive patrol enhance citizen satisfaction or citizen sense of security?

A more specific research issue deals with the interception capabilities of motorized patrol units. We already mentioned the discussion of the Science and Technology Task Force with respect to this issue (The Institute for Defense Analyses, 1967). Other studies have attempted to determine whether or not preventive patrol does pose a threat to the would-be offender through the possibility of a random interception.

These studies have asked the question:

Does preventive patrol facilitate the interception of crimes in progress?

These five questions represent the bulk of the activities of researchers in the area of preventive patrol. We have reviewed nearly 30 studies which have addressed these issues; our assessment of this research is discussed later.

3.2 RESEARCH EXAMINING THE MERITS OF THE POLICE EMERGENCY RESPONSE SYSTEM

The police emergency response system is most readily described in terms of a sequence of events that occurs following an incident that will ultimately require on-scene police service. First, the incident, such as a robbery or vehicular accident or fire, occurs. Second, the incident is detected by a person or device that will report the incident to the police. Third, the detector, say, a citizen, attempts to call the police. Fourth, usually moments later, initial contact is made with the police, usually with a police emergency telephone operator. Fifth, critical information describing the incident is communicated to the police telephone operator. Sixth, this information is converted to a patrol beat number and dispatcher identity number and assembled for communication to the dispatcher. Seventh, the information is then transmitted to the dispatcher, either by hand, conveyor belt, or via computer memory transfer (as would occur in a Computer-Aided Dispatch [CAD] system). Eighth, the incident report now enters the dispatcher queue, which, if it contains additional incident reports, may severely delay dispatch of one or more police vehicles to the scene. Ninth, ultimately a patrol unit is dispatched. Tenth, it arrives at the scene to provide required service. Finally, eleventh, that service is completed and the patrol unit reports

its availability to the dispatcher.

Such a linear sequence of activities that is initiated by an incident requiring on-scene police service lends itself to a time-oriented description. Thus, it is natural and understandable that response time, or more precisely each of the components of the response time identified above, would be used as a surrogate measure of effectiveness of the police emergency response system. This in fact has happened, as many studies have examined police response time to reported incidents. Unfortunately, many of these studies have made one or both of two errors: Error type 1 occurs when the various components of response time are lumped or aggregated together into a single response time measure; the resulting study conclusions while focusing allegedly on response time as a single entity would be more appropriately focused on the constituent components of response time such as dispatcher queuing delay or travel time, or reporting delay until an attempt is made to contact the police. The second type of error occurs when all incident types are lumped or aggregated together and treated as a homogenous pool of incidents having homogenous response needs and characteristics; since 80 to 90, or even higher, percent of calls to police are of a non-urgent nature, this grievous error of call-type aggregation results in conclusions which are dominated by a non-urgent (often service-oriented) call. The potential for erroneous research conclusions is enormous, since improper response to the small minority of highly urgent calls can yield catastrophic consequences. Each of these types of errors has occurred in police research literature. An additional error has also occurred which is related to error type 1: one researcher may label "response time" as travel time while another researcher may label response time as the sum of the internal

communications room delay and travel time, while yet a third researcher may label response time as the sum of the reporting delay plus the internal police communications delay plus the travel time; thus we have studies which allegedly yield commensurate quantities, but definitional problems preclude their contrast and comparison.

In addition to the aforementioned problems relating to the response time performance measure, it should be noted that response time is not itself a comprehensive measure of performance of the police emergency response system. Other measures include the probability of miscategorizing the call, probability of taking down an incorrect address, and the probability of dispatching a unit whose officers are inadequately trained to handle to incident. Still, almost all studies of the police emergency response system have focused solely on response time, and therefore our hypothesis-based approach will focus on this measure as well.

Intuitively, it seems that the likelihood of apprehending an offender should decrease as the amount of time taken by the police to arrive at the scene of the offense increases. Thus, considerable research has been designed around the question:

Is response time inversely related to apprehension probability?

The police have also assumed that response time correlates well with citizens' perceptions of police service. Again, it is *intuitively* plausible that a citizen's satisfaction with the police would decrease as response time to an incident reported by that citizen increases. Researchers have therefore queried:

Is response time inversely related to citizen satisfaction?

While some have questioned the validity of response time as a measure of police performance, others have accepted response time reduction as a

desirable goal. There have been several proposals suggesting how patrol forces may reduce their response times. Two hypotheses that have been empirically examined are:

Is response time inversely related to the number of units on patrol?

Do Automatic Vehicle Monitoring Systems reduce response time?

The results of 16 studies of police response time will be presented in Part IV.

3.3 RESEARCH EXAMINING THE MERITS OF ALTERNATIVE ORGANIZATIONAL AND MANPOWER ALLOCATION SCHEMES

Until recently, the manner in which police patrol was practiced remained unchanged for nearly 60 years. This situation is changing, however, with researchers investigating alternatives to the traditional modes of police patrol organization and manpower allocation. One emotional issue for patrol officers concerns the number of patrol officers in patrol cars. Since policing is a highly labor-intensive activity, the reduction (or increase) in the number of officers per car could have large cost consequences. When considering one-officer versus two-officer patrol units, the two key research questions have been:

Is one-officer patrol more efficient/effective than two-officer patrol?

Does one-officer patrol present a greater danger to officers' safety than two-officer patrol?

There have been larger scale proposals regarding the reorganization of the entire patrol force. One such proposal involves creating "teams" of generalized patrol officers who perform both patrol and investigative functions. While team policing presents one alternative, *specialized*

patrol involves a different division of labor in the patrol force. Specialized patrol schemes require officers to perform specific tasks (e.g., respond to calls for service, *period*). Forms of team policing and specialized patrol have been researched in detail, with both of these patrol alternatives being compared to routine patrol. This is evidenced in the following two research questions:

Is team policing more efficient/effective than routine patrol?

Is specialized patrol more efficient/effective than routine patrol?

One issue of special concern since the 1972 amendment of Title VII of the Civil Rights Act concerns the ability of women to perform the duties of patrol officers. Since women may not be excluded from police work solely on the basis of sex, it has become important to determine whether or not women can provide effective patrol service. Hence, researchers have attempted to answer this question:

Are women as efficient/effective on patrol as men?

We have uncovered over 20 studies which examine issues of organization and manpower allocation; the results of these studies will be presented in the next section.

These 14 research questions represent the thrust of the majority of patrol research completed to date. Having presented the major hypotheses governing patrol research, it is now time to examine the research products themselves. In Part IV, we present our assessment of patrol research in hypothesis-specific terms.

IV HYPOTHESIS-BASED ASSESSMENT

This section presents a detailed examination of the major findings of patrol research conducted over the past 30 years, with an emphasis on research completed during the last decade. Our purpose is to synthesize and assess a *body of research*. Hence, our presentation will focus on the *research question or hypothesis* as the unit of analysis as opposed to the individual research studies.

In order to convey our results in an efficient manner, we will attempt to become rather systematic in this section. First, for each of the three "families" of hypotheses identified in the last section (preventive patrol, response time, manpower organization and allocation), we will present a list of the hypotheses contained in that family. Then, for each hypothesis, we will present the findings of related studies and critically assess the merit of these research efforts. Where a sufficient number of studies permits, our analysis of research questions will conclude with a "findings/credibility" matrix such as that shown in Table IV. In this anonymous format, it is possible to summarize the extent to which patrol research has substantially confirmed or refuted a particular research hypothesis, and the validity of the research in this area.

We will now discuss how we determine the "credibility" of a research effort. In Part II, we outlined an idealized structure for patrol research. Many of the studies we encountered were of this form, and it

Table IV

RESEARCH QUESTION: Research question of interest.

CREDIBILITY				
	HIGH	MEDIUM	LOW	TOTAL
YES, HYPOTHESIS CONFIRMED				
INCONCLUSIVE				
NO, HYPOTHESIS REJECTED				
TOTAL				

NB: Entries in boxes will correspond to number of studies.

is thus possible to spot crucial deviations from a sound research design. For example, a study which was completely lacking in the notion of *control* (be it pure control group, comparison group, or a statistical control) will have difficulty establishing the credibility of its findings, especially if the policy implication of the study indicates any form of plan for action elsewhere. Improper use of statistical methods will serve to lower a study's credibility, as will heavy reliance on small sample sizes. Faulty or unreliable performance measures can also damage a study, as can poorly collected data. In short, research projects which suffer from serious methodological flaws will have low credibility. On the other hand, those studies which have maintained a research design of high integrity and have made proper use of research methodology will be said to be of high credibility. Unfortunately, these studies are few in number but they do provide useful examples of how one can conduct credible research in the field of police patrol. Of necessity, our assignment of credibility level is subjective in nature.

Having explained our assessment strategy, we will now proceed to examine the main body of patrol research, beginning with studies that addressed issues of preventive patrol.

4.1 RESEARCH EXAMINING THE MERITS OF POLICE PREVENTIVE PATROL

From our review of the literature, it has become obvious that the most fiercely debated issue in police research today concerns the effectiveness of routine police preventive patrol. The following five questions seem to summarize the intent of researchers in this area:

- (1) Does motorized routine preventive patrol deter crime?
- (2) Does motorized routine preventive patrol enhance citizen satisfaction?

- (3) Does foot preventive patrol deter crime?
- (4) Does foot preventive patrol enhance citizen satisfaction?
- (5) Does routine preventive patrol in general facilitate the interception of crimes in progress?

In Table V, we have listed those research studies which have examined at least one of the five questions posed. Our assessment of research in police preventive patrol is based upon our critical reading of these studies.

(1) Does motorized routine preventive patrol deter crime?

As discussed, the postulated deterrent effect of preventive patrol has provided the *raison d'être* for patrol as practiced today. We have identified 14 studies (one of which involved a bicycle patrol) which have to varying degrees examined this relationship between police patrol and crime. Though these studies are of widely different scales and have employed research methodologies ranging from the very simple to the very sophisticated, the studies are basically similar. By changing the *level* or *intensity* of patrol can one bring about a reduction in crime (measured by reported crime data or victimization survey results)?

Before discussing our findings in detail, let us briefly examine the research problems likely to surface in a study focusing on preventive patrol and its relationship to crime deterrence. First, the primary outcome variable of interest in these studies is usually crime rate. Unfortunately, crime rate as measured or as reported to the police or as reported by the police, is often quite different from crime rate as experienced by citizens; as mentioned earlier it is not unusual for only one in three serious crimes to be reported to and by police. Thus any

Table V
Research Efforts: Preventive Patrol*

- (1) A Preliminary Evaluation of the Des Moines Police Department's Comprehensive Neighborhood Patrol Program.
- (2) Allocations of Resources in the Chicago Police Department.
- (3) An Evaluation of a Police Patrol Experiment (Albuquerque).
- (4) Crime Control Team (Syracuse).
- (5) Evaluating the Effectiveness of One-Officer versus Two-Officer Patrol Units.
- (6) Examination of Police Patrol Effectiveness - High Impact Anti-Crime Program.
- (7) Final Report - Cleveland Deterrence, Detection and Apprehension Program.
- (8) Final Report - Overtime Foot Patrol (St. Louis).
- (9) Foot Patrols: The Fort Worth Experience.
- (10) Interception Patrol.
- (11) Isla Vista Foot Patrol: History, Operations and Evaluation.
- (12) Operation 25 (New York City).
- (13) Patrol Emphasis Evaluation (Cleveland Heights).
- (14) Patrol Evaluation Research: A Multiple Baseline Analysis of Saturation Police Patrolling During Day and Night Hours.
- (15) Police Tactics Against Robbery.

* Complete references may be found in the bibliography.

Table V

(Page 2 of 2)

- (16) Safe Streets Evaluation Report.
- (17) Science and Technology Task Force Report.
- (18) Social Evaluation Research: The Evaluation of Two Patrolling Strategies.
- (19) Some Effects of an Increase in Police Manpower in the 20th Precinct of New York City.
- (20) Special Police Units in Michigan: An Evaluation.
- (21) The Beat Patrol Experiment.
- (22) The Crime-Correlated Area Model: An Application in Evaluating Intensive Police Patrol Activities.
- (23) The Impact of Police Activity on Crime: Robberies on the New York City Subway System.
- (24) The Kansas City Preventive Patrol Experiment.
- (25) The Use of Paraprofessionals in Police Service.
- (26) The Wilmington Split-Force Experiment.
- (27) Urban Police Patrol Analysis.
- (28) What Happened to Patrol Operations in Kansas City? A Review of the Kansas City Preventive Patrol Experiment.

program that affects crime levels is potentially plagued by an accompanying change in the probability of a crime being reported. For instance, it is entirely conceivable that a new preventive patrol strategy could reduce actual crime rates while at the same time increasing reported crime rates; there is limited evidence in some of the studies that we have examined that this phenomenon has occurred. The major way out of this dilemma is to try to estimate true crime rates via expensive victimization surveys. Second, there is every reason to believe that crime rates should vary as the number of police patrol officers is varied; recent police strikes in various cities, and even the now infamous 1919 Boston police strike have graphically revealed that the total absence of police can in certain circumstances yield intolerably high crime levels; at the other extreme, virtual wall-to-wall police coverage essentially eliminates the opportunity for crime. The trouble is that most cities today have neither wall-to-wall police nor the total absence of police. Rather, most cities have anywhere from 50 police per square mile to 0.2 police per square mile. If the relationship between the number of crimes committed and police intensity is rather "flat" at typical levels of police coverage, then a virtual doubling or tripling of police or on the other end a halving of police presence might yield no measurable change in crime levels. This is another problem confronted by police researchers in this area. Third, the level of preventive patrol does not vary in proportion to the number of patrol units out in the field. We can see this by example. Suppose there is one patrol unit in a fixed area that spends four hours of an eight-hour tour servicing calls for service, and the remaining four hours on preventive patrol. Then, if a second car is added to the same fixed area, there is no reason to believe that the call-for-service workload

would be increased, thereby yielding an identical call-for-service workload of four hours, now shared between two vehicles. But the vehicles have available 16 total hours in an eight-hour tour, thus resulting in 12 hours of preventive patrol, up 300 percent from the four hours attributable to only one patrol unit. Here, a doubling in number of patrol cars has created a tripling in a preventive patrol level. One can think of other examples in which a doubling of patrol cars could yield a quadrupling in patrol levels or even an increase of patrol levels by a factor of five, six or ten. The amount of time that a patrol unit must spend on calls for service represents a "fixed charge" which renders the relationship between patrol intensity and the number of patrol cars not directly proportional. As obvious as this may sound, researchers have made the mistake of assuming that an increase in the number of patrol cars by x percent will increase the patrol level x percent; we have just seen that the amount of preventive patrol would be increased by greater than x percent. The fourth problem with patrol experiments of the type we are discussing here is the extreme difficulty encountered when trying to measure the intensity of preventive patrol itself. As we mentioned briefly earlier, such surrogate measures as number of miles traveled during an eight-hour tour are easily subverted. It has not been until very recently with the advent of automatic vehicle location systems that one can in fact design experiments in patrol that can be carefully monitored to ensure integrity of experimental conditions throughout the entire period of the experiments. Virtually all of the studies that we report on here did not have the benefit of such technology to assist the execution of the experiment.

In this section as well as in the following sections related to

specific hypotheses the reader is advised to consult the annotated bibliography for descriptions of the projects analyzed. Our focus in this and subsequent sections is on synthesis of results of the studies, but not on the idiosyncrasies of individual studies.

Six reports suggest that there is an inverse relationship between patrol intensity and crime occurrence. For example, the Crime Control Team (CCT) (Elliott and Sardino, 1971) in Syracuse increased the number of patrols during selected time periods by as much as a factor of four. The time-dependent manpower allocation scheme used by the Crime Control Team was determined by matching periods for intense patrol to observed high-crime periods. If the year-end summary statistics for the Crime Control Team are evaluated, it is noted that reported crime was reduced by a greater amount in the Crime Control Team beat than in the control beats.

As another example, consider the Wilmington Split-Force Experiment (Tien, Simon and Larson, 1976). Here, patrol was also allocated in a time-dependent manner with certain hours of the day receiving very intensive patrol. Wilmington also experienced a decrease in reported crime during the Split-Force study period.

Other studies which witnessed a decrease in crime rates after patrol operations were intensified include the Patrol Emphasis Project in Cleveland Heights (Gay, 1977), Budnick's evaluation of saturation patrol in Washington, D.C. (Budnick, 1972), Press's analysis of the manpower increase in New York City's 20th Precinct (Press, 1971), and Howard's study of campus bicycle patrols in Los Angeles (Howard, 1977). However, while these studies offer support to the contention that preventive patrol deters crime, there are five studies which found no evidence of the presumed effectiveness of preventive patrol.

Foremost among the studies which dispute the usefulness of preventive patrol is the famous Kansas City Preventive Patrol Experiment (KCPPE) (Kelling, Pate, Dieckman and Brown, 1974), the most elaborate police research study to date. The evaluators of this patrol project claim that during one year of marked variation in patrol intensities among three types of beat (regular intensity, high intensity, little or no intensity), no differences in the level of crime were observable between areas of intensive patrol and areas of no patrol. These results are based on statistical tests involving both reported crime indexes and victimization surveys.

Other studies have obtained the same basic results. The 1975 study by Schnelle *et al.* of saturation patrol in Nashville involved a quasi-experimental time-series design (Schnelle, Kirchner, Lawler, and McNees, 1975). Though arrest rates increased, the saturation patrol (of eight to fifteen additional patrol officers) did not produce an appreciable change in the reported crime rate.

Similar results were obtained by Wagner with respect to the Special Operations Section of the Albuquerque Police Department (Wagner, 1978). In this program, two eight-officer teams were fielded alongside the regular patrol to create saturation conditions in various parts of Albuquerque. No changes were detected in the reported crime rates as a result of the increase in patrol intensity.

In addition to those studies already mentioned, the following two studies--Lewis *et al.*'s evaluation of saturation patrol in Michigan (Lewis, Breene and Edwards, 1977), and the Safe Streets Evaluation Report (Iutcovich, M. and Iutcovich, J., 1977)--could not detect a relationship between patrol presence and crime occurrence.

Finally, there are also those studies which produced inconclusive results. In a second carefully monitored saturation patrol experiment in Nashville, Schnelle *et al.* discovered that intensive patrol correlated with reduced crime levels only at night (Schnelle *et al.*, 1977). Daytime crime levels remained the same in spite of saturations of up to 30 times the normal patrol level. Dahman's *post hoc* examination of the High Impact Anti-Crime Program's overt patrol projects yielded mixed results, suggesting that there is no uniform relationship between crime rate and overt police patrol (Dahman, 1975). The final report of the Cleveland Deterrence, Detection, and Apprehension Program indicated that after the introduction of a high visibility patrol program, crime rates decreased, but then increased (Cleveland Impact Cities Program, 1975).

It is apparent that there is substantial disagreement among police researchers as to whether police preventive patrol deters crime. This inconclusive state of affairs is further aggravated by the sad fact that the majority of the research efforts mentioned are methodologically flawed, often because of general difficulties cited earlier for this type of research. Additional technical problems with some of these research products are serious enough to undermine their claimed findings.

For example, the results from the Crime Control Team in Syracuse do not allow one to conclude that preventive patrol deters crime for two reasons:

- (1) Other beats in Syracuse not involved in the experiment experienced greater (or comparable) declines in the crime rate when compared to the experimental area; and
- (2) Other factors could easily be responsible for the reduction of crime in the CCT beat, including aspects

of the CCT not related to patrol intensity, or events external to the study (which were not well controlled).

Likewise, the Wilmington project did not provide crime statistics by time of day. Since the nature of the Split-Force experiment did not call for the use of control beats, the crime decrease experienced in Wilmington cannot be attributed to preventive patrol.

Those studies that disputed the effectiveness of preventive patrol also have their methodological weaknesses. The criticisms of the Kansas City Preventive Patrol Experiment are well known (Larson, 1975b; Fienberg, Larntz, Reiss, 1976; Davis and Knowles, 1975). Essentially, the major problem associated with this program was its inability to vary the levels of patrol to the extremes necessary for detecting the presence (or absence) of a deterrent effect upon crime. A second problem rests in the fact that the study tended to be biased in favor of the null hypothesis that varied levels of patrol will have no effect on crime (Fienberg, Larntz and Reiss, 1975). Other problems of experimental design and maintenance plagued this study, placing its controversial findings in question.

In Albuquerque, the selection of beats for the Special Operations Section program was arbitrary; this could have biased the results obtained. Also, the patrol officers participating in the study *volunteered* to take part; this could also have led to biased results.

Needless to say, there are several problems with completed research on this question. Our review of relevant research has convinced us that as of now, there are no credible, definitive studies which answer the question posed. This is reflected in Table VI which summarizes our findings on the issue.

(2) Does motorized preventive patrol enhance citizen satisfaction?

Present-day police departments are seen by both police

Table VI

RESEARCH QUESTION: Does motorized preventive patrol deter crime?

CREDIBILITY				
	HIGH	MEDIUM	LOW	TOTAL
YES, HYPOTHESIS CONFIRMED	0	2	4	6
INCONCLUSIVE	1	1	1	3
NO, HYPOTHESIS REJECTED	0	2	3	5
TOTAL	1	5	8	14

administrators and the general public as the deliverers of a wide range of municipal services. When viewed from the perspective of public service delivery, client satisfaction with the mode of police service received becomes important. Of research concern is the validity of the contention that citizens are by and large satisfied with routine preventive patrol, and that increases in the level of patrol would increase the level of citizen satisfaction with the police.

This contention was addressed explicitly by the Kansas City Preventive Patrol Experiment. Through the use of survey techniques, the Kansas City researchers concluded that citizen satisfaction was unaffected by the changes in patrol associated with that experiment. However, a re-interpretation of the data provided in the final report of the Kansas City study suggests that there may be a strong relationship between citizen satisfaction and preventive patrol. On pages 331 to 351 of the KCPPE's Technical Report (Kelling, Pate, Dieckman and Brown, 1974), a wealth of information remarkable in its consistency is presented which in itself supports the idea that preventive patrol enhances citizen satisfaction. These results have apparently remained obscure; it is useful to highlight them here:

- (1) Community perceived need for neighborhood police officers: the results *consistently* state that more officers are needed.
- (2) Community perceived need for city police officers: again the results *consistently* state that more officers are needed in Kansas City as a whole.
- (3) Community perception of time spent on patrol: when comparing *perceived* amount of patrol to *preferred* amount of patrol, the results *consistently* state that citizens feel more patrol is necessary (i.e., preferred level of patrol is greater than perceived level of patrol).
- (4) Community perception of time spent on aggressive patrol: again, the results *consistently* show that citizens would prefer more aggressive patrol than they *perceive*.

- (5) Community suggestions to reduce neighborhood crime: where suggestions are given, the modal response is *consistently* to implement more frequent police patrol.
- (6) Aspect of neighborhood police service liked best: where answered, the modal response is *consistently* that police aren't patrolling enough in the neighborhood.

The Kansas City researchers realized that the above six findings did not vary in type of beat. Since patrol was presumably varied by reactive, control and proactive beats, their conclusion was that patrol intensity had no influence on citizen satisfaction with the police.

However, the consistency of the above six points is somewhat overwhelming. If the criticisms of Larson and others discussed earlier are correct, then it should come as no surprise that citizens *did not detect or perceive* different levels of patrol where the experiment would have expected these differing levels to exist. These results also seem to indicate that preventive patrol does enhance citizen satisfaction.

In Syracuse, the Crime Control Team experiment did not generate specific evidence with respect to the question under discussion. The authors of that study indicate that through discussions with business, civic, political, and religious leaders, it was apparent that citizen satisfaction with the police had increased in the experimental beat (Elliott and Sardino, 1971). However, this assertion cannot be substantiated, and even if it were true, it would be incorrect to attribute it to the increased intensity of the patrol force.

Howard's study of bicycle patrol in the Claremont Colleges also included a survey of students there. He reports that students' attitudes toward departmental effectiveness became more positive, and that students felt more secure on campus after the special program had been operative for five months (Howard, 1977). Both of these may be taken as indications of improvements in students' satisfaction with the campus police.

Thus, if we take the researchers' word on their answers to this research question, we are again left with inconclusive results as shown in Table VII. Also, we cannot ignore the methodological problems accompanying this work and these will be addressed later (see Part V). However, if we consider our own interpretation of the Kansas City results, then more evidence would seem to favor the argument that preventive patrol does enhance citizen satisfaction. At any rate, there is no conclusive piece of research at present which answers in a definitive manner the research question posed.

(3) Does foot preventive patrol deter crime?

Though motorized patrol currently constitutes the major activity of urban U.S. police departments, foot patrol represents the oldest mode of police deployment. There are those who feel that foot patrol has been and continues to be an effective crime deterrent, and that the merits of foot patrol should not be overlooked in favor of motorized patrol. We have uncovered nine* studies which have examined the deterrent effect of foot patrol; the results of some of these studies will now be discussed in detail.

In Isla Vista, California, a foot patrol was initiated following 18 months of community unrest (Kinney, Howlett and Harris, 1976). While serious reported crime decreased, petty reported crime increased. The Isla Vista evaluators claimed that crime itself decreased, though reporting rates were thought to have risen. However, there is no evidence in the report that substantiates this claim.

* As a tenth study, we had hoped to review the Police Foundation's foot patrol experiment in Newark. Unfortunately, no documentation of this significant study exists at the time of writing.

Table VII

RESEARCH QUESTION: Does motorized preventive patrol enhance citizen satisfaction?

CREDIBILITY

	HIGH	MEDIUM	LOW	TOTAL
YES, HYPOTHESIS CONFIRMED	0	1	1	2
INCONCLUSIVE	0	0	0	0
NO, HYPOTHESIS REJECTED	0	1	1	2
TOTAL	0	2	2	4

Pendland and Gay reported that Part I crime decreased 25.4 percent in a high crime area of Fort Worth following the initiation of foot patrol (Pendland and Gay, 1972). Crime decreased by 11 percent citywide during the one-year program. The authors concluded that the foot patrol was effective in deterring crime.

An earlier study of foot patrol was conducted in New York City (New York City Police Department, 1972). On September 1, 1954, the foot patrol strength in New York's 25th precinct was increased from 188 to 440 patrol officers. This level of foot patrol was maintained for four months. Felonies and misdemeanors decreased by 55.6 percent in the precinct while arrest rates increased. These results prompted New York police officials to conclude that the foot patrol had been a success. However, the study was not controlled; there was no analysis pertaining to crime displacement and certain minor crimes were reported to have increased--prompting questions and doubts about crime categorizations by police officers.

Another New York study, this time of foot patrol in the subway system, was conducted by the New York City Rand Institute (Chaiken, Lawless, and Stevenson, 1974). Using an interrupted time series design, the Rand researchers examined eight years of subway robbery data. During this period, police presence in the subway almost tripled. Robberies apparently decreased after the increase in foot patrol and these robberies were not deferred to other hours of the day. Rather, a "phantom effect" prevailed whereby crime decreased at hours just outside of the foot patrol shifts. Unfortunately, some time after the dissemination of the results of this study, it was learned that much of the data analyzed by the researchers had been falsified during compilation by police employees. However Chaiken (1978) has reanalyzed this study considering the effects

of the data falsification, and he concluded that the earlier results are valid with the exception of their magnitudes (i.e., the deterrent effect was less than stated).

Not all foot patrol programs have demonstrated a deterrent effect. In Nashville, an additional six foot patrol officers were deployed in two target areas (Schnelle, Kirchner, Lawler and McNees, 1975). Using time-series models based upon six weeks of data, it was determined that foot patrol had no effect on the arrest rate. The number of reported offenses increased in the areas provided with foot patrol. Thus, the effectiveness of foot patrol is questioned by this study. However, here problems of random fluctuations due to the small sample size, basically in favor of the null hypothesis, and change in crime reporting probabilities may all have influenced the outcomes of the study.

Another study of foot patrol was conducted in St. Louis (Walsh, 1975). From June 1972 to November 1975, overtime foot patrols were deployed in areas of the city exhibiting high crime rates. These foot patrols were reallocated quarterly. According to the project evaluation report:

Measurable crime reduction has occurred only in isolated cases when compared to area and citywide trends. No significant geographic displacement of crime appears to have occurred. Crime appears to have been displaced to the unpatrolled hours in the experimental areas. (Walsh, 1975).

One of the more interesting studies in foot patrol was reported by Bright (1970). This one-year experiment was performed in the British cities of Cardiff, Manchester, Newcastle, and Sheffield beginning in December 1965. Each city selected one beat as a control (one foot officer/beat) and one beat as experimental (0, 2, 3, 4 foot officers/beat). Crime levels were examined as a function of the number of foot officers/beat. The results indicated that crime decreased markedly when the level of

foot patrol changed from no officers/beat to one officer/beat. Crime levels did not change with increases in foot patrol intensity above one officer/beat. Thus, it would seem that foot patrol is certainly preferable to no patrol, but that the actual level of foot patrol may not be important (within the ranges examined by this experiment).

Table VIII summarizes our assessment of studies which have examined the deterrent effect of foot preventive patrol. As is the case with motorized patrol, no easy conclusions are reachable. This is due to the conflicting results reported by different researchers, and the low technical quality of most research performed to date. Thus, our review of completed studies cannot support or refute the hypothesis that foot patrol deters crime.

(4) Does foot preventive patrol enhance citizen satisfaction?

As is the case with motorized patrol, police officials are concerned that citizen response to foot patrol be favorable. Indeed, it is often foot patrol that tends to be stepped up in an area in response to citizens' outcries for more "police protection." Four of the studies we reviewed surveyed citizen attitudes toward foot patrol, and all four yield similar conclusions.

In Fort Worth a survey was administered to two independently selected random samples of residents, one before foot patrol, the other after. According to the researchers, this second survey indicated ". . . a generally favorable response on the part of area residents to the Foot Patrol Unit" (Pendland and Gay, 1972).

A direct comparison of foot patrol to motorized patrol was obtained in St. Louis. As part of the evaluation of the Overtime Foot Patrol Project, a survey was administered to citizens asking them to compare the

Table VIII

RESEARCH QUESTION: Does foot preventive patrol deter crime?

CREDIBILITY

	HIGH	MEDIUM	LOW	TOTAL
YES, HYPOTHESIS CONFIRMED	0	1	3	4
INCONCLUSIVE	0	1	1	2
NO, HYPOTHESIS REJECTED	0	1	2	3
TOTAL	0	3	6	9

effectiveness of foot patrol to car patrol. Ninety-four percent said that foot patrol was as good as or better than car patrol, with 69 percent saying "better." This was taken as an indication of citizen satisfaction with foot patrol by the St. Louis evaluators.

The evaluation of foot patrol in Isla Vista included a citizen survey. This survey showed that Isla Vista residents preferred foot patrol to other types of policing. However, these findings are not entirely believable, as "The sampling techniques employed to select survey respondents were not precisely described; consequently, neither the representativeness of the sample nor the levels of statistical confidence in the results could be assessed" (Kinney, Howlett and Harris, 1976). Another problematic survey is presented with the preliminary evaluation of a foot patrol program in Des Moines, Iowa (Central Iowa Crime Commission, 1977). This survey was presented in conjunction with one month of foot patrolling to small samples of citizens (20-30). Though the representativeness of this survey cannot be guaranteed, it did indicate that citizens were satisfied with foot patrol.

Thus, from the four studies we have examined on this issue, it appears that citizen satisfaction is enhanced through the use of foot patrol. Again, the technical quality of some of these reports is questionable. However, in the absence of strong counter-evidence, we conclude that completed research supports the contention that foot patrol enhances citizen satisfaction with the police.

(5) Does preventive patrol facilitate the interception of crimes in progress?

The interception capabilities of motorized patrol units have been analyzed from both theoretical and applied perspectives. Theoreticians

have relied on an area of operations research known as "search theory" to model the likelihood of events such as the space-time coincidence of randomly patrolling cars and randomly located crimes. Empirical estimates of these "interception probabilities" have been obtained by computing the fraction of crimes potentially observable by the police that resulted in arrests of criminals "caught in the act."

With respect to the theoretical aspects of this issue, it is noted that Blumstein and Larson (1967), Elliott (1973), Larson (1972b), Bottoms *et al.* (1972) and Kaplan (1979) have all formulated similar models of interception probability, and they have obtained similar results. An increase in the number of patrol units in an area will certainly increase the overall threat of intercepting crimes in progress. However, the actual *magnitudes* of these interception probabilities are so small that the cost of deploying additional patrol units may outweigh the benefits of the improved interception capabilities.

We previously mentioned the finding of the Science and Technology Task Force that interceptions are so rare that they occur once in 14 years. Larson (1972b) estimated that at a patrol frequency of one passing per hour, and for a crime lasting one minute, the likelihood of interception is only about 1.7 percent. In Syracuse, Elliot (1973) estimated an interception probability of 0.8 percent, while Kaplan (1979) derived an interception probability of 0.6 percent using data from San Diego. All of these probabilities are very low. Since *apprehension* probabilities are even smaller than interception probabilities, these models suggest that patrol in and of itself is not an effective strategy for apprehending offenders.

The only large scale experimental study which explicitly addressed this question was the Crime Control Team in Syracuse. It is true that at

times, the number of patrol units was increased in the experimental beat by as much as a factor of four. It is also true that the interception rate of 3.8 percent obtained was an improvement over the interception rate of the regular patrol by a factor of six. However, Elliott was disappointed with this result, having expected to achieve an interception rate of 10 percent to 15 percent. He stated that he ". . . was not able to impress the Crime Control Team with the importance of the speed of the vehicle to an effective interception patrol. All of the people connected with the experiment continued to patrol at a constant slow speed, which maximized their detection capabilities rather than their interception capabilities." (Elliott, and Sardino, 1971, p. 116).

Elliott's later monograph entitled Interception Patrol: An Examination of the Theory of Random Patrol as a Municipal Police Tactic (Elliott, 1973) consolidated his previous theoretical work and his research with the Crime Control Team. He proposed a method for constructing computer-designed patrol routes based on the notion of maximizing interception probabilities, and concluded that his methods required extensive experimental evaluation at high cost.

Larson also examined the notion of allocating patrol resources with the objective of intercepting crimes in progress. His model produces optimal coverage functions which prescribe the *relative amounts of time* different areas should be patrolled (as opposed to the fixed route patrols resulting from Elliott's model). One interesting finding from Larson's work is the idea that in order to maximize crime interception, certain areas should not receive any patrol. This theoretical result buttresses Larson's notion that "fluid patrol" could be an efficient and effective patrol option.

A detailed examination of this same model was performed by the Operations Research Task Force of the Chicago Police Department (Bottoms, et al., 1972). Using actual robbery data from Chicago's Second Police District, the Chicago researchers were able to determine the amount of patrol effort that should be allocated in order to maximize the probability of a space-time coincidence. However, the maximum interception probabilities obtained were on the order of one or two percent. While these percentages may be disappointingly small, they may account for a sizable fraction of arrests for particular types of crimes (e.g., burglaries); an increase, say from two to four percent interception rate would correspond to a *doubling* of on-scene interception arrests.

It would seem, though, from this review that although one can allocate patrol resources in a manner which will maximize the interception capabilities of patrol units, these interception capabilities are quite limited even when operating at optimum levels. Thus, one would say that preventive patrol does facilitate the interception of crimes in progress, but this in itself is of limited consequence in the achievement of overall patrol objectives.

4.2 RESEARCH EXAMINING THE MERITS OF RAPID POLICE RESPONSE

Another contested issue in patrol research concerns the effectiveness of rapid police response to calls for service. Recalling our earlier discussion, police response time (too often aggregated by type of call and by response system component) is used widely as a surrogate measure of the effectiveness of the police response system.

- (6) Is response time inversely related to apprehension probability?
- (7) Is response time inversely related to citizen satisfaction?

- (8) Is response time inversely related to the number of units on patrol?
- (9) Do Automatic Vehicle Monitoring Systems reduce response time?

Our assessment of research in response time is based on those studies listed in Table IX.

(6) Is response time inversely related to apprehension probability?

"The probability of arrest is strongly related to the elapsed time between a criminal event and the arrival of police on the scene . . ." (Bottoms *et al.*, 1972, p. 89). The Chicago Operations Research Task Force is not alone in assuming the correctness of the above proposition; indeed this belief has long been held by police administrators dating back to August Vollmer and the beginnings of motorized patrol. Our research has uncovered one theoretical and five empirical studies relating to this issue; the results of these efforts are as follows.

In a little known report entitled Police Tactics Against Robbery (Bottoms, 1971). Bottoms presented a model relating apprehension probability to response time (which Bottoms refers to as "time late"). Using ideas from search theory and some simple assumptions governing patrol behavior and criminal escape routes, Bottoms was able to demonstrate why the likelihood of apprehending a thief should decrease markedly with increases in response time. Thus, Bottoms' model provides a theoretical rationale for the expectation that response time and apprehension probability are inversely related.

As mentioned, we have discovered five studies which have empirically researched this issue. The approach in all these studies was similar. Essentially, each study examined the fraction of all calls with response time not exceeding minutes that resulted in at least one arrest. Here

Table IX

Research Efforts: Response Time *

- (1) Analysis of Response Delays and Arrest Rates.
- (2) Evaluating the Effectiveness of One-Officer versus Two-Officer Patrol Units.
- (3) Patrol Staffing in San Diego: One- or Two-Officer Units.
- (4) Police Response Time: Its Determinants and Effects.
- (5) Police Tactics Against Robbery.
- (6) Resource Allocation in the Chicago Police Department.
- (7) Response Time Analysis.
- (8) Science and Technology Task Force Report.
- (9) St. Louis AVM: Phase I.
- (10) St. Louis AVM: Phase II.
- (11) The Kansas City Preventive Patrol Experiment.
- (12) The Relationship of Response Delays and Arrest Rates.
- (13) The Wilmington Split-Force Experiment.
- (14) The Worcester Crime Impact Program.
- (15) Urban Police Patrol Analysis.
- (16) What Happened to Patrol Operations in Kansas City? A Review of the Kansas City Preventive Patrol Experiment.

* Complete reference may be found in the bibliography.

"police response time" is the sum of communications room delay and travel time, and calls for service are usually aggregated over a wide class.

The response time/arrest rate relationship was tested with respect to its form and strength to determine if apprehension probability and response time bear an inverse relationship to each other.

Of the five studies examined, three were able to demonstrate a strong inverse relationship between response time and apprehension probability (Isaacs, The Institute for Defense Analyses, 1967, Clawson and Chang, 1977, and Tarr, 1978), while two claimed that the postulated inverse relationship was either weak or non-existent (Kansas City Response Time Study, Kansas City Police Department, 1977, Pate, Ferraia, Bowers and Lorence, 1976). It is interesting to note that the two studies rejecting the hypothesis under discussion had sample sizes much smaller than the other three projects. Indeed, Pate *et al.*, considered only 731 calls, while the Kansas City Response time analysts sifted through 949 incidents. In sharp contrast to this, Clawson and Chang examined 2,532 calls, Tarr studied 3,639, and the Isaacs study sampled 4,376 calls for police service.

If one closely examines the methods used in these five studies, it is apparent that the Isaacs, Clawson and Chang, and Tarr papers utilized approaches which are well suited to the research question posed. The other two studies are fraught with methodological problems, some of which will be discussed in Part V. Thus, the evidence presented would seem to favor the notion that there is an inverse relationship between response time and apprehension probability (see Table X).

However, this relationship is not necessarily causal. It is not true that a quick response time will guarantee an apprehension. It may be that for certain types of calls (e.g., victim-triggered robbery alarms, to be extreme), officers will respond faster due to their knowledge that there

Table X

RESEARCH QUESTION: Is response time inversely related to apprehension probability?

CREDIBILITY

	HIGH	MEDIUM	LOW	TOTAL
YES, HYPOTHESIS CONFIRMED	2	1	0	3
INCONCLUSIVE	0	0	0	0
NO, HYPOTHESIS REJECTED	0	0	2	2
TOTAL	2	1	2	5

is a high likelihood of an arrest being made for these types of calls. This "chicken-or-egg" syndrome will not be sorted out without recourse to a carefully controlled study; Isaacs in 1967 made this clear in stating:

The data collected on the response time in duplicating field units appears [sic] to support the hypothesis that faster response time leads to more arrests. . . . (But) only a controlled experiment designed specifically to test this hypothesis would be conclusive proof.
(The Institute for Defense Analyses, 1967, pp. 100, 93)

To date, no such controlled experiment has occurred.

(7) Is response time inversely related to citizens' satisfaction with the police?

We have already discussed why client satisfaction is important to the police. The level of motorized and/or foot patrol is one indicator thought to be correlated with client satisfaction; response time is another assumed surrogate for citizens' satisfaction with the police. We have uncovered four studies which question the notion that citizens' satisfaction is partially governed by police response time, and it is of note that *these studies have all reached the same conclusion.*

The Police Foundation study Police Response Time: Its Determinants and Effects examined this issue in detail using data generated by the Kansas City Preventive Patrol Experiment (Pate, Ferrara, Bowers, and Lorence, 1976). It was found that citizen satisfaction with response time remained at a constant (and high) level over a large variation of *perceived* response times. However, a significant correlation was found between citizen satisfaction and the difference between *observed* and *expected* response time; if the police were able to respond quicker than expected, the citizen involved was more likely to be satisfied than if the police responded slower than expected.

The LEAA-funded Response Time Analysis (Kansas City Police Department, 1977) also researched this question. Again, surveys reported that most of the population was satisfied with response time regardless of the actual response time involved. The researchers also advanced the argument that it is the difference between perceived and expected response time which is crucial in determining citizen satisfaction. There are some technical flaws in the statistical methods accompanying this report (see Part V); however, the results obtained regarding citizen satisfaction were probably not greatly affected.

In Worcester, Massachusetts, researchers (Tien *et al.*, 1975) noted that citizen satisfaction was consistently high despite variations in response time. For example, 46 percent surveyed there experienced response times ranging from 0-10 minutes, yet 50 percent were very satisfied with the response time incurred. Like the other studies mentioned, the Worcester study also indicates that citizen satisfaction is not too dependent on response time.

The same finding appeared in Wilmington (Tien, Simon, and Larson, 1976). Of 180 people surveyed, nearly 50 percent stated that a response time of over 10 minutes would be acceptable. The researchers attempted to determine an upper bound for the range of response times which would leave citizens satisfied with the service received. One survey showed that a delay of up to 40 minutes would be unacceptable to 74 percent of 192 respondents, while another survey showed that 54 percent of 189 respondents would not accept delays of up to 30 minutes. The Wilmington study detected tremendous indifference among citizens as to the relationships between response time and quality of service. In two surveys, well over 70 percent of survey respondents stated that response time had no

effect on the quality of police service received. Finally, in a very limited sample, citizens were informed that a response delay would occur--and 45 percent of this sample responded that they "couldn't care less". Hence, from the Wilmington study, it would appear that response time does not have much of an effect on citizen satisfaction.

We have seen four studies, which employed different methodologies and were designed for different purposes, approach a near consensus on the issue of the relationship between response time and citizen satisfaction. It is certainly suggested from this review that response time *does not play a major role contributing to citizen satisfaction with the police (see Table XI).*

Extreme care must be exercised in interpreting this result regarding citizen satisfaction and police response time. It would be incorrect for police decision makers to interpret this result in a way which argued for indiscriminate increase in police response time; the research studies reviewed here do not claim that a deliberate increase in response time would be received favorably or, at best, indifferently by the populous at large. The measured insensitivities of citizen attitude with respect to various levels of responsiveness is due to several factors. First, the great majority of calls for police assistance are non-urgent in nature; these may either be service-related calls, such as parking violations and lock-outs, or reports of crimes that occurred hours or days earlier. For such incidents, citizens are now known to voluntarily incur significant delay between discovery of the incidents and reporting to police; this is a major finding of the Kansas City Response Time study (Kansas City Police Department, 1977). Thus, a citizen voluntarily delaying a call to

Table XI

RESEARCH QUESTION: Is response time inversely related to citizens' satisfaction with the police?

CREDIBILITY

	HIGH	MEDIUM	LOW	TOTAL
YES, HYPOTHESIS CONFIRMED	0	0	0	0
INCONCLUSIVE	0	0	0	0
NO, HYPOTHESIS REJECTED	0	4	0	0
TOTAL	0	4	0	0

the police is not likely to care whether the police respond within 5 minutes, 10 minutes, or even 45 minutes, as long as the delay incurred is not judged to be excessive. This accounts for the finding that it is citizens' anticipated delay for police service versus the actual delay that is the critical variable, not the absolute delay incurred. Thus a citizen who is calling in and who is advised that police response may require 45 minutes is not likely to be perturbed if that citizen is reporting a low-priority call. A second problem related to these studies is that each of the police departments involved in the studies are by the selection process of the study being done there in the first place relatively progressive, innovative, and willing to service calls from the public in an effective manner. We have personally visited police departments in the United States in which a sizeable fraction of calls for police assistance are never responded to, which results in a virtually infinite response time. In a number of departments, queues at dispatcher's stations of an hour or more preclude immediate dispatch of calls for service; these queues are found not only during the more traditional high crime hours but may occur at any time of the day or night. It is unlikely that citizen surveys of police response time in such cities would yield results similar to the results we have seen for the four studies cited here. Third, even the studies cited here tend to aggregate their findings over the entire class of calls for service, thereby relegating the importance of extremely urgent and high priority calls to the "back burner". It appears highly unlikely that a citizen who is calling for police assistance while someone is attempting to break into his or her residence would be satisfied with a 15-minute or 45-minute response time; the reason that

these results do not show up in the studies is that such calls for service account for a very small percentage of total calls for service.

Thus, the policy implications of a particular set of research studies, even when the research studies share a consensus of findings, are not at all obvious. In the early 1970s, mayors and city managers reacting to early press releases of the Kansas City Preventive Patrol Experiment results jumped to the conclusion that preventive patrol--due to its relative ineffectiveness--could be virtually eliminated, thus allowing a reduction of up to 50 percent of total patrol officers; this policy conclusion was also simplistic and inaccurate. It remains a challenge to translate research findings into positive, action-oriented policy results.

(8) Is response time inversely related to the number of units on patrol?

Related to the notion that small response times are "good" is the question of how response time may be reduced to desirable levels. One intuitive strategy is simply to increase the number of police cars fielded. Indeed, there exist reasonable mathematical models relating mean response time to the strength of the patrol force, and these models all exhibit inverse relationships between response time and the number of units on patrol.

Hence, one of the expected results of the Kansas City Preventive Patrol Experiment was that response time would vary by type of beat; i.e., proactive beats with three patrol units were expected to experience rapid responses, while reactive beats with no patrol were expected to experience lengthier responses. However, it was found that response time did not vary at all by beat. This result is tenuous at best, due to improper labelling (i.e., categorizing by type of car rather than type of beat) and due to a large number of cross-beat dispatches. In all likelihood, this

discovery says more about the inadequacies of the experimental design of the Kansas City experiment than about the "hypothesis" being tested.

In San Diego, researchers (Boydston, Sherry, and Moelter, 1977) indirectly touched on this issue when response times involving two answering units were compared to response times involving one answering unit. It was found that two-unit response times were lower than one-unit response times. Had response times been measured according to the *first* unit to arrive on-scene in the two-unit case, then this finding that two-unit response times are more rapid than one-unit response times would make sense. However, the observed result was accompanied by the fact that two-unit response times corresponded to the response times of the *second* unit to arrive on-scene. One cannot accept such an unexplained (and perhaps unexplainable) finding as proof of much; one can suspect that something was problematic with the conduct of the experiment.

Thus, although two empirical studies speak to the contrary if accepted at face value, we feel that the relationship between response time and the number of patrol units fielded is, in fact, inverse. Raising the number of available units in an area should serve to reduce response time, usually according to a "square root law" as discovered and verified empirically by Rand researchers in a fire context (Chaiken, Ignall, and Walker, 1975).

(9) Do Automatic Vehicle Monitoring systems reduce response time?

Another proposal for reducing response time involves the use of Automatic Vehicle Monitoring (AVM) systems. This technology provides dispatchers with real-time information pertaining to the location and availability of patrol units. The anticipated savings in response time are due to the fact that with AVM information, it would be possible to dispatch the patrol car closest to the incident.

In Urban Police Patrol Analysis, Larson (1972b) modeled the performance of AVM systems with respect to reductions in response time due to closest car dispatching. He concluded that the use of car locators such as AVM could be expected to reduce travel time by 10 to 20 percent. For cities with mean travel times of about 5 minutes, this translates into a mean savings of up to one minute in response time. However, since travel time typically comprises only about 40 percent of total police response time, even a 20 percent reduction in travel time corresponds to only an 8 percent reduction in total response time.

The Chicago Operations Research Task Force (Bottoms *et al.*, 1972) also analyzed anticipated savings in response time due to the use of car locator systems. Using a detailed simulation model, the Task Force concluded that the car locator system alone does not result in large scale improvements in system efficiency. The maximum savings in response time due to the car locator were reported to be two minutes. If intersector dispatching was allowed, and if a car locator system was in use, then response time savings were predicted to approach four minutes. However, the bulk of these savings was attributed to the allowance for intersector dispatching rather than the use of the car locator system.

Considering the analytical results discussed above, the evaluations of the implemented St. Louis AVM car locator system have revealed some surprises (Larson, Colton, Larson, and McKnew, 1976; Larson and Simon, 1979). It was anticipated that AVM could reduce travel time by as much as 15 percent. Empirically, reductions of this magnitude simply did not occur; when comparing the drop in travel time citywide to the AVM district's decrease, it was found that the AVM district experienced a net decrease in travel time of only 4 percent. Hence, the evaluators

concluded: "Regarding the effect of AVM on average travel times, we must view the results of Phase I (one-district AVM) as inconclusive" (Larson, Colton, Larson, and McKnew, 1976, p. 23).

The Phase II (citywide AVM) evaluation revealed a similar finding. "The impact of AVM on response time was small, and not sufficient to materially influence apprehension rates or the effectiveness of the department" (Larson and Simon, 1979, p. 106). Typically, AVM-related savings in response time were on the order of 15-20 seconds.

To date, the only cities that utilize AVM systems are St. Louis, Missouri; Dallas, Texas; and Huntington Beach, California. We have discovered a Master's thesis by Otto Reichart (1977) describing the response time benefits of the Huntington Beach AVM system. For this study too, there are no measurable response time benefits due to AVM, compared to the police response system operating prior to AVM.

Thus, current empirical evidence does not support the contention that an AVM system reduces police travel time. However, close scrutiny of the evaluation reports in question, both for St. Louis and Huntington Beach, reveals that the AVM systems in those two cities experienced serious technical difficulties during the period of the evaluation. In St. Louis, for instance, it is known that dispatchers frequently did not follow the "closest car" concept due to their feeling that the system was not functioning properly from a technical point of view. Thus, while the statistical evidence to date does not support response time reduction due to AVM systems, one may correctly question whether the finding is due to inadequacy in the theory or inadequacy in the technology implemented to date.

4.3 RESEARCH EXAMINING THE MERITS OF ALTERNATIVE ORGANIZATIONAL AND MANPOWER ALLOCATION SCHEMES

A broader body of research has attempted to examine several exploratory hypotheses in the areas of patrol force organization and manpower allocation. Table XII contains a list of studies that have examined at least one of the following questions:

- (10) Is one-officer patrol more efficient/effective than two-officer patrol?
- (11) Does one-officer patrol present a greater danger to officers' safety than two-officer patrol?
- (12) Is team policing more efficient/effective than routine patrol?
- (13) Is specialized patrol more efficient/effective than routine patrol?
- (14) Are women as efficient/effective on patrol as men?

The results of research into these aspects of patrol are the subjects of discussion in this section.

- (10) Is one-officer patrol more efficient/effective than two-officer patrol?

The postulated benefits of one-officer patrol are well known. Indeed, reports along the lines of the Chicago Police Department's One-Man Patrol Cars (Chicago Police Department, 1963) present a host of reasons for utilizing one-officer patrol cars. Though police officials across the country have long held differing views on this topic (see Governmental Research Institute's survey One-Man Patrol Car Operation [Governmental Research Institute, 1957]), little research has been carried out until recently with respect to patrol car staffing.

Table XII

Research Efforts: Alternative Organizational and Manpower Allocation Schemes *

- (1) An Analysis of Team Policing in Dayton, Ohio.
- (2) An Evaluation of the Bellevue Police Department's Experiment in Team Policing.
- (3) Atlanta High Impact Program Project Evaluation.
- (4) Crime Control Team.
- (5) Evaluating the Effectiveness of One-Officer versus Two-Officer Patrol Units.
- (6) Evaluation of Women in Policing Program, Newton, Massachusetts.
- (7) Evaluation of the Community Centered Team Policing Program.
- (8) Final Evaluation of Team 28 Experiment.
- (9) Final Report: West Philadelphia Strike Force, Act I, North, Central-Northwest Strike Force, Act II.
- (10) First Year Evaluation of the San Jose Patrol Emphasis Program.
- (11) Montpelier, Vermont's Directed Patrol Experiment.
- (12) One-Man Patrol Cars.
- (13) One-Man Police Patrol Car Operation.
- (14) Patrol Staffing in San Diego: One- or Two-Officer Units.
- (15) Policewomen on Patrol: Final Report.

* Complete references may be found in the bibliography.

Table XII
(Page 2 of 2)

- (16) Report on One-Man Patrol Cars in Kansas City, Missouri.
- (17) Special Police Units in Michigan: An Evaluation.
- (18) Team Policing Experiment: Analysis and Evaluation.
- (19) The Beat Commander Concept.
- (20) The Cincinnati Team Policing Experiment.
- (21) The Use of Paraprofessionals in Police Service.
- (22) The Wilmington Split-Force Experiment.
- (23) The Worcester Crime Impact Program.
- (24) Women on Patrol: A Pilot Study of Police Performance in New York City.

One early exception to this last statement was the Kansas City Police Department's Report on One Man Police Patrol Cars (Kansas City Police Department, 1955). This study compared patrol performance in 1952, when all cars were staffed with two officers, to patrol performance in 1954, when all cars were staffed with one officer. In terms of response time, number of calls serviced, and crime rates, the one-officer patrols performed well. However, due to its short time span and lack of statistical controls, this study's findings are not easily generalized. Also, through personal communication with the Kansas City Police Department, we have reason to believe that not all results of this study were reported in an acceptably unbiased manner.

As part of the Crime Control Team experiment in Syracuse (Elliott and Sardino, 1971), a limited test was conducted to evaluate the interception capabilities of one- and two-officer patrol units. Here, manpower was held constant, i.e., two one-officer units were substituted for one two-officer unit. It was found that two-officer units consistently outperformed one two-officer unit in terms of detecting "simulated" crimes (e.g., tape on a window to represent a break-in). Since manpower was held constant while detection capabilities were increased, it was concluded that one-officer patrol is more efficient than two-officer patrol.

In Seattle, Tarr (1978) analyzed response-related arrests as a function of the number of officers per primary unit. She reported that for response times under 10 minutes, two-officer units have significantly higher arrest rates than one-officer units. However, she also notes that this relationship could be due to the dispatching policy of the Seattle Police Department.

A twelve-month experimental study of patrol unit staffing was performed in San Diego. This experiment substituted one-officer cars for two-officer cars on a unit-for-unit basis. In the evaluation report Patrol Staffing in San Diego: One- or Two-Officer Units (Boydston, Sherry, and Moelter, 1977), it is concluded that on the basis of calls handled, arrests, response time, monetary cost, and other measures, one-officer patrol is clearly as effective and more efficient than two-officer patrol.

Finally, Kaplan (1979) has investigated this issue using mathematical models in conjunction with data provided by the San Diego report. By modeling performance measures such as patrol coverage, response time, patrol frequency and visibility, interception probability, and system cost, he was able to conclude that one-officer patrol is more efficient than two-officer patrol. However, Kaplan's research assumed that two one-officer units would be substituted for each two-officer unit (within cost constraints), a strategy that preserves manpower. His models would not support a unit-for-unit substitution of one-officer cars for two-officer cars.

It would appear that with the exception of the Seattle data, most researchers have found one-officer patrol to be an efficient staffing mode. The arguments for one-officer patrol have generally assumed manpower conservation within cost constraints; assuming officer safety and effectiveness are not problematic, one-officer patrol is probably justified in this context. However, one study (San Diego: Boydston, Sherry, and Moelter, 1977) did go beyond this, suggesting that unit-for-unit substitution (and the implied manpower decrease implicit in this substitution) is both feasible and desirable.

(11) Does one-officer patrol present a greater danger to officers' safety than two-officer patrol?

We are aware of only two studies which have examined this question, and both studies committed the same basic mistake. In attempting to compare the safety of one-officer and two-officer patrol, researchers in Kansas City (Kansas City Police Department, 1955) and San Diego (Boyd-stun, Sherry, and Moelter, 1977) examined the frequency of injury for one-officer and two-officer units. The comparison statistic used was the number of injuries *per unit* as opposed to the number of injuries *per officer*. If one-officer and two-officer patrol were equally dangerous to an officer, then the number of injuries per two-officer unit would equal twice the number of injuries per one-officer unit; in either staffing mode the number of injuries per officer would be the same (Kaplan, 1979).

However, one can easily correct this error by halving the reported two-officer injury rate. In doing this, we discovered that in both mid-1950s Kansas City and mid-1970s San Diego, the injury rate per officer is *higher* for one-officer patrol. The difference between per officer injury rates for one- and two-officer patrol is not great, however, and in the absence of comparative statistics from other cities, we cannot yet make a judgment on this issue.

(12) Is team policing more efficient/effective than routine patrol?

The topic area of team policing includes a wide range of organizational strategies, not all of which are directly related to patrol. We will only concern ourselves here with the patrol aspects of team policing; results pertaining to other facets of team policing (such as new strategies for criminal investigation) are discussed in another section of this study. Also, a large number of team policing studies have been completed in recent years. To assess all of these would be outside the scope of this project.

Thus, we have chosen a sample of nine representative team policing studies for review and assessment.

The common feature linking most team policing programs is their reliance on the notions of *decentralization* and *generalization*. Thus, the hypothesis underlying team policing is that effective patrol and other services can be provided in an efficient manner via a decentralized (sometimes neighborhood-based) police department consisting of officers who are generalists in the law enforcement field. From our review of team policing studies, it would appear that the validity of this hypothesis remains an unresolved issue.

We have already commented about the preventive patrol aspects of the Crime Control Team in Syracuse (Elliott and Sardino, 1971). While it is true that crime rates went down in the CCT beat, it is difficult to conclude that this was due to the new organizational structure of policing in the experimental area. Indeed, this appears to be the major difficulty in the evaluation of team policing programs in general--there is no clear relationship between the change in police organization implied by team policing and most of the measures of effectiveness chosen for evaluation.

However, in some cases where team policing has been implemented, patrol performance has improved markedly. The Crime Control Team was one example. Crime rates were down over 30 percent in the Los Angeles experimental area following the introduction of team policing (Los Angeles Police Department, 1974). Another example occurred in Bellevue, Washington (Ulberg *et al.*, 1976), where burglary rates decreased by 12.5 percent after the implementation of team policing. Similar results were obtained by the Atlanta Crime Analysis Team's evaluation of the

Atlanta High Impact Program's team policing project (Atlanta Police Department, 1976).

There have been reports of ineffective team policing programs as well. For example, the Dayton, Ohio, team policing program was evaluated (Cordrey and Pence, 1972; Cordrey and Kotecha, 1971), and it was found that on the basis of clearance rates, apprehension rates, and the like, no differences emerged between team policing and routine patrolling. In St. Louis (St. Louis Police Department, 1977), crime rates did decrease, but not significantly so, leaving team policing and regular patrol at nearly equivalent levels of effectiveness.

Finally, in the most in-depth study of team policing to date, Schwartz and Clarren (1977b) determined that crime rates decreased in Cincinnati's team policing area and that more crimes were *reported* to the police (a desired side effect that is, presumably, indicative of a neighborhood's perception of police effectiveness). However, there appears to be the possibility that some displacement of crime occurred. The evaluators concluded that their results ". . . will serve both advocates and opponents of team policing. What one makes of the findings depends on the assumptions and background one brings to them" (Schwartz and Clarren, 1977a).

Again, we have happened upon an issue which has not been resolved by empirical research. It is also true that the credibility of most studies in team policing is low (Gay, Day, and Woodward, 1977). The generic problem of linking organizational changes in police departments to patrol performance has made the evaluation of team policing programs very difficult, *forcing* most evaluations into a state of methodological helplessness in the absence of strict experimental controls as discussed

in Part II. On top of this, there are some studies which have allowed for research designs that would be problematic even with the use of controls. For example, Bloch and Ulberg (1972) caution the reader to "be aware that the project began with a call for volunteers who may be biased in judging the project's success." The authors of the Los Angeles Team's study (Los Angeles Police Department, 1974) went so far as to recommend that ". . . any future team policing experiments not make use of control areas for evaluative purposes, but be contrasted to city-wide data."

Thus, we were simply not able to determine whether team policing is more productive than routine patrol. The conflicting findings and low credibility of the studies involved simply do not permit a definitive answer to the research question posed. This situation is summarized in Table XIII.

(13) Is specialized patrol more efficient/effective than routine patrol?

An organizational structure quite different from team policing is found in those programs which have experimented with specialized patrol. While team policing attempts to promote the notion of a generalist, "Jack-of-all-trades" police officer, specialized patrol strategies avoid the assignment of multiple functions to patrol officers. Terms such as "split force", "directed patrol", and "strike force" have been developed to denote the unique assignments undertaken by these patrol officers.

One concept dating back to the mid-1960s is that of split-force patrol. The idea behind split force is that the productivity of a police department may be improved if the two major activities of patrol--response to calls for service and preventive patrol--are separated. Thus, a split

Table XIII

RESEARCH QUESTION: Is team policing more efficient/effective than routine patrol?

CREDIBILITY

	HIGH	MEDIUM	LOW	TOTAL
YES, HYPOTHESIS CONFIRMED	0	1	4	5
INCONCLUSIVE	0	1	0	1
NO, HYPOTHESIS REJECTED	0	1	2	3
TOTAL	0	3	6	9

force involves the formation of both response-oriented and preventive patrol-oriented subforces within the overall command of the Chief of Police.

A demonstration experiment in split-force patrol was formulated and executed by the Chicago Operations Task Force in 1969. This three-month experiment was designed to ". . . increase the effectiveness of aggressive preventive patrol activities while providing normal police service" (Bottoms *et al.*, 1972). The results obtained indicate that through deferral of non-critical calls, police availability was increased; response time increased on average by 30 seconds (though this was deemed insignificant); and preventive patrol effort was virtually doubled (though there were no discernible changes in crime rates). Thus, though the effectiveness of the patrol appeared to remain the same, the split force did improve patrol efficiency.

In Wilmington, a one-year experiment in split-force patrol reached similar conclusions (Tien, Simon, and Larson, 1976). The Patrol Division of the Wilmington Bureau of Police was divided into two patrol elements: Basic (response-oriented) patrol and Structured (prevention-oriented) patrol. The intention of this city-wide study was "to test the efficacy of the split-force concept. Unlike other more goal-oriented programs, the Wilmington split-force experiment was not required to achieve any pre-specified change in crime, fear, clearance or productivity level--it was solely to test a concept" (Tien, Simon and Larson, 1976). As it happened, the Wilmington split force operated in a more productive manner almost by definition. While patrol effectiveness did not decrease, patrol efficiency did increase. The conclusions of the Wilmington study strongly support the contention that split force patrol is a productive alternative to routine preventive patrol.

Building on the findings of the split-force experiment (i.e., that citizen satisfaction is a function of expectation and that the large majority of all calls for service are not critical in nature), Wilmington conducted a follow-on National Institute of Justice-funded management of demand program. What evolved was a response-oriented strategy which attempted to test the central hypothesis that "alternative response strategies cause an increase in call-for-service response productivity." The program evaluation (conducted by Public Systems Evaluation, Inc.) is completed at this writing and a draft report has been submitted which concludes that the reactive management of demand approach, as tested in Wilmington, causes a significant increase in call-for-service response productivity; results in increased capability to assess demand for police services; and permits an increase in police management effectiveness and flexibility.*

Another experiment in Worcester also lends support to the split-force concept (Tien *et al.*, 1975). Sworn police officers were freed to concentrate on patrol-related strike forces (e.g., robbery and burglary) as *civilian* Police Service Aides took responsibility for answering non-critical calls for service. Crime levels in the impact section of Worcester decreased significantly compared to the city of Worcester as a whole, and no crime displacement effects were detected. Paraprofessionals (students, in this instance) were also employed in the policing of the Claremont Colleges in Los Angeles (Howard, 1977). Uniformed patrol officers were utilized for serious incidents, while the civilian personnel maintained a patrol presence. Though crime was reduced, the possibility of crime

* Cahn, Michael F. and Tien, James M., 1980. An Evaluation Report of An Alternative Approach in Police Response: The Wilmington Management of Demand Program. Cambridge, MA: Public Systems Evaluation, Inc.

displacement was not ruled out. It would appear, however, that the bulk of the evidence reviewed with respect to split-force/civilianization approaches to patrol is supportive of these specialized patrol options.

Programs experimenting with other modes of specialized patrol have met with varying degrees of success. For example, the final evaluation of experimental strike forces in Philadelphia (Reagan *et al.*, 1974) was not able to determine the effectiveness of the project, principally due to the difficulties involved in establishing causal linkages between the strike forces activities and the crime rate. When examining implemented strike forces and other special police units in Michigan, Lewis, Greene, and Edwards (1977) could not detect any changes in crime rates, arrest rates, and clearance rates as a function of the patrol programs. In Montpelier, Vermont, a nine-month study of directed patrol yielded inconclusive results (Franks, 1980). Though Part I crime decreased in the target area by 23 percent, the city-wide crime decrease was 37 percent.

From this quick review of selected research in specialized patrol, it is apparent that organizational changes can be made in police departments and that some of these changes may be expected to improve the delivery of patrol services. Split patrol and the use of civilians in patrol work are two examples of successful patrol specialization. However, it would be naive to expect that *any* organizational change will impact positively on patrol performance. Designing the organizational structure of patrol forces in a manner which will maximize the usefulness of patrol is a challenge to both police researchers and administrators. The results from research in specialized patrol do offer a few pointers as to what may or may not be efficient/effective blueprints for the organization of patrol personnel.

(14) Are women as efficient/effective on patrol as men?

Police work has long been dominated by men. As of 1970, less than one percent of American police personnel were women, and these were primarily employed in traditional women's jobs (e.g., secretarial support) (Milton, 1978). However, with the 1972 amendment of Title VII of the Civil Rights Act, it became unlawful to deny women employment as patrol officers solely on the basis of their sex. Hence, police officials were faced with another unanswered question: Can women perform all patrol functions as well as men?

In an attempt to answer this question, Urban Institute researchers conducted a one-year experimental study in Washington, D.C. According to Policewomen on Patrol: Final Report (Bloch and Anderson, 1974), 86 "new women" and 86 "comparison men" were hired by the Metropolitan D.C. Police Department. These men and women were statistically compared using a variety of patrol-oriented performance measures. The researchers concluded that "the men and women studied. . .performed patrol work in a generally similar manner. They responded to similar types of calls for police service while on patrol and encountered similar proportions of citizens who were dangerous, upset, drunk or violent. . . .There were no reported incidents which cast serious doubt on the ability of women to perform patrol work satisfactorily. . ." (Bloch and Anderson, 1974).

An earlier study in New York City examined the performance of 41 statistically-matched pairs of male and female patrol officers over a seven-month period. Using measures such as type of incident serviced, type of action instigated by officer (e.g., use of force), and citizens' reactions to police services, it was determined that no differences existed between the sexes with respect to patrol performance (Sichel *et al.*, 1978).

Similar results were obtained by Kizziah and Morris (1977) in Newton, Massachusetts. Here, the performance of 12 female and 23 male patrol officers was studied using multiple measures. After four months of observation, no differences in performance were found, a result consistent with other women-on-patrol studies.

The conclusions of these three studies support the contention that women can perform as well as men on patrol. Though each of the studies mentioned suffers from the usual methodological problems associated with experimental design, we have not been able to determine "fatal flaws" which could completely negate the reported findings. Thus, we would agree that based on the evidence that exists, women are as efficient/effective on patrol as men.

This review of completed research in police patrol has perhaps raised more questions than it has been able to answer. There have been substantive agreements in a few research areas, but by and large, conflicting results and unresolved issues abound. The technical quality of the vast majority of research projects reviewed has been disappointingly low. This only serves to aggravate the lack of substantive consensus in patrol research.

In the next two parts of this report, we will attempt to sort out the information that has been gathered in this section. We turn our attention to research methodology in Part V, and attempt to synthesize the common problems experienced in research design and conduct. In Part VI, we will try to specify both the new knowledge we have acquired as a result of patrol research, and the gaps in our knowledge which remain to be filled.

V SYNTHESIZED METHODOLOGICAL FINDINGS

From our review of research in the field of police patrol, one fact has become obvious: many studies examined exhibit low technical quality. Inappropriate methods were used in some cases, while reasonable techniques were poorly applied in other instances. Since conclusions regarding the effectiveness of alternative patrol strategies are reached through such analysis, the credibility of these studies becomes questionable. Indeed, the "findings/credibility" matrices of Part IV reflect this state of affairs.

We are not the first to have noticed the technical shortcomings of patrol research studies. For example, consider the National Evaluation Project (NEP) patrol reports. The Team Policing NEP rated studies from "low reliability" to "high reliability" on the basis of data sources. Of 56 data sources, only four were rated to be highly reliable. With respect to the large number of studies rated low, the authors of the NEP state:

Most of the reports were rated as low primarily because of inadequate research designs which made it difficult to determine if the reported effects could be attributed to the team policing program evaluated. (Gay, Day, and Woodward, 1977, p. 4)

The NEP volume on specialized patrol also found problems with contemporary patrol research. When attempting to assess the merits of specialized patrol via a review of existing program evaluations, the NEP researchers state:

Serious flaws in the evaluation designs hindered any definitive conclusions. The most serious flaws were:

- Failure to use an adequate comparison group
- Failure to control for historical changes in project operation
- Failure to account for the effects of units other than the specialized patrol on target crimes
- Inadequate study of displacement.

(Webb *et al.*, 1977, p. 11)

In the introduction to the NEP volume on traditional preventive patrol, it is made clear that "... knowledge about patrol is incomplete in many respects and frequently of dubious quality" (Schell *et al.*, 1976, p. 5).

Indeed, the Mathematica review of policy-related research in policing labeled "Improper Study Design and Analytic Methods" as a major barrier to validity. With respect to actual data analysis, the Mathematica team stated that ". . . the main theme appears to be the misuse of statistical procedures . . . Where the techniques are discernible, what is discerned is often faulty . . . Inference, which is the step logically following from analysis, is thereby rendered invalid" (Gass and Dawson, 1974, p. 21). Several examples of flawed methodology are discussed in the Mathematica report.

These methodological problems cannot be ignored. We feel that a decision maker could be much worse off relying on an invalid piece of research than s/he would be if left "uninformed". Though not intentionally so, poorly designed research can mislead decision makers, resulting in potentially serious misallocations of scarce resources.

Several of the studies reviewed in Part IV qualify as poorly designed and/or executed pieces of research. Though we fully intend to discuss the generic difficulties associated with patrol research, a detailed example

illustrating the research problems we have alluded to above would be most useful. Such an example will now be presented.

5.1 A CRITIQUE OF THE KANSAS CITY RESPONSE TIME ANALYSIS (Kansas City Police Department, 1977; 1979)

The LEAA-funded study of response time in Kansas City was conceived as an investigation into the traditional assumptions governing police response time. The two stated objectives of this study read as follows:

- (1) Analysis of the relationship of response time to the outcome of arrest, witness availability, citizen satisfaction with response time, and the frequency of citizens' injuries received in connection with crime and noncrime incidents.
- (2) Identification of problems and patterns in reporting crime and requesting police assistance.

(Kansas City Police Department, Executive Summary, 1977, p. 1)

The initial data base for this study consisted of 949 Part I crimes which occurred in 56 of 207 Kansas City "beat-watches"** between March 1975 and January 1976. An additional 359 Part II crimes occurring over the same time period in the same beat-watches were also analyzed. In a lengthy statistical analysis, the components of response time (citizen reporting time, dispatch delay time, and travel time) were related to both intermediate factors (e.g., travel distance) and outcomes (e.g., arrest) via linear regression models (Kansas City Police Department, Analysis, 1977; 1979). Based on this analysis, the Kansas City researchers reached the following conclusions:

* A "beat-watch" is defined as an eight-hour tour within a fixed geographical beat.

First, although some patrol strategies affect police response time, a large proportion of Part I crimes are not susceptible to the impact of rapid police response. Secondly, for that proportion of crimes that can be influenced by response time, the time taken to report the incident largely predetermines the effect of police response time. Thirdly, the factors which produce reporting delays are primarily citizens' attitudes and voluntary actions rather than uncontrollable problems they encounter. Fourthly, if reporting time is not so long as to hamper police efforts, prompt field response has significant impact on crime outcomes in general. (Kansas City Police Department, Executive Summary, 1979, p. 23)

The authors of the Kansas City reports elicited several decision implications from their work, one of which states, "Because of the time citizens take to report crimes, the application of technological innovations and human resources to reduce police response time will have negligible impact on crime outcomes" (Kansas City Police Department, Executive Summary, 1977, p. 25). This is a strong statement, rooted in what appears at first glance to be solid research. However, based upon our technical review of the methodology employed by the Response Time Analysis, we question the validity of the stated policy-relevant conclusions of this study on several grounds.

(1) Small Sample Size

It must be noted that the majority of the analysis performed examined subsets of the crimes in the data base. Indeed, several of the analyses (particularly those of Part II crime in Volume III of the Response Time Analysis report) suffer from an exceedingly small sample size with which the researchers are trying to draw out strong conclusions. In Volume III, this is acknowledged at the end of the analysis section (on page 23), where it is written:

Finally, because of the small sample size of the variables analyzed, caution should be taken in interpretation of results.

However, no such acknowledgement is found in the implications section of the Executive Summary.

As one indication of small sample size, Table 3.1 on page 35 of Volume III indicates an N of 134 for involvement-type crimes in which response time may be a factor. Here the number of response-related arrests is 11 out of 134--only 8.2 percent of the total. Yet the authors try to draw major conclusions from such small numbers. Here the Kansas City researchers state:

Although the small N size presents a methodological weakness, analysis has still been conducted to obtain whatever value cautious interpretation might provide. (Kansas City Police Department, 1979, p. 34)

There is reason to be concerned with the representativeness of these results given the small samples utilized.

(2) Self-Reporting of Response Time Data

The Kansas City researchers criticize others who rely on self-reporting of response times:

. . . self-reporting sometimes relied upon individual estimates of times, which can be confused by memory and recall or factors of stress. (Kansas City Police Department, Methodology, 1977, p. 8)

Yet, the authors of the Kansas City reports themselves base the dominant contribution of their research, namely, the time until an incident is reported to the police by the citizen, on self-reporting.

Out of necessity, the time interval from crime occurrence to telephoning the police must be obtained from a victim or a witness, and measurement of this interval is reliant on the citizen's perception of time. (Kansas City Police Department, Methodology, 1977, p. 4)

It appears that there is a logical inconsistency here. This is compounded by the following reference to Isaacs' study (The Institute for Defense Analysis, 1967, pp. 88-106).

The results of Isaacs' study were limited by its self-reported database which did not allow for analysis of time intervals by second and a sample bias towards in-progress calls . . . (Kansas City Police Department, Methodology, 1977, p. 8)

If the limitations of self-reporting are severe enough to affect the results of the Isaacs study, then surely these same limitations apply to the self-reported data compiled by the Kansas City research team.

(3) Causation I: The Determinants of Travel Time

The authors of the Kansas City reports appear to have spent considerable amounts of time, money, and effort deriving known results. For example, Chapter 9 of Volume III presents the following hypothesis:

Obviously, the distance which must be travelled to the scene of the crime could be expected to affect the time taken to get there. Therefore, any dispatching or patrol procedures affecting distance could be expected to exert an influence over travel time. (Kansas City Police Department, 1979, p. 86)

Then, in a remarkable regression analysis of the *logarithm* of travel time versus 18 "explanatory" variables with a sample size of 154 calls--8.6 calls per variable on average (Kansas City Police Department, 1979, p. 193)--the authors "discover" that travel distance is the major factor influencing travel time.

As was expected, the distance that had to be traveled to reach the incident scene strongly affected travel time, with greater distances producing longer delays in arriving. (Kansas City Police Department, 1979, pp. 88-9)

This analysis was carried out apparently without awareness of numerous response time models that predict the type of relationships between response time and response distance or of the Rand researchers' studies of this same issue for fire departments. The need for cross-fertilization across artificially drawn research boundaries is apparent.

(4) Causation II: Citizen Satisfaction with Response Time

In Chapter 9 of Volume II (Kansas City Police Department, Analysis, 1977, p. 120), a system of regression models was proposed to determine the effects of various factors on citizen satisfaction with response time. The five equations analyzed were:

$$TT = a + b_1 TOC + e \quad (1)$$

$$DT = a + b_2 TOC + e \quad (2)$$

$$IRT = a + b_3 SC + b_4 TOC + b_5 TT + b_6 DT + e \quad (3)$$

$$(P-E)/E = a + b_7 SC + b_8 TOC + b_9 TT + b_{10} DT + b_{11} IRT + e \quad (4)$$

$$CS = a + b_{12} SC + b_{13} TOC + b_{14} TT + b_{15} DT + b_{16} IRT + b_{17} (P-E)/E + e \quad (5)$$

where: SC = Social characteristics of the involved citizen

TOC = Type of crime

TT = Travel time

DT = Dispatch time

IRT = Importance of response time

(P-E)/E = Perceptions and expectations index

CS = Citizen satisfaction

a's, b's = constants to be estimated

e's = residual variation

According to the report:

This model was analyzed through successive multiple regression analysis of each equation listed above. By examining the path coefficients [b's], it was possible to obtain the total effect that an independent variable had on citizen satisfaction by examining both its direct effects and its indirect effects through other variables. (Kansas City Police Department, Analysis, 1977, p. 120)

The "model" that is presented here has some peculiar implications.

Suppose that equations (1) through (5) are true. It is a simple algebraic exercise to show via the substitution of equations (1) through (4) into equation (5) that the following result is also true:

$$CS = A + B \cdot TOC + C \cdot SC + e \quad (6)$$

where A, B, and C are constants, ϵ is a random error term, and CS, TOC, and SC are defined previously. Equation (6) states that citizen satisfaction with response time is determined solely by the type of crime committed, the social characteristics of the involved citizen, and random fluctuations. Somehow, this result is troublesome. The *best* result that could be produced by this model is one that dictates police ineffectiveness. If the proposed model is true, all attempts by the police to increase the level of citizen satisfaction with response time are doomed to fail.

Intuitively, one senses that citizen satisfaction with response time should be a monotonically decreasing function of response time. A model exhibiting this behavior could provide a useful framework for analysis. While the model depicted by equations (1)-(5) does include some of the factors which may be thought of as affecting citizen satisfaction with response time, the way these factors are related in that model is neither useful nor meaningful.

There are other problems associated with this study which are more than technical. For example, the revelation that reporting delays are large is, in fact, not a revelation at all. One only has to consult the literature on emergency medical services to realize that the median time between onset of heart attack symptoms and contacting an EMS is 3.5 hours. This has caused many in the EMS field to argue for improved citizen education, although it is not education itself which is to blame. The same 3.5 hour median delay is also found among a special subset of the population: physicians. The delay seems to be caused by a denial syndrome rather than lack of knowledge of what the symptoms mean. However, this has not caused people in the EMS field to argue against deploying ambulances to

have efficient, effective, and rapid response. It has caused them to argue for both citizen education regarding the denial syndrome and for rapid response, because when both are solved, the probability of survival and full recovery is maximized.

The claim that the Kansas City study was the first to examine reporting time is also false. Elliott collected data pertaining to reporting time in Syracuse from a sample of 2,200 crimes (Elliott, 1973, pp. 10-12). Noting that 30 percent of all crimes were reported to the police within 10 minutes of crime occurrence and that 25 percent of all crimes were reported within two minutes of crime occurrence, Elliott concluded that a significant fraction of crimes could be apprehended by the police. The reliability of Elliott's data is comparable to the Kansas City sample, as both relied on self-reporting of incident times. Thus, there is no reason to reject Elliott's work based on the quality of his data. In fact, it is interesting to note that the Kansas City data is more optimistic than the Syracuse figures in that over 60 percent of all calls experienced reporting times less than 10 minutes in length, yet the interpretation of these data by the Kansas City researchers is pessimistic.

One recurring inconsistency concerns the potential usefulness of Computer-Aided Dispatch (CAD) systems. In the Executive Summary, the researchers state:

Other innovations which rely to varying degrees upon the assumed importance of rapid response have resulted in software 'queueing' programs, construction of computer-simulated beat configurations, installation of computer-aided dispatching equipment and design implementation of automated vehicle location systems. *It is not the potential benefits of such innovations which are in question, but their relative effectiveness, given citizen delays in crime reporting.*

(Kansas City Police Department, Executive Summary, 1977, p. 26)

While the authors argue against the software queueing programs and CAD systems, they argue for selected stacking and prioritization of anticipated delay in response:

. . . providing the expected time of officer arrival, based on the availability of officers, the type of incident reported, how quickly it was reported, etc., might be an important consideration in maintaining citizen satisfaction with response time. (Kansas City Police Department, 1979, p. 8)

It is the software queueing programs that the authors criticize that provide this feedback via an intelligent CAD system! Somehow, the authors of the Kansas City reports have been led to believe that *all* queueing software and *all* CAD software are geared towards the minimization of response time over all types of calls. This is clearly not the case, as prioritization is a normal procedure in almost all CAD systems we have observed.

The decision implication reflecting the researchers' views that "the application of technological innovations and human resources to reduce response time will have negligible impact on crime outcomes" mentioned earlier is indicative of an anti-technology bias. This major policy implication is based on, as we have seen, *very* questionable analysis. The researchers' assertion is not only misleading, it is blatantly untrue for victim-triggered robbery alarms and intrusion detection burglary alarms.* Taken at face value, this recommendation could lead to very poor decisions.

What we have tried to show is that one cannot merely accept the message of a research document based on a perusal of the Executive Summary

* Limited evidence (See, for example, The Institute for Defense Analyses, 1967, p. 99) suggests that arrest probability when responding to a victim-triggered or suspect-triggered alarm is roughly 30 percent (this figure excludes false alarms).

or Findings and Conclusions. All research results are based on analysis of some sort, and in the field of police patrol, most of the analysis we have reviewed has been weak. This is why we have assigned the label "low credibility" to so many studies.

There have been several generic methodological problems experienced by patrol researchers. We will now discuss the major difficulties, providing examples where necessary.

5.2 THEORY AND PROCEDURE IN PATROL RESEARCH

Initially, it is useful to distinguish between two classes of methodological error in patrol research. The first class of errors we will label "procedural". The second class consists of errors that are more "conceptual" in nature.

Procedural errors refer to flaws that arise during the mechanics of analysis. Improper data aggregation, algebraic errors, and computational miscalculations may all be viewed as procedural problems. Procedural errors may be committed within the framework of a research design which is in itself technically sound, and some of these errors, if detected, can be corrected without too much difficulty. It is our guess (and hope) that these errors do not occur in isolation with sufficient frequency to warrant further attention.

Those errors we have termed as conceptual comprise a more serious group of technical problems. Conceptual errors may arise from the researcher's incorrect perception of the process by which the *inputs* to a patrol strategy (e.g., number of officers, number of units) are transformed into the *outcomes* of a patrol strategy (e.g., level of deterrent effect), and from the researcher's insertion of this process into a

methodological framework for purposes of analysis. In short, conceptual errors result when the relationship linking patrol inputs to patrol outputs is not well structured by the researcher.

One implication of this lack of theory concerns the anticipated outcomes of research studies. According to Nobel Laureate Peter Medawar:

No experiment should be undertaken without a clear pre-conception of the forms its results might take; for unless a hypothesis restricts the total number of possible happenings or conjunctions of events in the universe, the experiment will yield no information whatever. If a hypothesis is totally permissive - if it is such that anything goes - then we are none the wiser. A totally permissive hypothesis says nothing. (Medawar, 1979, p. 72)

Problems with theory in patrol research are sufficiently basic to affect the formulation of research hypotheses. An ill-conceived hypothesis can cause all kinds of trouble, including the selection of meaningless performance measures, the collection of irrelevant data, and the application of poor analytical techniques (or unnecessary application of sophisticated methods). In our discussion of one-officer versus two-officer patrol in Part IV, we noted that the hypothesis:

If one-officer and two-officer patrol cars are equally safe, then the number of injuries resulting from one-officer patrol units should equal the number of injuries resulting from two-officer patrol units

led to the specification of injuries per unit (as opposed to injuries per officer) as the key performance measure. This error in turn led to the data analysis which acted to refute the hypothesis in question. Luckily, this example was easy to correct, and luckier still, the correct result does not differ sharply enough from the incorrect result to affect policy significance. However, it should be obvious that this will not always be the case.

The most serious *design* problem facing patrol researchers rests with the formation of equivalent control and experimental groups. If one is to rely on the experimental framework outlined in Part II, then the formation and maintenance of control groups is critical. This step in the experimental methodology is essentially intended to reduce the number of explanatory factors for a particular outcome from infinity to two: chance and the experimental treatment. As we have seen, the rigidity required for this methodology is most often not obtainable in patrol settings. Thus, patrol research which relies in total upon this particular methodology is not likely to produce credible results.

In considering the relationship between theory and procedure in patrol research, it appears that the major methodological difficulties are of a self-perpetuating nature. The general cycle of knowledge accumulation in science is such that theory begets research which begets more theory, and so on. However, existing patrol theory is often insufficiently specified for research purposes, while current patrol research methodology is not entirely capable of generating new theory.

If the issues pursued by patrol research were not considered to be of great importance, there would be little reason to express our concern with research methodology. As Medawar writes:

It has been well said that if an experiment is not worth doing, it is not worth doing well. (Medawar, 1979, p. 75)

Yet the problems addressed by patrol research are important, so we must attempt to improve the technical standards of research methodology. Otherwise, we will be forced to remain satisfied with studies which tenuously extract major policy implications from demonstrably unsound analysis.

What is to be done? Initially, we may pose two views. On the one hand, due to lack of theory, one could continue to experiment but strive to implement the *most rigorous* designs possible. This approach could lead to more definitive research results but would involve spending enormous sums of money. On the other hand, one could attempt to further develop patrol theory before embarking on major empirical voyages. For example, patrol problems are set in a spatial perspective, hence there are certain physical relationships which must be understood in order to effectively design a patrol study. Most patrol studies have failed to take these relationships into account, allowing for the possibility that impacts due to experimental modes of police patrol are overshadowed by physical phenomena. In such cases (patrol "intensity" and response time studies are good examples), the effect of the experimental patrol mode will be hidden. If, however, the implications of these spatial relationships could be anticipated *a priori*, then one could weed out their effect on postulated outcomes. In order to understand the nature of such relationships, one must build a body of relevant theory. For the "spatial physics" example discussed here, such theory exists (see Larson, 1972b), but for other patrol problems, we are still very much in the dark.

What we have encountered with respect to patrol research methodology is disappointing. The problems we have discussed here obviously qualify the substantive results of research efforts. It is to these substantive results that our attention now turns.

VI SYNTHESIZED SUBSTANTIVE FINDINGS

Our discussion of patrol research methodology has placed obvious limitations on the strength of *any* substantive conclusions we might wish to infer from our review of patrol studies. However, in a number of instances, a consensus of results has been reached by researchers, and we feel that such occurrences are useful to report. Similarly, it is equally as important to present those research questions which have been asked but not answered. In this section, we will present the substantive findings from our review of Part IV, beginning again with issues of police preventive patrol

6.1 FINDINGS FROM PREVENTIVE PATROL STUDIES

Research studies of preventive patrol have collectively produced inconclusive results. There are no definitive studies that have been able to clearly depict the presence (or absence) of a relationship between police patrol and crime deterrence. According to the authors of the preventive patrol NEP:

Most of what is commonly called 'knowledge' about traditional preventive patrol is, in fact, opinion based primarily on experiential evidence. The gaps in knowledge are pervasive and, as a result, few definitive statements can be made about the impact of alternative approaches to patrol upon the ability of departments to realize the goals of patrol. (Schell, Overly, Schack, and Stabile, 1976, p. 77)

This state of inconclusiveness holds for hypotheses postulating the crime-deterrent effectiveness of both motorized patrol and foot patrol.

However, there is a difference between motorized and foot patrol when citizen satisfaction is the issue at stake. The research results were ambiguous with respect to citizen satisfaction with motorized patrol, while citizens were apparently quite satisfied with foot patrol. In "Police Patrol - Some Future Directions", Kelling and Fogel present some clues as to why this situation exists:

Community alienation is perceived by the police as a serious problem The basic problem remains because it makes little difference what plans are developed for a beat or district between sergeants and officers, since the patrol officer immediately comes under the control of the dispatcher as soon as he enters the patrol car and turns on his radio. . . . we suggest that available evidence supports a view that the critical issue for police today is how to overcome the alienation of well-intended police strategies which have had the unintended consequence of alienating citizens. (Kelling and Fogel, 1978, pp. 167-8, 177)

These writers feel that motorized patrol has detached police officers from their community and present foot patrol as one alternative strategy which would not suffer from this problem.

The one topic of preventive patrol which produced directly comparable research results concerns the interception capabilities of motorized patrol units. In estimating the probability of a space-time coincidence of a randomly occurring crime and a randomly patrolling police car, several researchers developed similar models. The estimates of interception probabilities produced by these models compared favorably with empirical figures. All of these models point to the finding that even under optimal allocations of preventive patrol effort, the likelihood of intercepting a crime in progress will not exceed 5 percent. Since actual apprehension probabilities are in fact lower than these estimated interception

probabilities, the effectiveness of preventive patrol as a strategy for apprehending offenders is very low indeed.

It would seem that the most visible knowledge gap in preventive patrol research centers around the relationship among patrol levels and tactics and crime rates. This is clearly a topic which requires *very* careful research. While our review of completed studies has not proved conclusive, we are hopeful that current research will help to answer many of our questions regarding the effectiveness of preventive patrol.

6.2 FINDINGS FROM RESPONSE TIME STUDIES

Research examining issues of response time has generated some interesting results. In particular, the notion that for a typical call for service citizen satisfaction with the police is largely dependent upon police response time has essentially been disproven. Rather, it has been shown that the *difference* between experienced and anticipated response time is a major determinant of citizen satisfaction. According to this result, police should provide citizens with realistic estimates of the amount of time it will take before a police unit can arrive on-scene. Feasible methods for deriving these estimates are available; their use in conjunction with Computer-Aided Dispatch (CAD) systems is discussed in a recent PSE report (Colton, Brandeau, and Tien, 1980).

The major interest in police response time stems from the postulated relationship between rapid response and the likelihood of apprehending offenders on-scene. Again, different researchers presented conflicting results. It is our feeling that, on the whole, the studies demonstrating an inverse relationship between response time and apprehension probability are more credible than the studies demonstrating the absence of such a relationship. However, no study has successfully eliminated the

"chicken-or-egg" problem discussed earlier in which officers are likely to self-select for high-speed response those incidents judged likely to yield an on-scene arrest.

Limited research has been undertaken with respect to the ability of AVM systems to reduce response time. It was discovered that the closest-car information provided by AVM resulted in minimal reductions in response time. Thus, current empirical evidence suggests that the effectiveness of AVM in reducing response time is low. However, as discussed earlier, the empirical evidence is derived from AVM systems having serious technological and human factor problems.

The important issue to be resolved is whether or not response time and apprehension probability are causally related. A controlled experiment is not really feasible due to the high stakes involved (e.g., a mandatory slow response to an in-progress bank robbery), but well thought out quasi-experiments are possible. For example, data related to calls generated *solely* by victim-triggered robbery alarms would eradicate the "chicken-or-egg" effect mentioned in Part IV, as all officers in this sample would have sure knowledge that apprehension is possible. Using analysis similar to that employed by Clawson and Chang (1977), it could be determined if rapid response time influences arrest probabilities. Certainly, intuition would argue strongly that it does.

6.3 FINDINGS FROM STUDIES OF ALTERNATIVE ORGANIZATIONAL AND MANPOWER ALLOCATION SCHEMES

Under the heading of alternative organizational and manpower allocation schemes we reviewed studies of one- versus two-officer patrol, split-force, women on patrol, team policing, and a recently completed management of demand program. With respect to the issue of one- versus two-officer

patrol staffing, we concluded that both theoretical and empirical results favor the notion that one-officer patrol is more efficient than two-officer patrol. However, there remains the unanswered issue of officer safety. Reanalysis of injury statistics for two studies yielded "no difference" between one- and two-officer units, but the small sample sizes involved do not permit generalization of this finding.

The split-force and management of demand concepts were shown to be productive alternatives to routine patrol. While separation of the preventive patrol and call-for-service response functions and implementation of alternative response strategies have minimal impact on crime, they are much more efficient strategies than traditional patrol. The use of civilian para-professionals was also shown to increase the efficiency of the police, as sworn police officers were more often free to answer critical calls for service. Thus, the split-force/management of demand/civilianization approaches to policing offer alternatives which are no less effective, and more efficient, than routine patrol.

Several of the reports we reviewed were studies of team policing programs. As mentioned in our methodological findings, these studies encountered a good deal of difficulty in their attempt to determine the effectiveness of team policing. It should come as no surprise that the collective findings of team policing studies are inconclusive. Some studies claim improvements in patrol performance through team policing, while other studies detect no difference between the performance of team policing and routine patrol.

Finally, three reports compared the performance of female patrol officers to male patrol officers in an attempt to determine whether or

not women are as effective on patrol as men. None of the studies found significant differences between the police-related performances of male and female officers. Thus, it would appear that women may be utilized as patrol officers without sacrificing the quality of police patrol.

This section has summarized the substantive findings of our review of police patrol studies. Given what we now know about the state of patrol research, we wish to propose a number of recommendations for future research.

VII RECOMMENDATIONS

Having examined the findings and quality of a large body of patrol research, we are in a position to suggest topics for inclusion in future patrol research agendas. We do not shoulder this task lightly, as the recommendations of earlier research syntheses in police patrol appear to have had substantial impact. Consider the following partial list of previous research recommendations:

- Undertake studies in large police departments of crimes, arrests, and operations (The Institute for Defense Analyses, 1967)
- Establish a single, uniform police telephone number (The Institute for Defense Analyses, 1967)
- Undertake experiments to improve statistical procedures for manpower allocation (The Institute for Defense Analyses, 1967)
- Support operations research staffs in large criminal justice agencies (The Institute for Defense Analyses, 1967)
- Support scientific and technological research through a research institute (The Institute for Defense Analyses, 1967)
- Experiment with team policing combining patrol and investigative duties (President's Commission on Law Enforcement and Administration of Justice, Police Task Force, 1967)
- Examine the relative merits of one- vs. two-officer patrol units (Schell *et al.*, 1976)
- Develop time-dependent and location-dependent patrol manpower allocation schemes (National Advisory Commission on Criminal Justice Standards and Goals, 1973)
- Research the concept of productivity in a law enforcement context (Gass and Dawson, 1974)
- Research the relationship between response time and arrest and clearance rates, and crime levels (Gass and Dawson, 1974)

Though we do not claim that all research in the topics mentioned above stemmed from these recommendations, it is true that all of the recommendations listed have been acted upon. It is our hope that the recommendations we will now present may also be acted upon in the future.

Public sector research is often driven by larger societal forces which change the environment in which public institutions function. The research often seeks to find an accommodation between the current functioning of public institutions and desired behavior as reflected by the new social conditions. Projecting recent trends into the decade of the 1980s, one could reasonably conjecture the following:

- (1) A continuation and broadening of severe fiscal constraints that will limit the growth and in some instances force diminution of municipal service agencies. (A significant number of urban police departments have already experienced sharp cutbacks in personnel.)
- (2) Increasing pressures for accountability in public institutions, with the public interested in performance and productivity.
- (3) At best, a maintenance of the current crime levels. More likely, a continued growth in the numbers and types of services that police are called upon by citizens to deliver. (Many of these services are not related directly to crime or to the sworn status of the police officer.)

These conflicting trends, if true, would seem to create an impossible situation in which a constant or reduced level of police resources is asked to provide more services, by number and by type.

In addressing police research needs of the 1980s, we feel that obtaining workable solutions to the above dilemma would be one worthwhile research

goal. Obviously, there are other goals as well, including the direct building on the impressive body of research that has occurred substantially over the decade of the 1970s.

In seeking workable police strategies in an atmosphere of austerity, the research of the 1970s suggest some solutions to test:

- (1) Rapid police response time is not important for the majority of calls for police service. Citizens are willing to experience delays in response if they feel that the call is non-urgent and if they are advised of the anticipated delay. Deliberately delaying lower priority calls will result in a higher level of police availability when an urgent call is reported, thereby creating a lowering in response times for the small fraction of calls that really require rapid response.
- (2) A significant fraction of calls for service do not require a sworn officer at the scene. Many callers can be (i) correctly advised that their call is not a police matter; or (ii) serviced over the phone (e.g., a police-related information request or reporting a minor property crime); or (iii) referred to another more appropriate public agency; or (iv) serviced at the scene by non-sworn personnel ("civilians"). Thus, the new telephone strategy of *screening*, *on-phone servicing*, *referral*, or *civilian dispatch* can help alleviate the problem of growing demands for service.
- (3) Police patrol commanders have great flexibility in spatially deploying a fixed number of field units over a fixed area. Given the relatively low productivity of routine preventive patrol that is associated with fixed beat designs having "one car for one beat," there would seem to be strong arguments

favoring a more proactive problem-directed (often crime-directed) patrol. To alleviate the problem that many patrol officers treat preventive patrol periods as "rest breaks between calls for services", effective implementation of more flexible and more fluid patrol deployments might entail a *split-force* concept (with some units specializing in calls for service and others in direct patrol); these assignments could be rotated periodically.

- (4) There is no evidence suggesting that police departments will become less labor intensive in the 1980s. Various technologies represent potential means for improving service levels without adding to labor costs. But several early police experiences with technology have been disappointing: CAD systems that automated procedures that had been standard since the 1930s (in effect representing little more than electronic conveyor belts) or AVM systems whose information was of poor quality and/or not utilized by police decision makers. Yet increasingly sophisticated management of police demands and police resources requires better and more timely management-oriented data and computer-implemented ways for processing the data; the police emergency response system will require technologies suited to more complex real time decision making.
- (5) As exemplified by the split-force and civilianization approaches, during the past decade there has been a greater emphasis on productivity-oriented approaches to meeting the

demand for police services. The recent management of demand program discussed above was based on the premise that a police demand pattern can be managed *reactively* so that a more optimal supply pattern could be achieved. Traditionally, demand for police services has been a given, while the corresponding supply is somehow allocated to meet the given demand. In addition to causing a significant increase in response-related productivity, the management of demand program suggests that the approach is worthy of evaluation and further testing by other police departments; and that a *proactive* management of demand program (i.e., which seeks to change the underlying demand pattern through strategies which affect service availability or mitigate potential demand) has the potential to bring about even greater productivity improvement, and deserves testing.

Police field services research for the next decade could potentially be structured around a conjectured model (such as the one outlined above) of an efficient, effective and socially just police department operating in a fiscally restrained environment. Each of the items (1) through (4) above represents conjectures arising from earlier research and implementation experiences that should be tested in a new research environment. One striking feature of these conjectures is their interconnectedness. It would seem beneficial to test them all simultaneously in one or more *urban police laboratories* rather than to test one item at a time in each of several cities. This would provide an opportunity for synergism that is not available in an incrementalist ("try one thing at a time") approach.

If police field services research for the 1980s is to be driven by overriding societal concerns, seeking to find "better" ways of doing things within a new environment, then research designs will of necessity have to become more action-oriented. The popular null hypothesis approach to research usually takes a conservative stance: H_0 : (the innovation will result in no change.) Then, within limited research resources, one is forced to disprove this hypothesis in order to argue for the change. A preferred way of structuring research would be to try and avoid biasing in favor of any hypothesis, but rather to develop a stance that a priori fairly reflects one's current knowledge about each possible alternative hypothesis. Then the research can be geared toward updating and firming one's initial information profile in hopes of finding that hypothesis that is most likely to hold up under continued testing. Hopefully the surviving hypothesis has implied action consequences that will assist and guide police administrators, at least until more definitive research findings are available.

Finally, one complaint about previous research is that a progressive, innovative, well-staffed department is the one willing and eager to do the research. For instance, Clarence Kelly--when he headed the Kansas City police department--was in large part responsible for the impressive set of studies done in that department (both during his tenure and, as a result of his tradition, after as well). However, the selection process in the past could be said to have suffered from a form of selection bias that precluded the results being useful to more typical departments (e.g., those having strong police unions or high calls-for-service workloads or other similar problems). If police field services research in the 1980s is to have external validity (i.e., be generalizable across a wide range

of police departments), then the "urban laboratories" that are established should be representative of United States sample police departments.

The entire criminal justice enterprise could only benefit from such a representative network of research centers.

APPENDIX A

ANNOTATED BIBLIOGRAPHY

Atlanta Police Department, 1976. Atlanta High Impact Program Project Evaluation, April 1, 1975 - September 30, 1975: Model Cities Crime Control Team. Atlanta: Atlanta Crime Analysis Team, Atlanta Police Department.

This interim report presents an analysis of six months of data from the Atlanta Model Cities Crime Control Team Program. The primary goals of this project were to reduce the incidence of stranger-to-stranger crimes, and to reduce the amount of community fear in the target area. Total stranger-to-stranger crime decreased by 20 percent over the six-month evaluation period. As of the time of publication, no information was available regarding citizen fear. This report does not describe the workings of the Model Cities Crime Control Team; rather, the main body of the report illustrates data analysis techniques to be applied throughout the evaluation of the team policing program.

†Bloch, P. and Anderson, D., 1974. Policewomen on Patrol; Final Report. Washington, D.C.: Police Foundation.

This report evaluates the Washington, D.C. Women on Patrol program. Over the course of one year, the performance of 86 female officers was compared to that of 86 "comparison men." Overall, the women and men were quite comparable, though some questions can be raised regarding the practice of assigning women to light duty more frequently than men. With the exception of number of arrests and traffic citations, women and men performed equally as patrol officers.

Bloch, P. and Ulberg, C., 1972. "The Beat Commander Concept." The Police Chief, September, pp. 55-63.

This article presents some results from a team policing program in Detroit. Under the "Beat Commander" system, a group of officers is assigned to a particular neighborhood under the command of the beat sergeant. Though the program did not seem to reduce crime levels, the team appeared to perform favorably in other regards. For example, a higher percentage of team arrests resulted in court cases when compared to the remainder of the police precinct. Response times were also lower in the team area over the 14-month experimental period. The authors conclude that the team policing system appeared to benefit the police and the community.

NB: Abstracts for studies marked with an asterisk (*) are modified National Criminal Justice Reference Service (NCJRS) abstracts.

Studies marked with a dagger (+) are previous summary studies.

Studies marked with a double dagger (‡) are major research efforts.

Bottoms, A., 1971. Police Tactics Against Robbery. Monument Beach, MA.

This study attempts to demonstrate that coordinated police "pounce" tactics are feasible, require a minimum of specialized training, and do not require many resources. Indications are that these concentrated units can increase robbery arrests by up to 300 percent over present levels. Also included in this study is a model relating response time to arrest rate, indicating that arrest rates decline as response times increase.

†Bottoms, A., Nilsson, E., Olson, D., and Charanian, T., 1972. Allocations of Resources in the Chicago Police Department. Operations Research Task Force, Chicago Police Department. Washington, D.C.: Government Printing Office.

This is the final report of the Operations Research Task Force, a team of eleven individuals established to examine resource allocation problems in the Chicago Police Department. The team attempted to examine police response to calls for service, methods of aggressive preventive patrol, and results from team-designed field experiments. The chapters of this report cover applications of systems analysis to law enforcement, allocation uses of budgeting (e.g., PPBS), allocation models of police manpower, response time analysis, preventive patrol, and the results of a mini-experiment in resource allocation. This report serves as a good example of how operations research can be applied to police problems.

†Boydston, J., Sherry, M., and Moelter, N., 1977. Patrol Staffing in San Diego: One- or Two-Officer Units. Washington, D.C.: Police Foundation.

This report evaluates a one-year experiment in patrol staffing. The performance of 22 one-officer units and 22 two-officer units was monitored using variables such as response time, number of calls for service handled, officer initiated activities, safety, cost, citizen and officer satisfaction. It was concluded that one-officer patrol is as effective as two-officer patrol, and certainly more efficient. Also, one-officer patrol was claimed to be safer than two-officer patrol.

Brannon, B., 1955. Report on One Man Police Patrol Cars in Kansas City, Missouri (Comparing the completely two men cars of 1952 with the completely one man cars of 1954). Kansas City, MO: Kansas City Police Department.

This report examines two years of Kansas City patrol data in order to determine the impact of the introduction of one-officer patrol on policing and crime. In 1952, the Kansas City Police Department staffed only two-officer cars; in 1954, only one-officer cars were fielded. The numbers presented indicate that crime rates decreased while the fractions of crimes cleared by arrest increased. Regarding safety, there was an actual increase in the number of injuries, but a decrease in the number of injuries per unit. Of course, the use of "injuries per unit" as a performance measure

is questionable; the number of injuries *per officer* increased slightly from 1952 to 1954. Other data pertaining to patrol workloads and system costs are presented. This information seems to suggest that one-officer patrol is as effective as two-officer patrol, and certainly more efficient.

Bright, J. A., 1970. The Beat Patrol Experiment. London, England: Home Office Police Research and Development Branch.

This paper reviews the implementation and evaluation of a British experiment in foot patrol. A one-year experiment in foot patrol was performed in the cities of Cardiff, Manchester, Newcastle, and Sheffield beginning in December 1965. Each city selected one beat as a control (1 foot officer/beat) and one as experimental (0, 2, 3, 4 foot officers/beat). The major result indicates that the crime rate is very sensitive to changes from 0 to 1 officer per beat. However, the crime rate is apparently insensitive to manpower changes above one officer per beat.

Budnick, F., 1972. Crime Correlated Area Model: An application in evaluating intensive police patrol activities. Kingston, RI: University of Rhode Island, College of Business Administration.

The majority of this report is devoted to the development of a statistical model for estimating crime levels. Budnick hypothesizes that crime rates in certain areas of a city may be treated as functions of crime rates in other areas. Using 30 months of index crime data from Washington, D.C., Budnick discovered that the crime rates of certain areas were highly correlated. This model was used as an evaluation tool. It was determined that the crime rate experienced by an area of intensive police patrol was less than the "expected" crime rate based on model predictions, indicating the effectiveness of the intensive patrol.

Carte, G. and Carte, E., 1975. Police Reform in the United States: The Era of August Vollmer, 1905-1932. Berkeley, CA: University of California Press.

This biography of August Vollmer traces his career in police work from his initial involvement with the Berkeley Police Department to the establishment of the Berkeley school of criminology in 1951. As a result of their research, the authors have written a very readable account of the life of one of policing's greatest innovators.

Central Iowa Area Crime Commission, 1977. A Preliminary Evaluation of the Des Moines Police Department's Comprehensive Neighborhood Patrol Program. Des Moines: Central Iowa Area Crime Commission.

This preliminary evaluation presents an analysis of one month of data collected during the Neighborhood Foot Patrol program, and as such, this document is intended to be read as an interim report. The program placed an additional eight officers on foot patrol in target areas, increasing the total (foot and motor) patrol manpower by around 50 percent. The major goal of this program was to increase police effectiveness via improved police/citizen cooperation. Evidence is presented regarding police/community interaction and crime prevention activities. While the indications are that the foot patrol has been moderately successful, the one-month evaluation period is too short to consider these results as more than tentative.

[†]Chaiken, J., 1978. "What is Known about Deterrent Effects of Police Activities." In Preventing Crime. Edited by J. A. Cramer. Beverly Hills, CA: Sage Publications, Inc.

This review thoroughly examines the problems and prospects of patrol research. After listing police activities which are claimed to be effective in reducing crime, Chaiken identifies several measurement problems which hamper patrol research. He also discussed problems which are specific to cross sectional studies and longitudinal studies. Empirical research reviewed includes the 20th precinct and Operation 25 experiments in New York City, the New York City subway patrol project, Dahman's comparison of three projects from the High Impact Anti-Crime program, the Kansas City Preventive Patrol Experiment, the Los Angeles and Seattle response time studies, and other projects of interest. Chiken concludes that the deterrent effect of patrol will not be determined by a single study; rather, a long-term commitment to patrol research is required.

Chaiken, J., Lawless, M., and Stevenson, K., 1974. The Impact of Police Activity on Crime: Robberies on the New York Subway System. New York: Rand Institute.

This report presents an interrupted time-series analysis of subway robbery data in New York City. Eight years of data were subjected to analysis. During this period, police presence in the subway almost tripled. Robberies apparently decreased after the increase in police presence at an estimated cost of \$35,000 per crime deterred. During the day, crimes were not displaced to other times; rather, a "phantom effect" prevailed whereby crime decreased at hours just outside the extremes of the patrol shifts. Unfortunately, it has been learned since publication of this study that the data analyzed were falsified by the New York City Transit Police, weakening what was a careful job of research by the Rand Team.

Chapman, S., ed., 1970. Police Patrol Readings. Springfield, IL: Charles C. Thomas.

This book contains several articles which address various issues of police patrol. Chapter headings include the police in a democracy, the patrol force and patrolmen, methods of patrol, patrol force distribution, British team and unit beat policing, violence, traffic and special functions, and vocational training. This reference provides an excellent account of traditional approaches to police patrol.

Chicago Police Department, 1963. One-Man Patrol Cars. Chicago: Chicago Police Department.

This report outlines the pros and cons of one-officer patrol as perceived by the Chicago Police Department. Reasons for using one-officer units include improved patrol coverage, reduced response time, more effective police observation capabilities, reduced costs, and reduced risk to officer. Arguments against one-officer patrol include the danger factor felt to be associated with this type of staffing, reduced aggressiveness of officers assigned to one-officer cars, inability of one-officer cars to handle many calls due to insufficient manpower, and problems with one officer simultaneously driving and observing the street. It is concluded that one-officer cars have proved their value in policing, and that a well thought out mix of one- and two-officer cars is best.

Clawson, D. and Chang, S., 1977. "Relationship of Response Delays and Arrest Rates." Journal of Police Science and Administration, Vol. 5, No. 1, pp. 53-68.

This paper examines the relationship between arrest rates and travel time, delay time, and overall response time. Statistical curves were evaluated predicting arrest rates from Seattle response time data. The data from Isaac's Los Angeles study were also reanalyzed. It was found that shorter travel and response times are significantly related to higher arrest rates. However, it was also emphasized that this relationship is not causal, that is, quick response times do not guarantee arrests.

Cleveland Impact Cities Program, 1975. Cleveland Impact Cities Program - Deterrence, Detection, and Apprehension Operating Program - Final Evaluation Report. Cleveland: Cleveland Impact Cities Program.

This report evaluates the Deterrence, Detection, and Apprehension program of the Cleveland Police Department. This high visibility patrol program was initiated in order to address a rising crime rate. The goal of the program was to reduce stranger-to-stranger crimes of violence. During the course of this program, crime rates initially decreased, but later increased, so the results of this study are viewed as inconclusive.

*Cordrey, J. and Kotecha, K., 1971. Evaluation of Community Centered Team Policing. Dayton, OH: Wright State University.

This report evaluates a Dayton, Ohio experiment in generalized policing. Aside from the implementation of decentralized team policing, civilians were trained as police assistants, and hired to perform certain tasks. The objectives of this experiment were to determine the effectiveness of team policing in improving police services and to produce a community-centered police structure which would be more responsive to neighborhood life styles. The number of dispatch calls answered, clearance rates, the value of property lost and recovered, apprehension time and successful prosecutions were all compared to a period prior to the experiment. Two community attitude surveys were also conducted. Evaluation of this program showed that, in general, team policing had helped develop a more community-centered police department. The 39 officers who volunteered for this experiment achieved measures of effectiveness comparable to prior time periods. It was recommended that the team policing experiment be continued.

'Cordrey, J. and Pence, G., 1972. "An Analysis of Team Policing in Dayton, Ohio." The Police Chief, August, pp. 44-49.

This article examines the experience of team policing in Dayton, Ohio. The major objective of the team policing program was to improve police effectiveness. Using performance measures such as number of calls answered, clearance rates, recovery rates for stolen property, apprehension time and number of successful prosecutions, the authors concluded that no major changes in police effectiveness resulted. However, the authors concluded that team policing can be expected to improve police effectiveness in Dayton over the long run.

*Dahman, J., 1975. Examination of Police Patrol Effectiveness - High Impact Anti-Crime Program. McClean, VA: Mitre Corporation.

This document presents an analysis of crime data for three overt police patrol projects which were funded and implemented as part of the Law Enforcement Assistance Administration's high impact anti-crime program. The projects examined are the special crime attack team in Denver, Colorado, the concentrated crime patrol in Cleveland, Ohio, and the pilot foot patrol in St. Louis, Missouri. Each of the three projects is examined individually and the crime levels during the time period covered by police patrol project operations are analyzed. This crime level analysis is conducted using four time series models developed as part of the research. These models predict crime levels for the treatment period based on past crime levels in the area. These predicted or expected levels are then compared with the actual levels of crime observed during project operations. For each case at least one of the crimes examined (murder, rape, aggravated assault, robbery, burglary) was significantly lower during project operations

than expected. In no one project were all five crimes lower than expected, and no one crime was lower than expected in all three cases. In general, the results suggest that while there may be no uniform relationship between overt police patrol activity and official crime levels there is evidence that patrols implemented in high crime areas have been accompanied by crime levels which are lower than would have been expected.

Elliott, J., 1973. Interception Patrol: An Examination of the Theory of Random Patrol as a Municipal Police Tactic. Springfield, IL: Charles C. Thomas.

This short book draws together Elliott's work in the area of random patrol. Elliott defines his research problem as one of deploying police patrol in a spatial and temporal manner so as to maximize the probability of intercepting a crime in progress. Pursuant chapters cover the theory of random area search, methods for implementing an interception-oriented patrol, and methods for designing high intercept-probability patrol routes. This book also contains many of the interesting results from the Crime Control Team study, as well as data pertaining to the length of time it takes for committed crimes to be reported to the police.

+Elliott, J. and Sardino, T., 1971. Crime Control Team: An Experiment in Municipal Police Department Management and Operations. Springfield, IL: Charles C. Thomas.

This report describes and evaluates the Syracuse Crime Control Team. The team leader is given complete authority to determine how the team officers are deployed in the team beat according to this scheme; hence the Crime Control Team represents a decentralized approach to police patrol. Also, the theory of random area search was incorporated into the design of this study in an attempt to demonstrate the usefulness of an offensive police force. Evaluation methods and the rationale for using these methods are discussed in detail. The Crime Control Team appeared to be moderately successful in terms of reduced crime rates, increased clearance rates, and increased interception probabilities; implications of these results and suggestions for implementing similar programs elsewhere are discussed.

Franks, W. D., 1980. "Montpelier, Vermont's Directed Patrol Experiment." The Police Chief, January, pp. 24-26.

This short article by Chief Franks describes the effect of a directed patrol effort in Montpelier, Vermont. The program eliminated patrol services from 70 percent of the city, concentrating instead upon intensive foot and vehicle patrol of the downtown area. Utilizing a nine-month comparison, it was determined that the frequency of target crimes (burglary, vandalism, and disorderly

conduct) had decreased, calls for service did not increase, and displacement of burglary and disorderly conduct did not occur. However, reported incidents of vandalism increased by 183 percent. Also, the Part I crime decrease experienced in the target zone was less than the decrease experienced by the surrounding area.

[†]Gass, S. and Dawson, J., 1974. An Evaluation of Policy-Related Research: Reviews and Critical Discussions of Policy-Related Research in the Field of Police Protection. Bethesda, MD: Mathematica, Inc.

This report represents a major effort in the area of police protection. Approximately 200 research reports were examined in this study, and a subset of these studies are detailed in the report. Research reports concerned with police management, crime prevention, resource allocation, patrol operations and other areas are examined in terms of their internal and external validity. The major criticisms of police research surfaced by this report are:

- (1) Lack of commitment to research by policy makers;
- (2) Failure to articulate goals and objectives of police protection; and
- (3) Improper study design and analytic methods.

Gay, W., 1977. Patrol Emphasis Evaluation - Cleveland Heights, Ohio. Washington, D.C.: University City Science Center.

Beginning in 1974, patrol operations oriented towards the three goals of prevention, deterrence, and criminal apprehension were introduced in Cleveland Heights. This report documents the patrol tactics employed, and analyzes relevant data regarding program performance. Patrols were redeployed according to a scheme that would increase officer visibility and availability during high workload periods. For example, the department converted to one-officer cars and used foot patrols in commercial areas to improve visibility. Crime did decrease in Cleveland Heights, but crime also decreased citywide. Thus, it could not be established whether or not the crime drop was caused by the new patrol tactics.

*Gay, W., Day, H., and Woodward, J., 1976. National Evaluation Program Phase I Summary Report: Neighborhood Team Policing. Washington, D.C.: National Institute of Law Enforcement and Criminal Justice (NILECJ), Law Enforcement Assistance Administration (LEAA), U.S. Department of Justice.

The information contained in this report relies heavily upon formal evaluations of team policing programs in 14 cities. The report describes characteristics of team policing programs, assesses the state of the knowledge about team policing and indicates what additional information is needed to fully evaluate team policing. This review of team policing programs indicates that several team

policing programs have failed because of the inability of departments to implement the most basic components of the program. Where team concepts have been operationalized, however, several departments have demonstrated that team policing can improve the performance of patrol, investigative, and community service activities because evaluators often fail to carefully monitor the extent to which planned program activities have been implemented. It is said to be difficult to determine whether the concepts of team policing or extraneous variables are responsible for the evaluation results reported.

Governmental Research Institute, 1957. One-Man Police Patrol Car Operation: A Report to the Board of Commissioners, St. Louis, Missouri. St. Louis, MO: Governmental Research Institute.

This report contains the results of a survey of 16 large American cities pertaining to the use of one-officer patrol cars. The 27 questions asked covered a range of topics, including the number of one-officer cars in use, where and when these units are in service, types of incidents serviced by these units, dispatching considerations, safety considerations, and other issues. The report also contains a brief summary of the pros and cons of one-officer patrol, and recommendations to the St. Louis Police Department regarding the use of one-officer cars.

Howard, W. B., 1977. "The Use of Paraprofessionals in Police Service." The Police Chief, January, pp. 52-56.

A program involving students as patrol aides was initiated in 1974 at the Claremont Colleges in Los Angeles. This article briefly describes the program and examines related performance statistics. The crime rate at Claremont Colleges decreased soon after the introduction of paraprofessional patrol, and the article attributes this to the program. While displacement may have occurred, this issue is not addressed by the article.

† Institute for Defense Analyses, 1967. Task Force Report: Science and Technology (A Report to the President's Commission on Law Enforcement and Administration of Justice). Washington, D.C.: Government Printing Office.

This report examines in detail the application of Science and Technology to criminal justice issues. Areas of application include the police apprehension process, police command, control, and communications, court management and corrections, crime analysis, and the total criminal justice system, criminal justice information systems, and criminal justice research and development. Several independent "mini-studies" are presented as appendices, including Isaacs' study of response time in Los Angeles. This report represents one of the earliest independent research efforts that examined problems of police patrol.

Isaacs, H., 1967. "A Study of Communications, Crimes, and Arrests in a Metropolitan Police Department." In Task Force Report: Science and Technology (A Report to the President's Commission on Law Enforcement and Administration of Justice). Washington, D.C.: Government Printing Office.

This study examined two months of data collected in August and September 1966 in Los Angeles, California. Information pertaining to response time, arrests, clearances and other variables was obtained. The data collected is consistent with the hypothesis that faster response times lead to more arrests. It was also noted that the clearance rate was very low for cases with unnamed suspects. Isaacs' recommendations for further research include the institutionalization of a fundamental research program in police issues, and the development of criteria for emergency dispatching.

Iutocovich, M. and Iutcovich, J., 1977. Safe Streets Evaluation Report, 1976-1977. Erie, PA: Northwest Institute of Research.

This report presents an evaluation of a five-year "Safe Streets" saturation program undertaken in high crime areas of Erie, Pennsylvania. The evaluation included a victimization survey to discern whether or not victimization had increased in the target area. The study also surveyed citizens' satisfaction with the police. No significant differences emerged between pre-saturation and saturation victimization and satisfaction levels.

[†]Kansas City Police Department. Response Time Analysis: Executive Summary, 1977. Volume I: Methodology, 1977. Volume II: Analysis, 1977. Volume III: Part II Crime Analysis, 1979. Kansas City: Board of Commissioners, Kansas City, MO.

This study presents a detailed statistical analysis of ten months of Kansas City Response Time data. Volumes I and II examine 949 Part I crime incidents, while Volume III considers 359 Part II crime incidents. The major objective of the study was to test the relationship of response time and various outcome measures such as arrest likelihood, witness availability, citizen satisfaction with response time, and frequency of citizen injury. Included in the measurement of response time were self-reported estimates of the length of time citizens take to contact the police. It was concluded that response time does not influence outcomes of serviced calls, largely because of the amount of time citizens take to contact the police. Rather, citizens' expectations of response time were identified as explaining observed citizen satisfaction. In the Executive Summary of this report it is strongly suggested that response time minimization is not a justifiable goal, and that technologies geared towards response time reduction are not likely to be effective. Though some of these findings may be true, there are enough methodological problems with this study to warrant serious questioning of the published results.

Kaplan, E., 1979. "Evaluating the Effectiveness of One-Officer versus Two-Officer Patrol Units." Journal of Criminal Justice, Vol. 7, No. 4, pp. 325-355.

This article presents an analysis of one- versus two-officer patrol staffing. Relying primarily upon probabilistic models used in conjunction with data from the Police Foundation report Patrol Staffing in San Diego: One- or Two-Officer Units, this paper considers issues of patrol coverage, response time, frequency and visibility of patrol, probability of intercepting crimes in progress, injury probability, and comparative costs. Kaplan concludes that one-officer patrol is more effective than two-officer patrol in light of the performance measures mentioned above.

+Kelling, G. and Fogel, D., 1978. "Police Patrol - Some Future Directions." In The Future of Policing. Edited by A. W. Cohn. Beverly Hills, CA: Sage Publications, Inc., pp. 151-181.

This paper reviews empirical research in police patrol. After an historical section, the authors review a number of challenges to contemporary modes of police patrol. Studies reviewed include Press's analysis of the manpower increase in New York City's 20th precinct, the Kansas City Preventive Patrol Experiment, the Nashville experiments of Schnelle, *et al.*, the St. Louis AVM studies, the Kansas City response time studies, and several others. The authors suggest that motorized preventive patrol has been proven ineffective, and that foot patrol might be a promising avenue for patrol strategists to pursue.

**Kelling, G., Pate, T., Dieckman, D., and Brown, C., 1974. The Kansas City Preventive Patrol Experiment: A Technical Report. Washington, D.C.: Police Foundation.

This is the evaluation report of the famous Kansas City Preventive Patrol Experiment. In this year-long experiment, three controlled areas of routine preventive patrol were used. One area, termed "reactive" received no preventive patrol. Officers entered the area only in response to citizen calls for assistance. In the second area, called "proactive" police visibility was increased two to three times its usual level. In the third area, termed "control" the normal level of patrol was maintained. Analysis of the data gathered revealed that the three areas experienced no significant differences in the level of crime, citizens' attitudes toward police devices, citizens' fear of crime, police response time, or citizen's satisfaction with police response time. This technical report includes an analysis of the strengths and weaknesses of the study. A discussion of design issues and methods of analysis and comparisons of Kansas City with other cities of similar size. Though this study remains the most ambitious patrol experiment to date, it has received its share of criticism. See Larson (1975) for a critique of this report.

Kinney, J. A., Howlett, J. B., and Harris, D. H., 1976. Isla Vista Foot Patrol - History, Operations, and Evaluation. Santa Barbara: Anacapa Sciences, Inc.

This report constitutes a description and evaluation of the Isla Vista Foot Patrol Program. Jointly established by the Santa Barbara County Sheriff's Office and the University of California at Santa Barbara Police Department, the foot patrol was a response to a wave of serious incidents in Isla Vista. In the five years following the initiation of the program, serious reported crime decreased while petty reported crime increased. The authors claim that crime itself went down, but that reporting rates went up. Also, a survey showed that Isla Vista residents preferred foot patrol to other forms of policing, though some misgivings existed with respect to certain aspects of the program.

Kizziah, C. and Morris, M., 1977. Evaluation of Women in Policing Program - Newton, Massachusetts. Oakland, CA: Approach Associates.

This report evaluates the Newton, Massachusetts Women in Policing Program. Between May 1 and August 31 of 1977, the performances of 12 female and 23 male officers were compared. Using measures such as number of arrests, number of calls handled, commendations and reprimands, accidents, injuries and illnesses, and supervisors' assessments, it was concluded that there is little difference between the performance of male and female officers. However, it was also found that the male officers hold a negative opinion regarding the ability of women to do police work.

Larson, G. and Simon, J., 1978. Evaluation of a Police AVM System: A Phase II City-Wide Implementation. Cambridge, MA: Public Systems Evaluation, Inc.

The findings of Public Systems Evaluation, Inc.'s Phase II (city-wide) evaluation of Automatic Vehicle Monitoring (AVM) in St. Louis are presented in this report. The objectives of the project were similar to the Phase I program: reduce response time, improve officer safety, reduce voice band congestion, and improve police command and control. (See Larson, Colton, and Larson, 1976). As in Phase I, response time reductions were minimal; results regarding the other goals were mixed. However, several potentially positive uses of AVM were identified, including improved dispatching of units to extraordinary events (e.g., "hot pursuits"), dynamic reallocation of patrol forces to maintain patrol presence or reduce queuing levels, and better supervision of the force.

[†]Larson, R., 1972. Urban Police Patrol Analysis. Cambridge, MA:
The M.I.T. Press.

This book, the first of its kind, introduces the reader to a multitude of analytical methods available for analyzing police patrol operations. Dr. Larson outlines the types of operational problems faced in police patrol, and provides detailed descriptions of the police emergency response system, a typical eight-hour tour of patrol duty, and measures of effectiveness for police patrol. These issues are illustrated in a chapter which examines patrol operations in a hypothetical city. Technical chapters present models of travel time and optimal beat design, models of preventive patrol, a patrol allocation algorithm, a simulation model of patrol operations, models of Automatic Car Locator systems, and models of intersector cooperation and repositioning. This book is invaluable to anyone involved in the study of police patrol.

Larson, R., 1975. "What Happened to Patrol Operations in Kansas City? A Review of the Kansas City Preventive Patrol Experiment."
Journal of Criminal Justice, Vol. 3, No. 4, pp. 267-297.

This paper reviews various aspects of the design, execution, and evaluation of the 1972-73 Kansas City (MO) Preventive Patrol Experiment, focusing on the operational behavior of the patrol force during the experiment. The design of the experiment is examined to see whether the conditions expected were actually brought about. The types of data used in evaluating the final outcome of the experiment are reviewed. Where appropriate, simple probabilistic models are employed to estimate frequencies of preventive patrols and response times in each of the experimental areas. Larson argues that the operational consequences of the experimental design were not adequately considered by the original researchers and were so different from those expected that the validity of the design as a means for greatly reducing patrol levels in a subregion must be questioned. This suggests two policy conclusions: (1) great caution should be used in attempting to induce the general value of a visible patrol presence from the results of the Kansas City Preventive Patrol Experiment; (2) patrol administrators in other cities could remove conventional patrol coverage from certain beats and markedly increase manning in others nearby without incurring significant degradations in service.

Larson, R., Colton, K., and Larson, G., 1976. Evaluation of a Police-Implemented AVM System - Phase I, A Summary Report. Cambridge, MA: Public Systems Evaluation, Inc.

This report summarizes the findings of Public Systems Evaluation, Inc.'s Phase I (one district) evaluation of the St. Louis Automatic Vehicle Monitoring (AVM) system. The evaluation examined AVM technology, the impact of AVM on police operations (in terms of response time, officer safety, voice-band congestion, and command and control), and attitudinal/organizational concerns. It was found that AVM did not result in substantially reduced response time, nor was AVM sufficiently relied upon to affect officer safety. Also included in this report is a series of recommendations relating the potential advantages and disadvantages of AVM to those of other technologies (e.g., computer-aided dispatching systems, 911 systems).

Lewis, R. G., Greene, J. R. and Edwards, S. M., 1978. Special Police Units in Michigan: An Evaluation. Criminal Justice Systems Center.

This report is an evaluation of some 23 special projects undertaken by police agencies in the State of Michigan. Projects were of three types: regionalized detective units, saturation patrol units and surveillance units. The major objective of this program was to reduce crime in target areas. Using the techniques of time series analysis, the authors concluded that there is no reason to believe that establishment of the special police units resulted in crime reduction. Despite certain deficiencies in their data, the authors are convinced that the statistical analysis has demonstrated the ineffectiveness of the special units as implemented in Michigan.

Los Angeles Police Department, 1973. Final Evaluation of Team 28 Experiment: Introduction and Overview. Los Angeles, CA: Los Angeles Police Department.

The results of the Los Angeles Team 28 Experiment are discussed in this summary report. Team policing was introduced in 1972 to one Los Angeles "Basic Car area" as a new approach to crime reduction. According to the writers, the experiment was successful. Burglaries were 31.7 percent lower than expected, while community attitudes towards the police improved. The attitudes of police officers towards the community were also reported to have become more positive.

⁺Milton, C., 1978. "The Future of Women in Policing." In The Future of Policing. Edited by A. W. Cohn, 1978. Beverly Hills, CA: Sage Publications, Inc., pp. 183-204.

This chapter summarizes current knowledge pertaining to the performance of women in police work. Statistics pertaining to the participation of women in policing are presented in a background section, followed by a review of traditional women's roles in law enforcement agencies. The Washington, D.C. Policewomen on Patrol study is reviewed in some detail; other studies referenced include a St. Louis project reported by Lewis Sherman, and an unpublished Police Foundation study of women on patrol in New York City. Milton points out the problems women face when they are integrated into police departments, presenting several actual examples. The chapter concludes with an assessment of the effectiveness of women on patrol.

⁺National Advisory Commission on Criminal Justice Standards and Goals, 1973. Police. Task Force on Police, National Advisory Commission on Standards and Goals. Washington, D.C.: National Advisory Commission on Criminal Justice Standards and Goals.

This document presents and discusses a number of normative standards that the authors feel should be adhered to by the police. Chapter 8 of this report is dedicated to patrol, while Chapter 6 examines team policing. With respect to patrol, standards are proposed to:

- (1) Establish the role of the patrol officer;
- (2) Enhance the role of the patrol officer; and
- (3) Guide the deployment of patrol officers.

It is interesting to note that in discussing these standards, references to current research are made (This is especially true for the sections on patrol deployment).

*New York City Police Department, 1972. "Operation 25." In Police Patrol Readings. Edited by S. Chapman. Springfield, IL: Charles C. Thomas, pp. 342-353.

The four-month experiment described in this paper took place in 1954 in New York City's 25th precinct in Manhattan, an area with a very high crime rate. Increased police personnel, including foot patrolmen, detectives, traffic, emergency and supervisory personnel were assigned to the precinct. A special juvenile aid bureau and a special narcotic squad were also established. An in-service training program was also set up, using four instructors from the Police Academy. Compared to the same period in 1953, the number of felonies reported decreased 55.6 percent, total crime complaints decreased 27.5 percent, and arrests increased by one-third. Precinct residents and businessmen also became more relaxed and confident due to the presence of more uniformed patrolmen on the streets.

[†]Pate, T., Ferrara, A., Bowers, R., and Lorence, J., 1976. Police Response Time: Its Determinants and Effects. Washington, D.C.: Police Foundation.

This report presents an analysis of response time data collected in conjunction with the Kansas City Preventive Patrol Experiment. Using regression and correlation techniques, the authors set out to statistically determine both the determinants of response time and the degree to which response time influences the outcomes of crime incidents. The authors state that the length of time between the reporting of an incident and the dispatching of an officer, and the distance to the scene are the only two variables significantly correlated with response time. The authors also claim that response time is not the most significant predictor of outcome variables like result of encounter, (e.g., arrest), citizen satisfaction with response time, and attitudes towards police officers and the police in general. Rather, the difference between observed and expected response time was the most important variable in determining citizen satisfaction with response time. While the results of this study are interesting, questions may be raised concerning these findings in light of small sample sizes and the types of statistical methods used.

Pendland, M. B. and Gay, W. G., 1972. "Foot Patrols: The Fort Worth Experience." The Police Chief, April, pp. 46-68.

In response to a rapidly increasing crime rate, the Fort Worth Police Department established a special foot patrol unit. This article briefly describes the goals of the program, and presents some statistical results. After one year of foot patrol in a high crime area of Fort Worth, Part I crime in this area decreased by 25 percent as opposed to 11 percent city-wide. Also, citizens were favorably disposed towards the foot patrol in general. In the absence of detailed program description, stronger controls, and a longer time series data base, however, these results must be viewed as somewhat tentative.

Press, S. J., 1971. Some Effects of an Increase in Police Manpower in the 20th Precinct of New York City. New York: The New York City Rand Institute.

The results of a 40 percent increase in police manpower in New York's 20th precinct were statistically analyzed in this after-the-fact study. In some crime classifications, reported crime decreased from 20 percent to 50 percent when compared to control precincts; in other crime classifications, no changes were detected. Crime displacement effects existed, but were typically smaller than observed decreases in crime rates. This report does *not* describe the actual deployment conditions which may have given rise to these results, making the interpretation of the statistical analysis difficult.

*Reagen, M., Cooper, J., Gabriel, C., Gordon, F., MacDowell, C., and Makarushka, C., 1974. Philadelphia Police Department - West Philadelphia Strike Force - Act 1 - North, Central - Northwest Strike Force - Act 2 - Final Report. Syracuse, NY: Police and Security Management Consultants.

This report presents an evaluation of a project aimed at the reduction of stranger-to-stranger burglary and robbery in two high-crime areas of the city by utilizing computer technology in the tactical and logistical deployment of special police strike forces. The evaluation examined internal factors of the information processing and analysis system. These included records control and procedures, the overall records system, and statistical evaluation of the success of the project in reducing priority crimes. The consistency in reporting and processing offenses and the reliability of internal processing and preparation of the data were evaluated. Also examined were the reliability of the computer software and data automation systems. Statistical charts are provided showing the impact of the project in terms of offense rates, clearance rates, utilization and testing of new patrol techniques, police awards and morale, and citizen complaints regarding policemen in the units.

St. Louis Metropolitan Police Department, 1977. Team Policing Experiment: Analysis and Evaluation (Technical Report). St. Louis: Management Services Section, Planning and Development Division, St. Louis Metropolitan Police Department.

In April of 1976 the St. Louis Metropolitan Police Department implemented a team policing experiment. This report constitutes an evaluation of that experiment. According to the report, the major area of difference between team policing and traditional policing rests with management and administrative practices. The researchers found evidence that the police had become more effective under team policing, though no statistical changes in attitudinal variables such as job satisfaction and police community relations were found.

+ Schell, T., Overly, D., Schack, S., and Stabile, L., 1976. National Evaluation Program Phase I Summary Report: Traditional Preventive Patrol. Washington, D.C.: NILECJ, LEAA, U.S. Department of Justice.

The authors of this report identify the commonly accepted goals of patrol, and examine each of these goals in relation to the assumptions which link certain patrol activities to goal attainment. The writers also attempt to assess the validity of these assumptions and the type and quality of related performance measures. Patrol issues in need of further study are identified. This report based its findings on a review of available patrol literature, a survey of 300 police and sheriff's departments, and 26 site visits.

Schnelle, J., Kirchner, R., Casey, J., Uselton, P., and McNees, M., 1977. "Patrol Evaluation Research: A Multiple-Baseline Analysis of Saturation Police Patrolling during Day and Night Hours." Journal of Applied Behavior Analysis, Vol. 10, No. 1, pp. 33-40.

This article presents the results of a carefully monitored experiment in saturation patrol. Over four ten-day periods, patrol movement was reliably monitored using tachographs. Patrol movement was increased by a factor of four for normal levels and by a factor of 30 for patrol under 20 miles per hour. Using a multiple-baseline time series approach, it was determined that crime levels remained constant during daytime saturations, but that nighttime crime levels decreased significantly. However, the authors question the value of saturation patrol based on cost considerations.

Schnelle, J., Kirchner, R., McNees, M., and Lawler, J., 1975. "Social Evaluation Research: The Evaluation of Two Police Patrolling Strategies." Journal of Applied Behaviour Analysis, Vol. 8, No. 4, pp. 353-365.

This article presents a statistical evaluation of two police patrol strategies. A time series design was used to evaluate the effects of a home-burglary patrol; no effects could be attributed to the police. A multiple-baseline design was used to examine the effects of a foot patrol program. This second analysis revealed an increase in crime reporting, but no other effects were discovered.

† Schwartz, A. and Clarren, S., 1977. Evaluation of Team Policing in Cincinnati: A Technical Report (Volumes I and II), Washington, D.C.: Police Foundation.

This detailed report describes and evaluates the Cincinnati Team Policing Experiment. Initially planned to be an eighteen-month project, the program was extended for an additional year. The maintenance of this program became quite a problem, however, as the differences between team policing in the experimental area and routine policing in Cincinnati as a whole began to disappear within eighteen months of project initiation. The major goal of the program was to reduce crime and improve police-community relations. While burglary rates decreased in the experimental district, the rates of other crimes remained comparable to city-wide figures. Also, citizen satisfaction with the police did not increase as expected, though the level of citizen satisfaction remained high. The authors suggest that there is no reason to believe that team policing is less effective than routine policing. Rather, they feel that team policing could be beneficial to both the police and the public.

Sichel, J., Friedman, L., Quint, J., and Smith, M., 1978. Women on Patrol: A Pilot Study of Police Performance in New York City. Washington, D.C.: Government Printing Office.

This report evaluated an experiment involving women on patrol. Forty-one men and 41 women were roughly matched statistically; these officers were then comparatively evaluated over a seven-month period. Officer effectiveness was based on measures such as type of incident serviced, type of action instigated by the officer (e.g., use of force), citizens' reactions to police service, "successful" attempts at controlling subjects, and number of arrests made. No statistical differences emerged between the male and female officers based on the majority of these measures.

Tarr, D., 1978. "Analysis of Response Delays and Arrest Rates." Journal of Police Science and Administration, Vol. 6, No. 1, pp. 429-451.

This paper presents a replication of an earlier study by Clawson and Chang. Statistical curves were used to relate response times and arrest rates; a significant inverse relationship between these variables emerged. Also, it was found that arrest rates were heavily influenced by the number of officers in the preliminary response unit, with two-officer units obtaining a significantly higher arrest rate than one-officer units.

*Tien, J., Larson, R., Green, J., Williamson, J., Dunlap, V., 1975. An Evaluation Report of the Worcester Crime Impact Program. Cambridge, MA: Public Systems Evaluation, Inc.

This report presents a process evaluation of the Worcester Crime Impact Program. The program consisted of seven components aimed at achieving goals of civilianization, decentralization, and specialization within the department through concentrated patrol, increased investigative manpower, improved administrative support, use of civilians to answer service calls, and establishment of a crime prevention unit. All available data elements traditionally collected by the Worcester Police Department relevant to the project and especially those demonstrating the impact of the use of police service aides were analyzed. The results of a questionnaire administered to and interviews conducted among program participants were analyzed, as were telephone interviews with service call clients. The findings state that the Worcester Crime Impact program has successfully met its main output goal of reduced target crime, primarily because of the increase in manpower and improved flexibility and organization provided by the impact program.

[†]Tien, J., Simon, J., and Larson, R., 1977. An Evaluation Report of an Alternative Approach in Police Patrol: The Wilmington Split-Force Experiment. Cambridge, MA: Public Systems Evaluation, Inc.

This report presents an evaluation of the Wilmington Split-Force program. The evaluation is based on data collected from December 1, 1975 through November 30, 1976. During this time period, the Wilmington patrol force was divided into response-oriented (basic) and preventive patrol-oriented (structured) sub-forces. It was found that the split-force approach increased call-for-service response efficiency, in that pre-experimental volumes of calls for service were handled with reduced manpower. Although the purpose of this program was not to reduce crime, Part I crime did decrease by six percent over the study period. The structured patrol officers were responsible for a large increase in the number of crimes cleared by the patrol division, but many of these clearances came at the expense of the detective division, resulting in a net drop in the clearance rate. Citizens were found to be very satisfied with the performance of the split force, though two-thirds of the officers surveyed indicated they would like to see the program discontinued. The authors conclude that the split-force approach does constitute a more productive style of policing than traditional patrol; additional methods for improving productivity are also suggested as worthy of future consideration.

Ulberg, C. and Bentson, L., 1976. An Evaluation of the Bellevue Police Department's Experiment in Team Policing. Seattle, WA: Battelle Memorial Institute of Law Enforcement and Criminal Justice.

In this brief report, the authors describe the implementation and implications of a team policing program established in 1975 in Bellevue, Washington. The goals of this project were to involve citizens in crime investigation and prevention, to improve officers' job satisfaction, and to reduce the rate of burglary in particular and Part I crime in general. It was found that citizens having direct contact with the police were more satisfied with the police, though the overall level of citizen response to the program was not determined. Also, it was found that officer satisfaction decreased over the course of the project. Before and after examination of burglary rates yielded a 12.5 percent decrease, but this cannot be attributed to the team policing program.

Wagner, W. F., 1978. An Evaluation of a Police Patrol Experiment. Pullman, WA: Washington State University.

This Ph.D. thesis constitutes an evaluation of Albuquerque's Special Operations Section (SOS). The SOS consisted of two eight-officer teams which, when deployed along with regular patrol, served to create saturation conditions in various parts of Albuquerque. Hypotheses tested pertained to the effect of the

increase in patrol on the crime rate, and the effectiveness of marked versus unmarked patrol cars. No statistical changes were detectable in the crime rates, and no statistical differences surfaced between the effectiveness of marked versus unmarked cars. However, Wagner claimed on substantive grounds that unmarked units were more effective in the apprehension of felons. The presentation by Wagner is good, explaining the weaknesses of the SOS study as well as its strengths and explaining in detail what the SOS actually did.

*Walsh, J., 1975. St. Louis Metropolitan Police Department - Foot Patrol Project Evaluation Report. St. Louis, MO: St. Louis Metropolitan Police Department.

This is the final report on an impact cities project to augment the number of foot patrolmen in high crime areas of St. Louis in order to reduce crime, improve police-community relations, and supplement normal police patrol. Project results reveal that crime reduction has not been significant as a result of this program. The program was an outstanding success in terms of improved police community relations. However, the arrest rate per 100 man-hours of patrol was significantly below that of the remainder of the department.

† Webb, K.W., Sowder, B. J., Andrews, A. J., Burt, M. R., and Davis, E. F., 1977. National Evaluation Program Phase I Summary Report: Specialized Patrol Projects. Washington, D.C.: NILECJ, LEAA, U.S. Department of Justice.

This report reviews 21 projects in specialized patrol. The 21 programs are divided into low visibility patrol (eight cases), high visibility patrol (five cases), and combined low/high visibility patrol (eight cases). The report concludes that more research is needed regarding the effectiveness of specialized patrol. Also mentioned is the finding that existing research is of questionable quality given recurrent problems with the reliability and overall accuracy of completed evaluations.

‡Wilson, O. W. and McLaren, R., 1977. Police Administration. New York, NY: McGraw Hill.

This is the fourth edition of O. W. Wilson's classic text. Relevant to police patrol are the chapters on team policing, patrol, and allocation and distribution of operational manpower. Review of this work is essential for anyone undertaking research in patrol operations.

APPENDIX B

BIBLIOGRAPHY

BIBLIOGRAPHY

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