Forensic Evidence and the Police:

The Effects of Scientific Evidence on Criminal Investigations

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FOREWORD

The precision of physical evidence and its presumed lack of bias and distortion compared to the testimony of witnesses has fascinated both the criminal justice community and the public, at least since Conan Doyle introduced us to Sherlock Holmes. Over the years, police have been urged by courts, blue-ribbon panels and the media to adopt a more scientific approach to investigations and rely more on tangible clues than confessions of suspects or eyewitness accounts.

The importance of crime laboratories has increasingly been recognized, particularly for the role they have played in a number of celebrated cases and in cases involving use of controlled substances. Nevertheless, there has been little systematic verification that the collection of physical evidence such as fingerprints, blood and fiber and related trace evidence aids significantly in the investigation of crimes and the successful prosecution of the offender. In a world of shrinking budgets, law enforcement executives face tough decisions about allocating their limited resources. Without evaluation of the impact crime laboratories have on criminal investigations, resources may be allocated to other functions such as patrol that have evidenced clearer contributions.

In light of this situation, the National Institute of Justice is pleased to bring this report on the effects of scientific evidence on criminal investigations to the attention of law enforcement. The product of a 3-year study by researchers at the Center for Research in Law and Justice at the University of Illinois-Chicago Circle, the report indicates that scientific evidence can make a significant difference in criminal investigations. The information presented here sheds light on the effect of physical evidence collection and analysis on the investigation of various types of crimes, how clearance rates vary depending on whether physical evidence is collected, and the impact of physical evidence on the outcome of court cases. The report enhances the ability of law enforcement managers to make more informed decisions about the allocation of limited resources in both criminal investigations and crime laboratory operations.

I would like to express the appreciation of the National Institute of Justice to police and crime laboratory executives of the cities of Peoria, Chicago, Kansas City and Oakland who opened their organizations to the scrutiny of the research. Their commitment to increasing our understanding of policing has given criminal justice managers objective information to guide policy decisions.

James K. Stewart
Director

ABSTRACT

The goals of this project are to describe the various uses of physical evidence in criminal investigations and to assess the effects of scientifically analyzed evidence on the solution of serious crimes and the apprehension and prosecution of offenders. The absence of empirical studies in this area, coupled with the rapid growth of crime laboratories over the past decade, make this a particularly timely and important research topic. Data have been collected from approximately 2,700 case investigations drawn randomly from police and laboratory files in four jurisdictions.
Among the findings of the study are that rates of clearance for robberies and burglaries are significantly higher in investigations where physical evidence is examined, than in cases where it is not. Forensic evidence has its greatest effect in cases which traditionally have the lowest solution rates -- cases with suspects neither in custody nor identified at the outset of the investigation. Moreover, a significantly higher percentage of persons arrested for the crimes of burglary and robbery are convicted in cases with forensic evidence. The effects of scientific evidence on the clearance and prosecution of aggravated assault cases is less pronounced and, in many cases, not significantly different from cases where forensic evidence is not used. A number of recommendations, aimed principally at the patrol, detective, crime scene and crime laboratory functions, are presented. These recommendations, plus suggestions for future research, have the goal of focusing limited police and scientific resources on those investigations where physical evidence can make the greatest difference.

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FIGURES AND TABLES

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The authors, of course, assume total responsibility for all deficiencies and shortcomings of this report.

EXECUTIVE SUMMARY

Background

The goals of this project are to describe the various uses of physical evidence in criminal investigations and to assess the effects of this scientifically analyzed evidence on the solution of crimes and the apprehension and prosecution of offenders. The absence of empirical studies on this topic, coupled with the rapid growth of crime laboratories over the past decade, make this a particularly timely and important research topic.

Prior research into this area has not adequately pinpointed the uses and effects of evidence for various reasons. Because physical evidence is examined in a small percentage of crimes investigated by the police, past studies have lacked the necessary statistical basis to form reliable conclusions. Researchers have also been faced with record keeping systems inadequate to permit measurement of the impact of scientific evidence. Another problem repeatedly seen is the assumption that fingerprints are the only form of evidence registering an impact on cases. Finally, prior research tends not to differentiate laboratory analyzed evidence from other types of tangible evidence that may be collected in an investigation.

Although the present project certainly does not answer all the unresolved questions about the value of physical evidence, it does provide new insights into the patterns found in the recovery of evidence from major crimes. This study also delineates the types of evidence

routinely routed to the laboratory for analysis and records the success of laboratories in answering the questions posed by investigators. Most important of all, this study documents the effects of the evidence on the outcome of cases. The central questions explored in the study are as follows:

- What categories of physical evidence are collected from the scenes of major crimes and which types are most successful in linking offenders with these offenses?
- Does the collection and examination of physical evidence have an appreciable effect on the clearances of criminal investigations?
- How does the value of physical evidence compare with other types of information or strategies employed by detectives in investigating crimes?
- What effect does physical evidence have on the quality of arrests, expressed in terms of the fraction of arrests which lead to conviction?
- To what extent does the utility of physical evidence vary from one jurisdiction to another?
- May guidelines be developed to assist crime scene technicians, detectives and criminalists in determining in which types of offenses physical evidence is most likely to have the greatest payoff?

Major Findings

The rates of clearance for robberies and burglaries are significantly higher in investigations when physical evidence is collected and examined than in cases when it is not. Forensic evidence has its great-

est effect in cases which, traditionally, have the lowest solution rates--cases with suspects neither in custody nor identified at the preliminary investigation stage. Moreover, significantly more persons arrested for the crimes of burglary and robbery are convicted in cases with analyzed forensic evidence. Rape prosecutions also result in higher rates of conviction when semen is identified or when other physical evidence links the defendant with the victim. Conviction rates, in two of the jurisdictions studied, are significantly higher in homicide cases where physical evidence linking the offender with the crime is developed. The effect of evidence on the clearance and prosecution of aggravated assault cases is less pronounced and, in many situations, not significantly different from cases where scientific evidence is not used.

Approach

Approximately 1,600 investigations have been reviewed in which physical evidence was collected and examined and 1,100 cases where physical evidence was not used. Empirical data were collected in four jurisdictions: Peoria, Illinois; Chicago, Illinois; Kansas City, Missouri; and Oakland, California. These jurisdictions have been selected on the basis of size and geographical distribution, their different approaches to evidence retrieval and analysis, and their interest in exploring the research questions posed at the beginning of the project.

The data have been collected from case files maintained by the respective police agencies, crime laboratories, prosecutor and court offices in the different jurisdictions. Data collection focuses on the

five principal investigative stages of serious crimes: the crime report, the preliminary investigation, the follow-up investigation, the collection and analysis of physical evidence, and the judicial outcome of the case. The physical evidence cases in the study have been selected randomly from crime laboratory files, primarily from the offense categories of homicide, rape, aggravated assault, robbery, and burglary. The cases in the sample without physical evidence have been selected randomly from cases lacking physical evidence in the police files. These no evidence cases are confined to the crime categories of robbery, aggravated assault and burglary because of the high incidence of physical evidence collected in the categories of homicide and rape. This sampling approach is used to attempt to isolate the effects of the scientific evidence alone on the results of these cases.

Characterizing Offenses in the Study Sample

Following the introductory chapter and a brief summary of the literature on physical evidence and criminal investigations, Chapter III introduces the discussion of research results by first describing the process which controls the recognition, collection and examination of physical evidence in the crime laboratory. In addition, descriptive information about the 1,600 physical evidence cases in the sample is presented and interjurisdictional differences noted. The model described begins with the commission of the crime, its report to the police and on through the preliminary and follow-up stages of the investigation.

The following incident variables subsequently are shown to affect the gathering of physical evidence: the time lapse between the discovery of the crime and its report to police; the extent of physical interaction between the offender and the scene or victim; the type of location where the crime occurred; the presence of witnesses and the identity and whereabouts of suspects. One of the most significant characteristics of these investigations involving physical evidence is the high percentage of cases in which a suspect is in custody at the time the search for evidence takes place. Approximately one-half of the crimes in the Peoria and Oakland samples, one-third of the cases in Chicago and one-fifth of the cases in Kansas City have suspects in custody.

Blood, hair, firearms and fingerprints are the forms of physical evidence most frequently collected and examined in the laboratory. Suspected semen is high on the list of physical evidence collected in sexual assault cases. Evidence submitted to the laboratory in burglary and property crimes usually falls into one of the trace evidence or toolmark categories in addition to fingerprints. Evidence technicians and police officers specializing in crime scene processing are the principal collectors of this evidence.

Most evidence is submitted to the laboratory for the purpose of establishing an association among offenders, victims, crime scenes, and instruments (weapons, tools). The primary objective of evidence submissions in rapes and arsons is to identify traces of suspected semen and volatile liquids, thereby helping to establish an element of the crime. Evidence is also submitted for the purpose of corroborating or refuting other information gathered by investigators from victims, witnesses and

suspects. Evidence often helps reconstruct how a crime actually occurred.

The chapter concludes with a review of overall rates of clearance, charging and conviction of offenders in physical evidence cases. Very high rates of clearance are found, ranging from 84% of the cases in Oakland to 49% of the cases reviewed in Kansas City. High rates of charging and conviction of defendants are also the rule. There is a strong indication at this early stage of review and analysis that physical evidence cases are quite special, if for no other reason than their success in surviving the numerous screening levels of the criminal justice system. The remainder of the report attempts to explain the reasons for this success.

Investigative Uses of Physical Evidence

Chapter IV focuses on investigative uses of physical evidence by first reviewing the fraction of evidence collected from the field which is actually examined scientifically and various priority systems used by laboratories in deciding which cases will receive attention first. The nature of the crime, its seriousness, the perishability of the evidence, and the presence of suspects are the primary factors taken into consideration.

Several examples drawn from the files of the participating crime laboratories are included to illustrate the results of laboratory testing of evidence and its value to these investigations. The results range from cases in which materials are simply identified or classified to those in which conclusive linkages are established between a suspect

and the crime. Included, also, is an illustration of physical evidence which helped to exculpate a rape suspect.

This chapter concludes with a discussion of the manner and speed with which results are conveyed to investigators.

Laboratory Results

Chapter V describes those characteristics of criminal incidents which help to explain the types and quantities of physical evidence collected. It summarizes statistically the primary reasons evidence is submitted to the laboratory and the percentage of time evidence is successful in associating or disassociating the offender with the crime scene and/or victim. The chapter concludes with a discussion of sample cases in which fingerprints are the only form of evidence collected and examined.

More violent personal crimes result in greater quantities of evidence being gathered than less serious offenses. In personal crimes, more evidence is gathered at the preliminary investigation when detectives have the poorest information about suspects. However, in property offenses, more evidence is gathered when suspects are in custody or immediately identified. Only a fraction of the evidence collected from the field is actually examined. A higher ratio of evidence collected in property crimes is examined than in personal crimes.

The percentage of laboratory results leading to a statement of common origin (a match between two items of evidence) is highest in personal crimes. On the other hand, physical evidence collected in property crimes is more likely to result in showing items of evidence

have a different origin. Peoria has the greatest success in determining the origin of firearms evidence, toolmarks, fingerprints, and trace evidence. Oakland determines the origin of bloodstains and hair evidence most frequently. Chicago and Kansas City have the greatest success in identifying the presence of semen submitted in sexual assault cases.

In personal crimes, firearms and fingerprints are the evidence categories which resolve the question of association most often. Bloodstains, on the other hand, have the poorest record for associating persons and locations in three of the four cities. Trace evidence (paint, glass and fibers) and toolmarks lead to the greatest success in resolving the question of association in property crimes. Fingerprints, in contrast to their usefulness in personal crimes, are much less effective in associating suspects and crime scenes in property crimes.

The Role of Scientific Evidence in the Clearance and Prosecution of Criminal Cases

Chapter VI focuses on the rates of clearance, charging and conviction of cases in which physical evidence is collected and examined versus the sample of cases in which no physical evidence is gathered. Because the no evidence sample is, of necessity, restricted to the crime categories of robbery, aggravated assault and burglary/property crimes, only cases with physical evidence from these same crime categories are included in this analysis.

Examination of the cases reveals significant differences in the rates of clearance, charging, conviction, plea bargaining and charge reduction. The differences are most pronounced in the crime categories

of robbery and burglary. The rates of clearance for the cases with physical evidence are significantly higher in most cities while controlling for the presence of suspects, witnesses and speed with which crimes are reported to, or responded to, by the police.

At the court level, cases with forensic evidence result in significantly higher rates of conviction than cases without this evidence. The cases with physical evidence tend to go to trial a higher percentage of the time; also, the physical evidence cases in which the laboratory reaches a common origin conclusion are more likely to be adjudicated at trial. Rates of dismissal are higher when the laboratory results either disassociate or fail to associate the defendant with the crime.

Although it is not possible to compare the dispositions of homicides, rapes and arsons using this evidence/no evidence dichotomy, it is possible to look at their court dispositions while controlling for laboratory results. In the offense category of homicide, rates of conviction are higher in cases with common origin laboratory results in two jurisdictions (Kansas City and Oakland). In rape cases, the rates of conviction are higher in all jurisdictions when semen is identified or other evidence linking the suspect with the victim is found. But the differences are statistically significant only in Chicago and Oakland.

Estimating the Effects of Physical Evidence on Clearance and Conviction Using Log-Linear Analysis

The marginal effects of physical evidence on clearance and conviction were investigated in Chapter VI while controlling for the effects of other factors, such as the identity of a suspect, presence of witnesses or citizen report/police response time. Typically, analyses are

made by calculating the clearance or conviction rate for cases with and without physical evidence with the control variables at specified levels. The question arises as to whether the lack of control for these other explanatory variables at the same time may cause the results to be misleading.

Chapter VII reports on the results of a more sophisticated analysis to quantify and model the simultaneous, joint effects of physical evidence and several other independent variables on selected dependent variables. Three models are presented which describe the effects of scientific evidence on clearance and conviction. The advantage of this approach is that the interactions and differential effects of physical evidence on the dependent variables (clearance and conviction) can be estimated that might otherwise go undetected.

The results show that the effects of physical evidence on clearance and conviction depends upon the jurisdiction being discussed and the class of offense in which the evidence is examined. Generally, evidence has its greatest impact on clearance of robberies and burglaries in the jurisdictions of Peoria and Oakland. Moreover, the effects of physical evidence depends upon the presence or absence of witnesses and suspects at the time the preliminary investigation is initiated. Scientific evidence has its greatest effect on clearance when suspects are <u>not</u> in custody or named and placed at the outset of the investigation. On the other hand, physical evidence has a higher association with clearance when witnesses are present. In assault cases physical evidence has its highest association with clearance when <u>both</u> suspects and witnesses are available at the time of the crime report.

The presence of physical evidence is associated with the greatest increase in odds for conviction in Kansas City, followed by Oakland, Peoria and Chicago. As in the previous examination of clearance odds, the analysis shows that it is necessary to control for both offense category and jurisdiction in estimating the effects of evidence on conviction. Evidence generally has its greatest effect on robberies and burglaries, but with a negligible effect on assaults (except for Kansas City). Upon contrasting the effects of common origin laboratory results with all other forms of laboratory results, it is found that only in the category of burglary do these more specific laboratory findings have an observable effect on increasing the odds for conviction.

Conclusions, Recommendations and Future Research

The final chapter of the report offers a number of policy recommendations for police agencies and crime laboratories and suggests possible directions for future research.

Policies for Improving the Use of Physical Evidence

These policy recommendations are based on the findings of the current research and fall into six primary areas:

Patrol Operations - Patrol units must not only fulfill their traditional responsibilities of evidence recognition and crime scene preservation, but must also follow more explicit and systematic guidelines as

to when evidence technicians are to be called to the scenes of crimes and their responsibilities once technicians arrive.

Crime Scene Operations - Technician units should be placed in the same organizational unit as the crime laboratory. In addition, technicians' crime scene and investigative roles and responsibilities should be expanded and their incidental technical and evidence courier activities reduced.

Criminal Investigations - Investigators should adopt more rational guidelines, including consideration of potential physical evidence, in deciding if to investigate crimes. Investigators should recognize the value of physical evidence in making arrests which have a greater probability for resulting in convictions. Detectives, also, must work more closely with crime laboratories in assigning priorities to cases submitted for analysis.

Crime Laboratory - Laboratories must take a more active role in developing policies guiding the investigation of crime scenes and the setting of priorities for the examination of cases in the laboratory. Laboratory managers must not allow the demand for examining high volume evidence categories to consume an inordinate portion of scientific resources, at the expense of cases where more detailed and time-consuming analyses are required. Laboratories must also adopt management reporting systems to permit an ongoing assessment of the impact of physical evidence on case investigations and prosecutions.

Prosecution - Prosecutors should provide feedback to laboratories on the dispositions of all cases involving physical evidence. In order to improve communications one suggestion offered is to designate a forensic science resource person in the prosecutor's office who can coordinate inquiries, investigations and overall liaison with the laboratory.

Police Administration - The top level administration of the parent law enforcement agency should develop greater awareness and sensitivity to the needs of their crime scene search and laboratory operations. They must also see to it that well-defined and realistic policies are formulated and followed, to guide the search for, collection, and examination of physical evidence. They should also support the conduct of research in their laboratories and investigation units to assess the impact of physical evidence.

Future Research

Additional research is needed in the forensic science - criminal investigation area to develop more detailed evaluations of scientific services and their role in the investigation of cases. A prerequisite for engaging in future research, though, is a laboratory-based case management reporting system. Such a system would permit laboratories to trace the flow and outcomes of cases in which physical evidence is examined. Only with such a system can laboratories begin to collect, in a cost-effective fashion, the necessary data for defining the contribution of evidence categories to the investigation of different crime categories.

With a management reporting system in place, two basic types of research are recommended: one quasi-experimental and the other experimental. The quasi-experimental studies would entail making improvements or intensifying evidence utilization efforts in a particular crime category or, perhaps, a geographical area of a city. The purpose would be to measure the differences in the rates of clearance, arrest, charging and conviction of cases. The experimental design would require that cases reported to the police be randomly assigned to experimental and control groups. The experimental cases would receive intensive crime scene search and evidence evaluation while the control cases would either not be examined at all, or receive only routine processing. Such a design would permit researchers to isolate the effects of the physical evidence and laboratory analysis on the cases in question in a far more controlled and rigorous fashion than either the quasi-experimental design or the archival, case records approach used in this study.

CHAPTER I

PROJECT BACKGROUND AND OVERVIEW

Introduction

Fifteen years have passed since the President's Commission on Law Enforcement and Administration of Justice (1967) published its report on crime and the American system of justice. This multi-volume report underscored many glaring deficiencies in the system and set into motion a massive federal program to strengthen law enforcement and to upgrade generally the quality of justice. Although the federal block grant program has been phased out, research in criminal justice, and the police area in particular, has continued to improve and to challenge long-held theories and assumptions about crime control policies. This "what works and what doesn't work" approach to research has sought to identify those agencies and programs which contribute to the goals of the justice system from those which do not.

One area of law enforcement which has been studied and critiqued extensively in recent years is the criminal investigation function. Several studies (discussed in greater detail in the next chapter) have found that detectives are largely unsuccessful in solving crimes and that if a suspect is not in custody or identified at the preliminary investigation level, the chances for solution are extremely remote. A second area which has received far less attention concerns the contribution made by physical evidence to criminal investigations. This latter subject is the focus of this report.

This research is long overdue. Greater reliance on physical evidence and scientific methods of inquiry by the police has been advocated by such a distinguished body as the United States Supreme Court in Escobedo v. Illinois, 378 U.S. 478, 488 (1964). Similarly, the Police Task Force of the President's Crime Commission (1967) called for more resources to be devoted to physical evidence processing as did the National Advisory Commission on Criminal Justice Standards and Goals which recommended:

> Every state and every police agency should acknowledge the importance of efficient identification, collection, and preservation of physical evidence; its accurate and speedy analysis; and its proper presentation in criminal court proceedings. These are essential to professional criminal investigation, increased clearance of cases and, ultimately, the reduction of crime . . . (1973:299).

Spurred on by court decisions which restricted traditional police interrogation practices and the influx of federal funds (LEAA), the number of state and local crime laboratories increased from about 100 in 1968, to more than 250 in 1978 (Forensic Sciences Services, 1979). The increase in the nation's drug and alcohol abuse problem also served as an important stimulus to the expansion of forensic laboratory services. Police departments also greatly expanded the size and scope of their crime scene investigation operations and placed added emphasis on evidence recognition and collection training programs for recruit and inservice personnel. Despite this increase in resources and emphasis on professionalism, the literature has been practically void of evaluations of these scientific services.

That forensic science and crime laboratories are of some intrinsic value to the police has never been questioned. An explanation of their

value, however, is usually anecdotal in nature. Over the years, the worth of a crime laboratory to a police agency has hinged primarily upon its performance in a handful of celebrated cases.

On the other hand, forensic scientists believe their profession to have practically unlimited, if undeveloped, potential to aid criminal investigators. The fact remains, however, that most investigators do not look to the laboratory for help in developing leads or the generating of new suspects. Rather, they seek corroboration of a suspect's involvement with fingerprints or some other type of associative evidence, or possibly the identification of some type of contraband. What value can be placed on this corroborative evidence, and can it be expressed in such terms as clearances, arrests or arrests leading to conviction?

In response to these basic questions, the National Institute of Justice funded this project in the fall of 1979. Based on a grant to the Forensic Sciences Foundation, with a subcontract to the University of Illinois, this project addressed the following questions:

- What categories of physical evidence are collected from the scenes of major crimes and which types are most successful in linking offenders with these offenses?
- Does the collection and examination of physical evidence have an appreciable effect on the clearances of criminal investigations?
- How does the value of physical evidence compare with other types of information or strategies employed by detectives in investigating crimes?
- What effect does physical evidence have on the quality of arrests, expressed in terms of the fraction of arrests which lead to conviction?

- To what extent does the utility of physical evidence vary from one jurisdiction to another?

- May guidelines be developed to assist crime scene technicians, detectives and criminalists in determining in which types of offenses physical evidence is most likely to have the greatest payoff?

Report Organization

This report is intended principally for the chief executives and research administrators of police departments and crime laboratories; individuals who formulate policy and decide the level of resources to be allocated to the collection and analysis of physical evidence. This summary report is accompanied by a Technical Appendix which provides greater detail on the methods of data collection and statistical analyses presented in this report. Following a brief discussion of the research methods used in this project, the remainder of the report is divided into the following chapters:

Chapter II Summary of the Literature

This chapter reviews the literature to date on the collection and analysis of physical evidence and its use in criminal investigations.

Chapter III Characterizing Cases in the Study Sample

A description of the cases in the study sample and a review of the process in which physical evidence is collected, and submitted to laboratories for analysis.

Chapter IV — Investigative Uses of Physical Evidence

A review of the types of investigative information which may be derived from physical evidence, as illustrated through several case studies.

Chapter V — Physical Evidence and Laboratory Results

A discussion of the results of laboratory testing of the primary categories of physical evidence.

Chapter VI — Physical Evidence, Clearance and Conviction Conclusions and Recommendations

A comparison of the rates of clearance and conviction of cases with and without physical evidence.

Chapter VII — Estimating the Effects of Physical Evidence Using Log Linear Analysis

A multivariate analysis of cases employing clearance and conviction as response variables.

Chapter VIII — Conclusions, Recommendations and Future Research

A final summary chapter containing policy recommendations and suggestions for future research.

Methodology

Background

The purpose of this study is to describe the types of physical evidence used most frequently in criminal investigations, to summarize the information derived from this evidence through scientific testing, and to estimate the effects of this information on case outcome.

Prior studies of criminal investigation have focused principally on the following: the activities of detectives; the strategies they employ in deciding which cases to investigate; and the value of information collected from such sources as victims, witnesses, informants, and departmental files. Since the collection of physical evidence is a task no longer performed by most detectives, these studies have not treated scientific evidence with any detail. Practically the only physical evidence category which has received any attention is fingerprints (Greenberg, et al., 1973:66; and Greenwood, et al., 1975:84). Fingerprints have been shown to have only marginal value to the total volume of crime routinely investigated, identifying suspects in about 1% of burglary offenses (Greenwood et al.,93). At the individual case level, however, fingerprints have been found to be significantly associated with clearance of burglaries (Greenberg, et al.,1973 and Eck, 1979) and rank with suspect information and witnesses as one of the leading factors capable of forecasting case outcome.

From a crime laboratory standpoint, though, fingerprints are not usually given a high priority. Scientists in the laboratory seldom devote much time to fingerprint development or comparisons; this task

has been assumed principally by police identification units. The major evidence processing activities of contemporary crime laboratories are centered in the areas of serology (bloodstain and semen examinations), firearms and toolmarks, trace evidence (glass, paint and fibers), accelerants and explosives, drugs and narcotics, and questioned documents. But since these evidential categories are used infrequently, when compared with fingerprints or other testimonial evidence, little is known about their contribution to the apprehension of offenders or the clearance of cases. It is the value of these forms of physical evidence, ones requiring scientific analysis, which is the focus of this study.

All of the above factors were taken into consideration in the selection of the data collection approach used in this study. Data collection in the four sites spanned an eighteen month period from September 1980 to February 1982. Two different categories of cases were chosen for examination, those that had physical evidence collected and examined, and those that did not.

Physical Evidence Cases - To answer the question of what contribution physical evidence makes in cases where it is collected and examined, a number of cases were to be reviewed where evidence was actually analyzed. The only practical way to achieve this goal was to make a random selection of cases from crime laboratory files where evidence had been examined. These cases were drawn principally from the crime categories of homicide, rape, robbery, aggravated assault, burglary and arson. (Only two laboratories routinely examined arson-related evidence during the period of this study.)

A decision was made not to sample cases where evidence was gathered but never examined. There were two primary reasons for this: first, the principal study objective was to determine the effects of physical evidence and this could only be accomplished if, in fact, the evidence was analyzed; and secondly, a preliminary review of case files where evidence was collected but not examined revealed these cases seldom had suspects and were almost always suspended or closed for lack of information. Such cases would tell us little about the value of the evidence.

Non-Physical Evidence Cases - In order to attain the goal of determining what difference the physical evidence makes, a comparison sample of cases without physical evidence was drawn. In this way the outcome of a variety of cases could be compared, controlling for the presence or absence of scientific evidence. The only major crime categories where this proved feasible were robberies, aggravated assaults, and burglaries since it was found that some physical evidence was practically always collected in other offenses of interest, such as homicides and rapes. As a result, a comparison of the outcome of cases with and without physical evidence could only be accomplished in these three crime categories.

Once the cases were selected, the main police file on each incident was consulted. This file contained: the initial police report; the detective's report(s); all follow-up supplemental reports; statements taken from witnesses and suspects; the arrest report; crime scene report; and other miscellaneous documents. These police files contained the primary information collected and analyzed during the study.

The crime laboratory file folder was also reviewed for each case. These files generally contained an evidence inventory record, the

examiner's work sheets and notes, photographs and the laboratory report itself. Occasionally notes of conversations between examiners and investigative or prosecutorial personnel were also included.

In addition, prosecutor and/or court files were reviewed to determine the judicial outcome of cases where one or more suspects had been arrested and officially charged. Up to three defendants were tracked for each offense.

In total, approximately 1,600 cases with analyzed physical evidence and 1,100 cases without physical evidence were reviewed during the study. (See a summary of these cases in Tables I-1 and I-2). These offenses represent cases sampled randomly from among the major offense categories in which evidence was routinely processed by the particular laboratory. In this way, the cases sampled reflect the major offenses handled by those laboratories while providing a sufficient number of cases of similar offense types to make interjurisdictional comparisons.

Two additional samples were also collected. One which contained cases where only fingerprints were examined, and another where suspected contraband (drugs) was the only evidence collected. These cases will be treated individually in Chapters V and VI.

Data Collection Instruments

The physical evidence survey instrument addresses the following five stages of an investigation.

> Initial Crime Report - Information about the offense, when and where it occurred, and how it came to the attention of the police was recorded.

TABLE I-1

TOTAL CRIMES IN PHYSICAL EVIDENCE SAMPLE

Crime Classification	Jurisdiction				Total
	Peoria	Chicago	Kansas City	Oakland	
Homicide	29	72	51	71	223
Other Deaths	21	7	0	1	29
Rape/Sex Offenses	53	53	49	70	225
Robbery	17	36	57	39	149
Aggravated Assault	66	62	49	34	211
Burglary/Property	55	80	52	42	229
Arson	2	40	44	0	86
Weapons Related	39	24	0	4	67
Drugs	52	54	46	73	225
Fraud/Forgery	0	13	55	0	68
Other	48	15	1	15	79
TOTAL	382	456	404	349	1,591

TABLE I-2

TOTAL CRIMES IN NON-PHYSICAL EVIDENCE SAMPLE

Crime Classification	Jurisdiction				
	Peoria	Chicago	Kansas City	Oakland	TOTAL
Robbery	65	54	113	99	331
Aggravated Assault	78	50	84	103	315
Burglary	102	89	147	99	437
TOTAL	245	193	344	301	1,083

Preliminary Investigation - This section focused on the seriousness of the offense, the relationship between victim and suspect, the presence of witnesses, and the location and identification of possible suspects.

Follow-up Investigation - A summary of steps taken by investigators to identify, locate or link suspects with the crime was made. Included here were the various procedures taken by investigators as well as the types of information they collected.

Physical Evidence - This section described the principal locations searched for physical evidence, the types of evidence collected, reasons why it was collected, the results of laboratory testing, the speed with which results were reported, and the value of the evidence to the investigation.

Judicial Outcome - All cases with arrests were followed to their final disposition in the courts, recording initial and final charges, the mode of adjudication, verdict, and sentence given the defendant(s).

The nonphysical evidence case survey instrument is an abbreviated version of the physical evidence form, which permits the recording of information about the offense, the investigation of the crime and the judicial outcome. The survey instruments and a complete discussion of case sampling and review procedures may be found in Appendix A.

Study Sites

The sample of cases was taken from four different jurisdictions selected on the basis of their range in population, geographical location and resources devoted to physical evidence collection and analysis. Common to all jurisdictions, though, was an attitude of complete cooperation by laboratory and police officials, a willingness to grant our staff access to all relevant records and case files, and a sincere interest in trying to answer the questions identified at the outset of the project.

Peoria, Illinois

Peoria is the smallest jurisdiction in the study, reporting a population of 126,639 in 1979. (All population, crime report, and number of police employees data were taken from the Uniform Crime Reports for 1979.) Peoria is located 160 miles southwest of Chicago on the western shore of the Illinois river. Peoria is a manufacturing center, producing earthmoving equipment, steel, wire and distilled spirits. Peoria is approximately 88% Caucasian and 12% Black and the average unemployment rate in 1979 was 5.3%. Approximately 12,000 index crimes were reported to the Peoria Police in 1979, for a rate of 95.9 serious crimes per 1,000 population. The police department had 317 full-time employees, 218 of whom were sworn personnel. The department's criminal investigation division had 35 investigators organized into three basic units: vice and drug, juvenile and detection (personal and property). Peoria County is in the 10th Judicial Circuit of Illinois where in 1979-1980 1,077 felony cases were filed. Peoria County has approximately 13 state's attorneys and 9 part-time public defenders.

The Peoria Police Department has a crime scene unit (CSU) of six officers (including one sergeant), and is located within the department's general services division. This unit underwent expansion and upgrading in the delivery of crime scene services in the 1970's. The CSU was involved in a special physical evidence project in 1977-1978 and doubled its coverage of residential burglary crime scenes from 30% to 60%. (See the article in the January 1979 issue of Police Magazine entitled, "Forensic Science: Overburdened, Underutilized".) The crime scene unit investigated the scenes of 2,679 crimes in 1979.

Official department policy requires beat officers to call an evidence technician to the scenes of all serious crimes. In addition to crime scene work, the CSU also takes and develops photographs of crime scenes and accidents; classifies and files fingerprints; searches these files and compares fingerprint cards with latent prints developed at crime scenes; and transports physical evidence to the Illinois Bureau of Scientific Services Laboratory in Morton, Illinois. Peoria is the only city in the study in which the CSU officers conduct their own searches of department fingerprint files. In other departments, this function is performed by special fingerprint examiners.

The Morton laboratory is ten miles to the east of Peoria and in 1979 employed a total of nine scientific examiners. This regional laboratory is part of the larger State of Illinois Scientific Services System comprised of eight forensic laboratories. The Morton laboratory has capabilities in drug chemistry, bloodstains, hairs and fibers, firearms and toolmarks, arson accelerants, latent fingerprints and the polygraph. The laboratory examined a total of 2,697 cases in 1979, with the Peoria Police Department submitting 251 of these cases. About sixty percent of the crime laboratory's caseload are drugs and narcotics. During the study period, if the Morton laboratory did not have the capability of examining a particular type of evidence (glass, for example), it would send the evidence to one of their sister laboratories in the state system.

The major distinguishing features of the Peoria jurisdiction are: a police department which places great emphasis on physical evidence and devotes a greater than average share of its personnel resources to evidence collection and analysis; a cohesive, well-trained, and highly

motivated crime scene unit; a regional crime laboratory with the capability to examine most physical evidence categories and a moderate caseload; and a judicial system which is very aware of the capabilities and limitations of scientific evidence.

Chicago, Illinois

The largest jurisdiction in the study, Chicago, is the seat of Cook County and has a population of about 3 million persons. Chicago is the chief industrial, transportation, retail and wholesale trade and financial center of the Midwest. The city is approximately 66% White and Hispanic, and 34% Black. Unemployment in 1979 averaged 5.7%.

There were 186,728 index crimes reported to the Chicago Police Department in 1979. In that year, the police department employed approximately 13,642 persons, 12,392 of whom were sworn personnel. The department's criminal investigation division of 1,200 investigators was organized in the following way during the year of the study: burglary, robbery, homicide/sex, and general assignment units were divided into six geographical regions; three centralized (bomb/arson, financial and narcotics) units; and two geographical (North/South) stolen auto units.

The Chicago laboratory, in addition to its being one of the earliest pioneering criminalistics enterprises in the nation, is also widely recognized for its crime scene investigation training and ride-along programs. The crime laboratory division was for many years located within the Bureau of Criminal Investigation of the department but has since been placed under a new Bureau of Technical Services. The crime scene function, which answers to the director of the crime laboratory,

has about 95 officers and is divided into two basic units: the evidence technician unit, which provides coverage to all property crime scenes and less serious crimes throughout the six major geographical areas of the city, and a 30 member, centralized mobile crime laboratory unit which responds primarily to the scenes of death investigations and other major crimes. The mobile unit is an elite group, dressed in civilian clothes and works out of unmarked vehicles.

The evidence technicians, in addition to their crime scene responsibilities, are also responsible for photographing scenes of traffic accidents and lineups, administering breathalyzer tests in district stations and transporting rape kits and other physical evidence to the crime laboratory. The crime scene unit handled more than 38,000 crime scenes in 1979.

The Chicago Crime Laboratory, founded in 1930, received approximately 25,600 cases for examination in 1979. The 50 scientific examiners in the laboratory are divided into five primary divisions: microanalysis; firearms; toolmarks, questioned documents; and chemistry. (The polygraph unit is not included in this particular study.) Drugs and narcotics constituted about 55% of the laboratory's caseload in 1979, with another 24% of cases directed to the microanalysis section which handles all serological and trace evidence examinations. The firearms section examined about 2,000 fired evidence cases in 1979 and checked an additional 18,000 confiscated weapons. The Chicago laboratory is the only one in the study with a fully staffed questioned documents section. Chicago, also, is the only laboratory which has its own, specialized, toolmarks unit.

The Chicago, Cook County court system is among the largest in the country with about 175 trial court judges, 400 state's attorneys and 250 public defenders. Approximately 15,000 felony case filings were recorded in 1979-80.

It is this issue of volume which also distinguishes the evidence collection and examination activities in Chicago from the other jurisdictions. The criminal investigation function and particularly the evidence collection and crime laboratory functions must contend with an overwhelming number of incidents where potential physical evidence is present. Case volume directly affects the ratio of crime scenes searched, the amount of evidence collected, the ratio of cases with physical evidence which receive analysis, and the resources which can be applied to individual cases. Caseloads and backlogs are such that much evidence is examined only upon request of the prosecutor.

Kansas City, Missouri

Kansas City is one of the two medium-sized jurisdictions in the study. Located in Western Missouri at the confluence of the Kansas and Missouri rivers, Kansas City's population was 462,914 in 1979. Kansas City covers a very large geographical area (316 square miles) extending into three counties. The population is approximately 78% Caucasian and Hispanic and 22% Black. Kansas City is an established manufacturing and distribution center, with many businesses in printing, publishing and food processing. The average unemployment rate in 1979 was 5.2%

The Kansas City Police Department had 1,709 employees in 1979, 1,192 who were sworn personnel. Approximately 42,000 index crimes were

reported to the Kansas City police in 1979. The police department has a long history of engaging in research and experimentation in alternative policing strategies. The investigation bureau of the Kansas City Police Department is comprised of seven basic divisions: narcotics, crimes against persons, crime against property, fraud, juvenile, investigative support and criminalistics. The criminalistics division is divided into three units: polygraph, crime scene investigation and the regional crime laboratory.

The 22 officers in the crime scene unit serve the three primary geographic areas of the city. Unlike most evidence technician units, the Kansas City crime scene investigators do not work in uniform and drive unmarked vehicles. The police department emphasizes the investigative role of these officers, in addition to their evidence collection responsibilities. The goal of the unit is to process all major crime scenes. The district patrol officers search for latent prints at the scenes of routine property crimes. Kansas City also has a policy that patrol officers are to remain at the scene until a crime scene investigator arrives. The regional criminalistics laboratory, located in Independence, Missouri since its inception in 1973, recently moved to a downtown, Kansas City location. In addition to providing scientific services to the Kansas City Police Department, the laboratory also examines evidence for surrounding police agencies on a fee basis. The laboratory has 13 technical examiners, including two police officers in a fingerprint and photo section.

The primary scientific sections of the crime laboratory are: trace evidence and serology; firearms and toolmarks; and chemistry/instrumentation. The laboratory processed a total of 10,926

cases in 1979, 81% of which were submitted by the Kansas City department. Drugs and narcotics composed about 30% of this total caseload. The Kansas City Regional Laboratory uses a case management information system which permits the laboratory to summarize and analyze caseload trends to a greater extent than most crime laboratories in the nation.

The majority of persons charged with committing crimes in Kansas City are adjudicated through the Jackson County court system. The local Jackson County prosecutor's office has 35 district attorneys and the public defenders office has 20 attorneys. There were approximately 3,452 felony case filings in Jackson County in 1979-1980.

A distinguishing attribute of Kansas City is its well-integrated crime scene and crime laboratory function within the department's Bureau of Investigations. The laboratory has written policies regarding evidence priorities and criminalists make a concerted effort to coordinate their examinations with priorities and activities of investigators. At the prosecution level the Jackson County District Attorney's Office places major emphasis on physical evidence in deciding whether to file charges against defendants and in preparing cases for prosecution.

Oakland, California

The fourth study site, Oakland, is the seat of Alameda County and is located on the East shore of the San Francisco Bay. Oakland had a population of 344,686 (1979), 46% of whom were White, 45% Black, 7% Asian and 2% Hispanic. Oakland is a center of manufacturing, distribution, retail trade and medical care. Unemployment in 1979 was at the 8% level.

The Oakland Police Department reported 41,269 index crimes in 1979, making Oakland's per capita crime rate the highest of all four cities (119.7 crimes per 1,000). The police department had 602 sworn officers and an additional 271 civilian employees. Approximately 147 officers were assigned to the bureau of investigation, which is divided into the criminal investigation division, internal affairs, community services, vice, youth and criminalistics. The CID is divided into homicide, assault, robbery, burglary, theft and consolidated services sections.

The Oakland Police Department has, like the other study sites, participated in numerous research projects over the past several years. As a result of sharp budget and personnel cutbacks in recent years it has acquired a reputation for "learning to do more with less." One example is a downtown foot patrol project which is totally funded with donations from the private business community.

Oakland's twelve evidence technicians operate out of the department's patrol division. When not searching crime scenes, these officers are also expected to perform general patrol activities. With the exception of Peoria, which depends upon a state criminalistics facility for evidence processing, the Oakland crime scene unit is the farthest removed from its crime laboratory. The Oakland laboratory, founded in 1944, is the smallest of all study site laboratories with five scientists and two fingerprint examiners. Firearms and toolmarks, trace/serology and chemistry (drugs) constitute the primary units of the crime laboratory. The Oakland laboratory is unique from other jurisdictions in that scientific personnel regularly rotate case examination responsibilities to distribute the drug and narcotic workload. The laboratory handled approximately 2,736 cases in 1979, with the great majority being in the areas of fingerprints, drugs and narcotics.

The limited scientific resources are what distinguish the Oakland jurisdiction from the other sites in the study. As the remaining chapters will show, Oakland's resources permit them to examine only the most serious offenses in which physical evidence is collected. The Oakland Police Department has the lowest ratio of patrol officers, crime scene technicians and scientists to the number of index crimes reported of all the other jurisdictions in the study.

The reader is referred to Appendix A for additional information describing the staffing, budgetary, and operating characteristics of these agencies.

CHAPTER II

PHYSICAL EVIDENCE AND THE INVESTIGATION OF CRIMES: A BRIEF SUMMARY OF THE LITERATURE

This chapter provides a brief overview of research which addresses the examination of physical evidence in crime laboratories and its use in criminal investigations.

Physical Evidence and Crime Laboratory Studies

Beginning with Parker's survey of forensic laboratories in 1963, several efforts at measuring the actual use of laboratory services have been attempted. It was determined in this early study that less than 1% of the total criminal violations at the local level received laboratory examination. Since that time other studies have confirmed this low utilization rate. A project conducted twelve years ago by the California Council on Criminal Justice (Rogers, 1970) estimated that only one-half of one percent of available physical evidence at crime scenes was actually forwarded to a laboratory for analysis. A query of laboratory directors in the mid-1960's found that "the number of crimes committed in their jurisdictions that should have been serviced by the laboratory was six to twelve times greater than the number of cases submitted. . ." (Joseph, 1968). A study of capital cases in the State of Illinois found that scientific evidence was used in only 25% of these serious crimes, with the evidence restricted to three forms: firearms, blood typing and fingerprint comparison (Lassers, 1967). The use of other categories of physical evidence was practically nonexistent.

Why the low utilization rates? It certainly is not due to the lack of available physical evidence. A study by Parker and Peterson in 1972 showed that in 88% of the crime scenes they visited, collectible physical evidence was present. In 1972 Parker and Gurgin at Stanford Research Institute described the existing relationship between reported crime and the laboratory as follows: "The singular most impressive finding of this analysis was that criminalistics is disproportionally utilized in cases of suspected possession and/or use of drug compounds." They also reported that while laboratory casework in drug analysis had increased significantly over the past ten years, casework in the major crime areas had been almost constant or had decreased in some areas. The overloaded conditions in the laboratory due to drug cases appear to have deterred police officers from using the laboratory in other types of crime. Ward (1970) concluded in his national study of detective units that drug and narcotic evidence had displaced the physical evidence which would normally have been examined in such crimes as burglary and robbery.

An explanation of the low utilization of physical evidence was described by Peterson in 1974. He showed that the physical evidence screening process resembled an inverted pyramid where at each downward-succeeding level of the investigative process a decision maker screens out some amount of potential evidence until very little is left for processing by the time the apex (the crime laboratory) is reached. The patrol officer, the crime scene evidence technician and the detective all play important roles in determining which crime scenes are investigated for evidence, what physical evidence is collected and which items are ultimately examined in the laboratory.

Whether or not the small amount of physical evidence that does enter the criminal justice system has an impact has been difficult to ascertain. Researchers attempting to answer this question have run into extremely fragmented and inadequate recordkeeping practices. Tracking cases through the justice system where evidence has been examined in the laboratory is also very difficult. A study conducted by the Midwest Research Institute concluded that:

> . . .the involvement of the crime laboratory in the total body of crime has been so miniscule as to preclude judgment as to the impact of criminalistics on the criminal justice system (Benson et al., 1970).

Another study of laboratory effectiveness which confronted these same problems was conducted by Calspan Corporation in 1974 (Rosenthal and Travnicek). This unpublished study attempted to analyze the effectiveness of using physical evidence during four stages of the criminal justice process: search, analysis, investigation, and adjudication.

As a result of the disparate and unsystematic recordkeeping procedures in the study sites, the Calspan study developed few empirically based conclusions concerning the utility of physical evidence in criminal investigations. One of the key findings, though, resulted from an examination of physical evidence cases at the court level: the use of physical evidence appears to increase the ratio of guilty pleas as charged to pleas of guilty to a reduced charge.

The report also includes a detailed discussion of potential measures of effectiveness which may be applied to criminalistics operations. Among the measures suggested in the CALSPAN report which may be relevant to the present research are: the ratio of resolved investigations with physical evidence compared with <u>all</u> resolved investigations; and the

ratio of convictions with physical evidence compared to all convictions. The authors noted that record management systems in most laboratories require upgrading and expansion in order to make such measures operational. The report also made a number of recommendations for improving the use of physical evidence. These recommendations centered on improved communications among investigators, prosecutors and criminalists, and improved training programs for the nonscientific users of forensic evidence. Better integrated recordkeeping systems were also recommended so that patterns of usage and measures of impact might actually be monitored on a regular basis.

Crime laboratory based studies todate, therefore, have been unsuccessful in assessing the role or impact of physical evidence in a statistically reliable fashion. Nevertheless, forensic laboratory services have continued to expand under the assumption that forensic evidence does make a difference. The next section examines the relationship between physical evidence and the criminal investigation function.

Investigative Studies

The area of police investigations most closely aligned with the functions of the crime laboratory has been the use of the crime scene or evidence technician. O.W. Wilson (1960) was one of the first police administrators to define the need for evidence specialists to secure and protect the scene of the crime, collect relevant physical evidence and submit it promptly to a laboratory for analysis and interpretation. Wilson believed that investigations were bungled and valuable information destroyed due to the actions (or inactions) of patrol officers and

detectives who lacked the proper training in physical evidence recovery or were simply too busy with other responsibilities. He believed that crime scene specialists would minimize delays in responding to crime scenes, eliminate the unwarranted destruction of physical evidence, and increase the flow of evidence into the laboratory.

By 1967 most police departments across the nation had failed to take such steps, as reported by the President's Commission on Law Enforcement and Administration of Justice. The Commission advised that crime scene programs in police agencies were badly understaffed and that recruitment and training practices in these units were substandard. A study by the President's Commission on Crime in the District of Columbia (1966) found that less than 10 percent of Part I crime scenes received a search for physical evidence. A study by Isaacs and reported in the Science and Technology (1967) volume of the President's Crime Commission, found that evidence specialists were contacted about 40% of the time in a sample of 626 burglaries. Fingerprint evidence was "booked" in about 5% of these cases, which represented about 10% of cases where there were indications that evidence was available at the crime scene. No mention was made of other forms of evidence.

The Midwest Research Institute report on crime laboratories (Benson, et al., 1970) described the results of a small study in the District of Columbia, where approximately 70% of murders and rapes, 7% of robberies and 3% of aggravated assaults received a search for physical evidence by the department's mobile crime laboratory unit. Peterson (1974) reported on data collected from a California jurisdiction showing that about 18% of commercial burglaries and 9% of residential burglaries received a search by technicians. Latent fingerprints were collected from about half the crime scenes searched.

The recent Police Practices: The General Administrative Survey (Heaphy, 1978), conducted by the Police Foundation, found that 45 of those 50 responding police departments serving cities with more that 250,000 people have mobile evidence technician units. Departments deploy an average of four technicians per shift. The criminal investigation study by the Rand corporation (Greenwood,et al., 1975) surveyed departments with more than 150 full-time personnel in jurisdictions exceeding 100,000 population and found that 88% of them have specialized crime scene units. On the whole, crime scene personnel constitute 2.4% of the total police manpower in these departments.

The primary goal of the Rand study, however, was its evaluation of detectives and the larger investigation function. The scope of the study extended to the investigation of serious crimes and its objectives included assessing the contribution of such investigations to criminal justice goals, and finding the relationship of investigative effectiveness to differences in organizational structure, staffing, and procedures.

From a physical evidence standpoint, a key limitation of the Rand study was a decision to focus on burglaries and latent fingerprints. Petersilia explained, "we focus(ed) only on latent fingerprint collection and processing, since research has shown that other types of physical evidence are less important in most cases" (1978:158). This, of course, excludes from consideration the complete range of physical evidence other than fingerprints that is collected in personal and property crimes. This is unfortunate since crime scene technicians and laboratory scientists devote much of their time searching for, collecting and examining these other forms of evidence. The question remains: to what end?

Rand did conclude that physical evidence was available in most cases and latent fingerprints in over half. In a sample of 200 residential burglary cases taken from each of three cities, they found that in only about 1 percent of the cases in each jurisdiction was the offender identified as a result of the lifted prints. The rate of identification was insensitive to the percentage of scenes investigated by technicians and to the percentage of scenes where prints were actually recovered. Rand inferred from this finding that more technicians might have allowed for a higher rate of recovery of prints from scenes, but that this did not appear "to affect the rate at which fingerprint identifications serve to clear burglary cases." (Greenwood, et al., 1975:93). Rand concluded that more evidence is being collected from the field than can be effectively used and that more attention should be devoted to the processing of evidence after it is gathered. From the standpoint of fingerprints this would mean, first of all, limiting the size of fingerprint files in police departments by breaking them down by geographical area and, secondly, improving communications between the investigators who provide names of suspects to the fingerprint identification unit and the fingerprint specialists themselves. In spite of the limited pay off of fingerprints, "cold" searches of latent prints were actually found to be more effective than routine follow-up investigations by detectives.

In general, however, the key finding of the Rand study is that very few cases are actually solved by "investigation" in the popular sense of the term:

> The single most important determinant of whether or not a case will be solved is the information the victim supplies to the immediately responding patrol officer. If information that uniquely identifies the perpetrator is not present at the time the crime is reported, the perpetrator, by and large, will not be subsequently identified (Vol. 1, vi).

If the offender is not arrested at the scene, is not identified by the victim or an eyewitness, or if some uniquely identifying feature (such as a license plate number) is not obtained, there is little chance the case will be cleared. The essence of the Rand report is that classical investigation work, including the collection of physical evidence, does little to solve crimes.

Stanford Research Institute (Greenberg, et al., 1973) studied the activities of investigators in six Alameda County, CA. police agencies. The Stanford Research Institute (SRI) was to develop guidelines for burglary investigators to use in deciding which cases should receive follow-up investigations.

The SRI study sought to dissect the fundamentals of this investigative function by employing a computer analysis of information taken from burglary reports:

> The primary objective was to ascertain those informational elements that are essential to the investigation of burglary cases and to rely upon statistical analysis techniques to evolve those elements that are critical to the successful "closure" of cases, in effect, the Essential Elements of Information (EEI's) (5).

From the burglary reports, for example, 170 separate elements of information were identified. These were reduced to six categories of information for which a relative numerical weighting scale was devised. These six factors and their relative weightings were as follows: estimated range of time of occurrence (5); witness reporting of offense (7); "on view" reports of offense (1); usable fingerprints (7); suspect described or named (9); and vehicle description (0.1).

Using a value of 10 as a threshold, such that a case with a value greater than 10 is classified as "solvable", the model correctly classified cases about 80% of the time. In this model, usable fingerprints carried the same weight as "witness reporting of offense." Other physical evidence, and specifically toolmarks, were evaluated in the SRI study but were not found essential to case solution.

Greenberg concluded that inadequacies in the handling of information and physical evidence were primarily responsible for the low success rates achieved by police in burglary investigations. Great concern was expressed throughout the report for improving information systems in general. A suggestion was offered that a computerized regional information retrieval system be developed, with participation from local, state and federal agencies.

The Police Executive Research Forum (PERF) took the SRI statistically derived information model and tested its ability to predict burglary case outcomes in 26 police agencies from around the country (Eck, 1979). The ensuing analysis of approximately 12,000 cases found the SRI model to be accurate in predicting case outcome about 85 percent of the time. This replication study not only verified the reliability of the original SRI model but also has major implications for police managers. The decision model provides a powerful tool for police in screening out cases with a low probability for clearance, a procedure currently practiced by individual detectives largely on an intuitive basis. Also, it is the characteristics of the burglary cases themselves and the information collected in the <u>preliminary</u> investigation that determine case outcome and <u>not</u> information uncovered in subsequent follow-up investigations. This has important implications for forensic

operations since examinations in the crime laboratory are a "follow-up investigation" activity which, based on the PERF findings, may be irrelevant to the clearance of property crimes.

Judicial Outcome of Arrests

A number of writers in the policing field propose that a superior measure of the apprehension activities of the police, usually expressed in arrests or clearances, is the ratio of arrests which "survive the first screening level." (Hatry, 1975). Skogan and Antunes (1979) take this a step farther:

> Making an arrest is one thing; making an arrest that will result in an indictment and conviction is something else entirely. In some senses, a better measure of arrest productivity is the ratio of arrests resulting in conviction to crimes known to the police (248).

The growing literature which examines the disposition of police arrests at the court level is sobering. Vera Institute's study of felony case processing through New York City's courts found that 44% of 100,000 felony arrests made in 1971 were dismissed or acquitted and that only 15% of the defendants were convicted of felonies (Vera, 1977:6). Only 5% of all defendants received prison sentences prescribed for felonies. Rates of conviction varied widely depending upon the seriousness of the offense for which the defendant was arrested. Seventy-two percent of the homicide arrests resulted in a conviction, but only forty-one percent of the assaults. Downgrading of charges and guilty pleas were much more prevalent in property and victimless crimes than personal, violent crimes.

The literature on trial courts, however, has paid little attention to the role of scientific or any other kinds of evidence in the case disposition process. Heumann (1978), for example, said little about evidentiary considerations because, in focusing on plea bargaining, he found that defense attorneys quickly learned of the factual and legal guilt of "approximately 90%" of their clients. Rosett and Cressey (1976) also downplayed the import of factual evidence in plea negotiations; they argued that attorneys found it easier to agree on disposition than on oft-ambiguous or disputed facts. Mather (1973) and Neubauer (1974) did find overall strength of evidence to be associated with the likelihood to go to trial. Eisenstein and Jacob (1977) gave the most sophisticated treatment of the impact of evidence on case outcomes in three cities -- Chicago, Baltimore, and Detroit. They found strength of evidence to be associated with the likelihood of conviction and the sentence imposed, but they acknowledged the crudeness of their measures of evidence. Furthermore, their analysis aggregated various types of evidence so as to preclude assessment of the impact of scientific or any other type of evidence.

Studies of the use and impact of scientific evidence at the court level have been even fewer in number. Kalven and Zeisel's (1966) classic research, The American Jury, included a brief overview of the use of expert witnesses at trial. They reported that no experts appeared in about three-quarters of criminal trials studied and in only 3% of trials did both sides employ an expert. Prosecutors used experts four times as often as defense attorneys. Lasser's (1967) survey of capital cases before the Illinois Supreme Court found what he considered to be an inordinate reliance on confessions and witness testimony at the expense of scientific evidence.

> We think our study shows an incredible lag in the employment of modern methods. The prosecution does use scientific evidence in upwards of 25% of all cases, but it relies almost exclusively on three forms of such evidence, the newest of which is 40 years old: firearms identification (so-called "ballistics"), blood typing, and fingerprint comparison (Lassers, 1967:310).

These findings run counter to attitudinal data collected by researchers such as Schroeder (1977) who, in surveys of judges and attorneys, found overwhelming support for the increased use of science in the courtroom.

The study What Happens After Arrest? (Forst, et al., 1977), conducted under the auspices of the Institute for Law and Social Research (INSLAW), provided a particularly revealing look at the outcome of more than 17,000 arrests for felonies and serious misdemeanors processed through the United States Attorney's Office in the District of Columbia in 1974. More than 50% of these arrests were rejected or dismissed by prosecutors, with fully 70% not resulting in a conviction of any sort. Only 13% resulted in felony pleas or verdicts (Forst, 1977:17).

The INSLAW study was successful in identifying certain police activities and types of information which had a high association with arrests that led to a conviction. These activities included locating two or more witnesses to the offense, making prompt arrests and recovering tangible evidence.

> When tangible evidence, such as stolen property and weapons, is recovered by the police, the number of convictions per 100 arrests was 60 percent higher for robberies, 25 percent higher for other violent crimes, and 36 percent higher for nonviolent property crimes. (Forst, 1977:42).

It was not clear which, if any, of this "tangible" evidence was scientifically examined. In sum, therefore, the INSLAW study clearly speaks to the value of tangible evidence but sheds little light on the value of scientifically analyzed evidence.

Summary

There are very few studies which have evaluated the impact of physical evidence on the investigation and prosecution of offenses. The unpublished Calspan research suffers from an insufficient data base. The SRI and Rand reports restrict their evaluation of physical evidence basically to the use of fingerprints. The INSLAW study employs a very general and nonspecific category labeled "tangible evidence". Although the present report certainly does not resolve all the questions about the value of scientifically analyzed evidence, it does provide new insights into patterns of recovery of evidence from the scenes of crimes and the types of cases routinely routed to the laboratory for analysis. More definitive results have also been attained regarding the success of laboratories in responding to questions about evidence posed by investigators and the effects of evidence examined by the laboratory on the outcome of cases.

CHAPTER III

CHARACTERIZING OFFENSES WHERE PHYSICAL EVIDENCE IS COLLECTED AND EXAMINED

Introduction

A citizen called the police department to report a robbery in progress. When officers arrived at the scene, two suspects escaped through a backdoor, abandoning their white pickup truck. The evidence technician unit was called and the scene was processed for evidence. Several glove prints were developed. Latent fingerprints were also collected from the abandoned vehicle, along with several other items of evidence, including stolen credit cards and a pair of rubber gloves.

The truck was registered to a ficticious person, but with the address of two brothers known to the police investigators. Several of the latent fingerprints collected from the truck and from the credit cards (which were later determined to have been stolen in other robberies) were identified by the laboratory as being the prints of the brothers. Glove prints from the robbery scene were similar in their class characteristics to the gloves found in the truck. Approximately ten days before this robbery, a mother and daughter had been found shot to death in front of their apartment building. The daughter was semi-nude, and although no semen evidence was found, the investigators suspected that a rape attempt might have occurred. The victim's car was processed for latent prints during which an apparent glove print was collected.

The pattern of violence apparent in the cases to which the brothers had been tied already made them prime suspects in this double murder as well. Upon interviewing friends of the two brothers, investigators developed information that they had been bragging about their recent crime spree and kept their handguns hidden in the shrubbery just outside their home. Two revolvers found hidden near their home were submitted to the laboratory for examination. Laboratory examination established that several of the bullets recovered from the bodies of both women had been fired from each of the recovered handguns. In addition, the glove prints found on the murder victims' car were similar in their class characteristics to the rubber gloves found in the pickup truck.

The truck also fit the description of a vehicle sighted a few days before in a rape/robbery in which shots had been fired. The laboratory compared bullets recovered

in that case with the guns recovered from the brothers. Although a conclusive identification could not be made because of the poor condition of the recovered bullets, their class characteristics were consistent with those of one of the revolvers. Similarities were observed in some of the individualizing features as well.

The pattern of violence in the above cases proved similar to the modus operandi of a string of rapes and robberies committed during a three month period over a five county area. Upon completion of the investigation, both brothers were charged with these additional crimes. The laboratory results played a crucial role in the prosecution of the offenders. Each of the brothers was convicted of more than 50 felony counts, including 2 murders, 10 rapes and 25 robberies.

This actual case, taken from the files of one of our participating laboratories, is an unusual one and not representative of the typical cases handled by a crime laboratory. It does, however, vividly illustrate the potential role of physical evidence within the context of an ongoing criminal investigation. The purpose of this chapter is to prepare a foundation for the discussion and analysis of data collected during the study, by describing the process by which physical evidence is recognized, gathered and submitted to the laboratory for analysis. Accordingly, this chapter has two primary objectives.

- To provide a general framework of criminal investigations and identify several key levels in that process which influence the recognition, preservation, collection, and examination of physical evidence; and

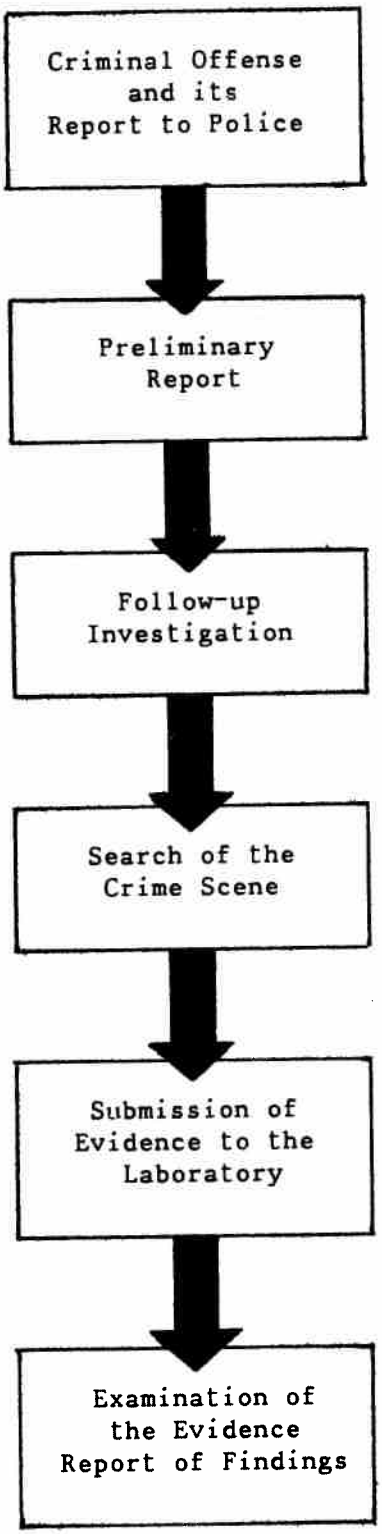
- To introduce the discussion of data collected in the study by describing: the types of offenses in the sample; the notification and response patterns of the police to these crimes; various investigative steps taken by investigators and the types of information they collect; and the types of physical evidence collected and examined.

It is important for the reader to keep in mind that the cases discussed in this chapter are only those where physical evidence was collected and examined by the respective crime laboratories. This discussion neither includes cases where physical evidence was not collected nor cases where evidence was gathered but was not analyzed.

This chapter is organized into six basic sections corresponding to the general flow of an investigation where physical evidence is collected and submitted for analysis. The six stages are depicted in flow chart form in Figure III-1. The discussion begins with the initial stage in which the criminal offense is reported to the police.

FIGURE III-1

PHYSICAL EVIDENCE FLOW CHART



The Criminal Offense and its Report to Police

Time Elapsed From Crime to Report/Arrival

The time elapsed from the commission of a crime until it is reported and responded to by the police has long been considered an important factor affecting the ability of police to locate and arrest offenders. From a physical evidence standpoint, reponse time has also been considered critical since as more time passes the likelihood that the evidence will become contaminated or destroyed increases.

It was possible to make an estimate of elapsed time in the current study by taking recorded times directly from the police incident reports. All jurisdictions estimated the time of occurrence of the crime. However, due to differences among cities, we did not record police response in an identical fashion; in Peoria and Oakland we recorded the time the crime report was made to the police, while in Chicago and Kansas City we recorded the time the first officer arrived at the scene. A second qualifier to the "response time" estimate is the way in which this variable was defined on the data collection instrument; it asked coders to measure the elapsed time categorically, in the following way: 10 minutes or less; more than 10 minutes and up to 60 minutes; and more than 60 minutes. In retrospect, we would have had greater flexibility in our analyses had this been made a continuous variable and actual times recorded.

Because in Peoria and Oakland we recorded the time at which the call was received, it is not surprising to find that, overall, there is a greater percentage of offenses from these cities where this interval

is 10 minutes or less than in Chicago and Kansas City. At the extremes, 76% of the Peoria offenses were reported to the police within 10 minutes of their occurrence; while in Oakland only 41% of offenses were responded to by the police within 10 minutes of their occurrence.

The other trend which stands out across all jurisdictions is that homicides, robberies and assaults are generally reported/responded to more quickly than rapes and burglaries. In Chicago, the largest jurisdiction, about two-thirds of homicides, robberies and assaults are responded to by police within 10 minutes of their occurrence, but only one-third of burglaries, and less than one-fifth of rapes. In Peoria, the smallest jurisdiction, between 85%-90% of homicides, robberies and assaults are reported within 10 minutes, as are 64% of burglaries and 42% of rapes.

Location of the Offense

Outdoor crime scenes present a greater challenge to investigators than do indoor scenes in the physical evidence gathering process. Single family residences are generally considered to be more orderly and cleaner than multi-family dwelling units and non-residential/commercial establishments. The cleaner the environment the easier is the task of sorting the evidence from extraneous material.

All evidence technicians expressed their aversion to searching filthy scenes of crimes. It is extremely difficult to find usable latent fingerprints or trace evidence in such locations. Technicians feel obliged to make an effort, though, if for no other reason than to maintain good public relations.

Overall, about 20%-30% of offenses in the total sample were committed out-of-doors. Peoria had the highest percentage of cases (37%) occurring outside. Multi-family dwellings are the most common crime scene locations in Chicago (35%) and Oakland (28%) , while non-residential locations (37%) are predominant in Kansas City. These differences are primarily a reflection of the different types of crimes in the respective samples. The Morton laboratory processes considerable evidence from robberies, assaults and weapons violation cases, most of which originate on the street. In Chicago and Oakland, the higher proportion of homicides, sex crimes and assaults occurring in multi-family living units make these locations the leading category. Kansas City has a high percentage of non-residential offenses such as robberies, burglaries and fraud/forgery crimes.

Commercial establishments present special problems to technicians since the proprietors are anxious to clean up the scene and resume normal business activities. The volume of traffic in and out of such establishments also makes the task of locating relevant evidence that much more difficult. A fingerprint recovered from the counter of a busy supermarket could belong to any one of hundreds of neighborhood patrons. The greasy conditions in many fast-food restaurants make the finding and lifting of latent fingerprints a frustrating assignment.

Reporting the Offense to the Police

The victims of crimes report most of the offenses to the police which lead to evidence being examined in Kansas City (54%), Chicago

(43%) and Oakland (32%), while other nonwitness citizens are the most frequent reporting group (28%) in Peoria. The majority of rapes, for example, are reported by victims in Chicago, Oakland and Kansas City, while some other citizen, such as a friend or neighbor, reports rape offenses most often in Peoria. The victims of robberies and assaults most commonly report their crimes to the police in all the study cities. Burglaries fit this trend in the same three cities, where victims are the primary reporting group. But in Peoria it is the police who initiate most of the burglary crime reports where evidence is gathered. Such cases result from officers observing burglaries in progress or situations where a building that has been broken into is first noticed by the police.

Taking the Preliminary Report

This stage includes a number of important decisions and actions which affect the outcome of the investigation as well as the collection of physical evidence.

Did the Offender have Contact with the Scene or Victim?

Visible signs of struggle, injury or breakage assist the patrol officer in determining the nature and legitimacy of the alleged offense. Such signs are also indicative of the presence of potential physical evidence. About 75% of burglary/property crimes in the cities where physical evidence is collected and examined involve a significant and observable interaction between the offender and the scene. Burglaries

where force was not used to make entry to the building would very likely not be reported to a technician unit, unless department policy mandates it. In the area of personal crimes, a very high percentage of homicides and virtually all sex crimes involve significant physical interaction between the offender and victim. The cities differ in the category of robbery, where only a quarter of these offenses in Peoria and less than half of the cases in Kansas City involve appreciable physical contact between the assailant and the victim. But, more than 70% of the robberies in Chicago, and almost 90% of robberies in Oakland involve a physical confrontation between the offender and victim. This suggests that robberies may be more violent in Oakland and Chicago. A more likely explanation is that the Oakland and Chicago crime scene units and laboratories screen out evidence except from only the most serious cases--offenses where injuries are sustained by the victim.

Protection of the Crime Scene and Preservation of the Evidence

All police training guides admonish the patrol officer and detective to protect the crime scene upon arrival and to prevent unauthorized individuals from disturbing the scene. The fragile, transient nature of physical evidence allows it to be easily contaminated or destroyed through careless handling. The police reports have been perused for indications that such protective measures were taken by the police, but the narratives rarely contain an account of such procedures. In the few cases in all cities where this has been noted, more than half are homicide/death investigations.

Patrol officers seldom rope off a crime scene or ban other police personnel from the scene except in the most extraordinary situations. Most officers are rather blase about taking such steps and are more interested in interviewing witnesses and completing their preliminary report so that they may resume patrol activities.

Kansas City has the only explicit policy about officers remaining at the scene until crime scene investigators arrive. In Chicago, it is not at all uncommon for technicians to arrive at crime scenes where no other police personnel are present. In these situations technicians must either piece together the movements of the assailant by talking to witnesses or victims, or by reading a copy of the report left behind by a patrol officer. This makes the job of searching for relevant evidence that much more difficult.

Witnesses to the Crime

A higher percentage of offenses (50% +) in the Peoria and Oakland samples have two or more witnesses than do those reviewed in either Chicago or Kansas City. Peoria and Oakland also have a very low percentage of crimes, approximately 20%, where no witnesses at all are present. The victim is considered a witness if he or she observes the crime and/or offender and supplies this information to the police.

Approximately 50% of the homicides (ranging from a low of 40% in Peoria to a high of 60% in Oakland) in all cities have two or more witnesses. A very high percentage (90% in Oakland and 71% in Peoria) of robberies have witnesses in addition to the immediate victim. Almost 50% of sex offenses in Peoria and Oakland have witnesses in addition to

the victim, which is practically twice the frequency in the other two cities.

There are two contrasting theories concerning the role of witnesses in the utilization of physical evidence. Witnesses normally contribute valuable information about the criminal incident to investigators which may lead to the location and recovery of more physical evidence. For example, witnesses can relate how the offender gained entry to a dwelling or what he may have touched or moved. On the other hand, investigators may conclude that an offense witnessed by one or more persons reduces the necessity for the collection of physical clues. In property crimes, however, physical evidence is almost always desirable, even if there are witnesses, to conclusively place an offender inside a dwelling. In offenses with no witnesses whatsoever, physical evidence may still contribute to an arrest or conviction if it can be conclusively associated with a suspect.

Victim-Suspect Relationship

When the victim is a relative, friend or acquaintance of the suspect, it makes the task of locating the suspect far easier than in stranger to stranger crimes. At the court level, however, a prior relationship works in the opposite direction and serves to reduce the likelihood that a case will result in a conviction (Forst et al., 1982).

Overall, 50% of the offenses in Oakland, 52% in Chicago, 54% in Peoria, and 66% in Kansas City involve offenses where the offender has no prior relationship with the victim. Burglary, property offenses and robberies make up the bulk of these stranger to stranger crimes.

However, crimes of violence, homicides/ deaths and assaults, are most commonly committed between persons who do have prior relationships. A substantial percentage, 40% or more, of the sex and rape offenses in Chicago, Oakland and Peoria involve victims and offenders who have a prior acquaintance.

Status of Suspect Identification at the Preliminary Investigation

Knowledge of a suspect's identity is the most critical item of information in predicting if a case will be solved. On this basis alone, the cases routed to the crime laboratory from Peoria have an excellent chance for solution. About 50% involve a suspect in custody at the time the crime scene is searched. Forty-eight percent of the Peoria burglary cases involve a suspect in custody at the time the crime scene is searched. Robbery is generally the offense category where there is the lowest percentage, with only 24% of offenders in custody. Another 19% of the Peoria sample involves offenders who are either identified (named) or named and placed (residence or business address provided). About 70% of all the physical evidence cases, then, begin with knowledge of the suspect's identity and place of residence or business.

Forty-one percent of the Oakland cases have at least one suspect in custody at the time the search for evidence takes place. Rape/sex offenses have the highest rate with 59% having suspects in custody, followed by burglaries with a 56% in custody rate. Assaults and batteries have the lowest rate--only 31%. An additional 18% of the Oakland sample has offenders either identified (named) or named and placed at the outset of the investigation.

In Chicago, 34% of the offenses involve persons in custody at the time of the crime scene search. With the exception of weapons violation cases in which the suspect is in custody 80% of the time, assaults have the highest proportion of suspects in custody, or 53%. About 30% of the burglary offenses, 26% of rape offenses, but only 13% of arsons have a suspect in custody. Another 17% of the Chicago cases have a suspect identified or named and placed.

Only 19% of the offenses sampled in Kansas City have suspects in custody. Assaults have the greatest percentage of suspects in custody with 34%, while arson cases have the fewest, with just 2% of the offenses having a suspect apprehended immediately. An additional 14% of the Kansas City cases commence with a suspect who has been identified and/or placed.

On the basis of suspect information alone, it is clear that the Peoria cases have a greater chance for clearance than do those in Oakland, Chicago or Kansas City. From a suspect identification standpoint, the cases worked in the Kansas City laboratory have a much lower likelihood for clearance than those cases examined in the other three cities' laboratories. The presence of suspects also has implications for the types of evidence and standards which are recoverable. The value of much physical evidence depends upon recovering a standard from a known source, which is commonly the suspect. The relationships found among the identification of suspects, the collection of various types of evidence, the value of that evidence, and the clearance of cases is a common theme discussed throughout the remainder of this report.

The Decision to Investigate

The submission of physical evidence to the laboratory for analysis in all of the cases in this sample is the primary indicator that a decision has been made to apply investigative resources to these cases. But what other strategies do investigators use in addition to submitting evidence to the laboratory?

Investigative Techniques Used

The various investigative steps and information gathering methods used and reported by investigators in their reports are discussed below.

Follow-up Interviews - Follow-up interviews by investigators are standard procedure in more than 80% of the physical evidence cases in Chicago and Peoria. Kansas City and Oakland engage in re-interviews to a lesser extent - about 70% of such cases. Rapes and sex crimes practically always involve follow-up interviews, while burglaries and property investigations use this approach the least.

Canvass of the Neighborhood - A canvass, or door-to-door search for suspects or witnesses, of the neighborhood is a less frequently used approach. It is noted in about 20% - 40% of the offenses across all four cities. Canvasses are used most frequently, or 85% of the time, in homicide investigations in Oakland, in robbery (53%) and arson (52%) investigations in Chicago and in homicide (65%), sex (43%) and burglary (42%) investigations in Kansas City.

Vehicle Descriptions/License Checks - This information is collected by investigators in only about 10% of the offenses throughout all jurisdictions. Not unexpectedly, robbery is the offense category where this information is gathered most often: 24% of robberies in Peoria, 21% in Oakland, 14% in Chicago, and 16% in Kansas City.

Photos/Mugshots - While photos and mugshots are mentioned in only about 10% of the investigative reports in Peoria and Chicago, they are employed in about 35% of the cases in Oakland. More than half of these instances are robbery investigations.

Informants - Anonymous tips and information coming from unidentified sources are placed in this category. Informants are mentioned in only 5% of the cases in Peoria and Chicago and in only 10% of the cases in Kansas City. But, informants are mentioned in 20% of the investigations in Oakland, usually in conjunction with a homicide investigation. These percentages may not accurately reflect the actual use of informants since this is one type of information which investigators might intentionally exclude from their official reports.

Public and Private Records - Record searches of one type or another are cited in about half of the Oakland investigations and about one-third of the cases in the other jurisdictions. Record checks include everything from a check of fingerprint records to an inquiry about a stolen vehicle or other property.

Polygraph - The polygraph is used as an investigative tool in about 12% of the Peoria investigations, 8% of the Kansas City investigations, 5% of the Oakland investigations, but only 3% of the Chicago investigations. The Peoria and Kansas City cases primarily involve homicide and sex crimes investigations.

Line-ups and Interrogations - Case files were also checked for the use of line-ups and any record of police interrogations of suspects. Line-ups are seldomly used: 7% of the cases in Peoria; 11% of all cases in Oakland; 12% of the cases in Kansas City; and 15% of the cases in Chicago. In all four cities line-ups are used predominantly in robbery and rape/sexual offense investigations.

Suspects are interrogated in 63% of the Peoria offenses, 58% of the Oakland investigations, but in only about 45% and 40% of the offenses in Chicago and Kansas City respectively. These figures are not so much a reflection of a decision by investigators to question or not to question a suspect, but, rather,an indication of the higher percentage of cases in Peoria and Oakland where suspects are in custody or are identified at the outset of the investigation.

In Appendix B of this report, an estimate of the utility of these various techniques and types of information is presented. Various types of information and information gathering strategies are correlated with follow-up arrests--arrests taking place more than 10 minutes after the crime occurred. The naming and placing of suspects and the presence of witnesses are the two critical factors having the highest association

with arrest. Line-ups proved to be significant in sexual assaults and robberies, and vehicle descriptions proved to have a significant association with follow-up burglary arrests.

Decision to Summon a Crime Scene Specialist

Peoria has the clearest departmental policy of all the jurisdictions concerning when an evidence technician is to be summoned to a crime scene; they are to be called in all serious offenses including residential and nonresidential burglaries. The policies in the other jurisdictions are not as explicit leaving considerable discretion for patrol officers and detectives. In Chicago, the centralized mobile crime lab unit is called in all homicides and other violent personal crimes where the victim is gravely injured. Discretion is afforded patrol officers concerning when technicians are to be called to burglaries, lesser assaults, robberies and rapes. District commanders generally set policy for their respective districts. In Kansas City, crime scene investigators are to be called to all serious offenses. Lesser or property crimes are usually processed for latent fingerprints by patrol officers. In Oakland, where evidence technicians function out of the patrol division, there are no firm guidelines. However, patrol units are expected to call for a technician in serious offenses when physical evidence is thought to be present.

Response of the Evidence Technician to a Call for Service

The speed and directness with which the technician responds to a call for service depends upon several factors influencing his availability. If the technician is searching another scene or has a series of calls awaiting processing, the delay can range from a few minutes to several hours. A homicide or other serious violent offense will practically always merit an immediate response on the part of the technician.

While the processing of crime scenes for physical evidence is the main reason for the creation of these specially trained evidence technician units, officers within these divisions are given other responsibilities as well. Police agencies commonly call upon technicians to perform other technical duties: photographing of traffic accidents, suspect line-ups, and corpses at the morgue are common assignments. They also operate breathalyzers and take the fingerprints from deceased victims of crimes and prisoners in custody at the hospital. Technicians are often required to retrieve evidence which has been collected by medical personnel in hospitals, such as rape kits, clothing, bullets or other biological fluids, and to hand carry it to the laboratory for analysis. While these are all evidence-related duties, such activities restrict the amount of time technicians have to process crime scenes.

Peoria is unique from the other jurisdictions studied in that evidence technicians also spend about one-quarter of their time in the station comparing latent fingerprints collected from crime scenes against files of known offenders. While this takes time away from crime scene investigations, it serves a useful purpose in giving these techni-

cians immediate feedback on the usefulness of fingerprints gathered from the field.

Search of the Scene for Evidence

Percentage of Crime Scenes, Victims and Suspects Searched

Potential indicators of the thoroughness of the crime scene search effort are: first, the crime scene is searched; second, secondary scenes or locations are searched; and third, suspects or victims are searched for evidence. For example, in 80% or more of the rape cases in which evidence is examined in the laboratories in Peoria, Oakland and Kansas City, the crime scene is also searched. Then too, the victim is practically always examined at a medical facility. In Chicago, only 30% of the rape cases in which evidence is collected from the victim also include a search of the crime scene.

Overall, almost 20% of the total Chicago evidence sample does not involve a crime scene search. Only 7% of the Oakland cases, 6% of the Peoria cases and 4% of the Kansas City cases do not include a crime scene search.

More than 40% of the Peoria cases and 35% of the Oakland cases entail a search for evidence in more than one location, such as in a victim's home or car or the suspect's home or business. Or a search could be conducted at another location where a crime may have also occurred. Only 15% of the Kansas City cases and less than 4% of the Chicago cases include such multiple scene searches.

Any combination of scenes, suspects and victims searched is also recorded, including: scene and suspect; scene, victim and suspect; or suspect and victim. It is these latter combination searches which have the greatest likelihood of yielding evidence and standards which can associate persons and locations together.

Once again, Peoria and Oakland have the highest number of cases involving these multiple location searches with almost 60% of all cases falling into one of these multiple search categories. Chicago and Kansas City have significantly fewer of these multiple collection cases, with only about 25% falling into one of these categories.

Types of Evidence Collected

Chapter V treats this subject extensively. The basic categories of evidence that are collected in the major crime categories are listed in Table III-1. Firearms, fingerprints, blood, hair and semen are the primary categories of evidence collected and examined across all jurisdictions.

TABLE 1

TOP FIVE EVIDENCE CATEGORIES* COLLECTED BY CRIME TYPE

Crime Type	Peoria	Chicago	Kansas City	Oakland
Homicide/ Death	1. Blood (78%) 2. Firearms (71%) 3. Fingerprints (61%) 4. Hair (35%) 5. Fibers (18%)	1. Blood (84%) 2. Firearms (68%) 3. Fingerprints (42%) 4. Other Weapons (20%) 5. Other Biol. (11%)	1. Fingerprints (94%) 2. Blood (88%) 3. Firearms (77%) 4. Hair (33%) 5. Fibers, Toolmarks (6%)	1. Fingerprints (86%) 2. Blood (78%) 3. Firearms (76%) 4. Other Biol. (25%) 5. Hair (22%)
Rape/Sex	1. Hair (92%) 2. Semen (75%) 3. Blood (52%) 4. Fingerprints (23%) 5. Fibers (12%)	1. Semen (90%) 2. Blood (35%) 3. Hair (35%) 4. Other Biol. (27%) 5. Fingerprints (20%)	1. Semen (88%) 2. Hair (78%) 3. Fingerprints (47%) 4. Blood (31%) 5. Fibers (8%)	1. Semen (84%) 2. Blood (76%) 3. Hair (69%) 4. Other Biol. (59%) 5. Fingerprints (27%)
Robbery	1. Firearms (41%) 2. Blood (35%) 3. Fingerprints (29%) 4. Hair (18%)	1. Blood (51%) 2. Firearms (49%) 3. Fingerprints (20%) 4. Other Weapons (14%) 5. Quest. Doc. (11%)	1. Fingerprints (79%) 2. Firearms (30%) 3. Hair (12%) 4. Blood (5%) 5. Tracks; Toolmarks (4%)	1. Firearms (64%) 2. Fingerprints (54%) 3. Blood (34%) 4. Containers; Tracks; Other Weapons (5%)
Aggravated Assault	1. Firearms (75%) 2. Blood (26%) 3. Fingerprints (21%) 4. Hair (4%) 5. Paint (4%)	1. Firearms (61%) 2. Blood (40%) 3. Quest. Doc. (17%) 4. Other Weapons (13%) 5. Hair (3%)	1. Firearms (92%) 2. Fingerprints (16%) 3. Blood (8%) 4. Hair (2%)	1. Firearms (81%) 2. Blood (33%) 3. Other Weapons (13%) 4. Fingerprints (21%) 5. Misc. Organic (17%)
Burglary	1. Toolmarks (35%) 2. Glass (34%) 3. Fingerprints (32%) 4. Firearms (20%) 5. Blood (9%)	1. Toolmarks (38%) 2. Fingerprints (34%) 3. Blood (25%) 4. Firearms (18%) 5. Quest. Doc. (14%)	1. Fingerprints (71%) 2. Glass (15%) 3. Blood; Toolmarks (14%) 4. Fire Related; Tracks; Paint (8%) 5. Hair (4%)	1. Fingerprints (55%) 2. Glass/Plastics (31%) 3. Tracks (19%) 4. Blood; Firearms; Toolmarks (12%) 5. Paint (7%)
All Crimes	1. Firearms (52%) 2. Blood (32%) 3. Fingerprints (28%) 4. Hair (23%) 5. Semen (14%)	1. Firearms (40%) 2. Blood (38%) 3. Fingerprints (23%) 4. Quest. Doc. (13%) 5. Semen (12%)	1. Fingerprints (63%) 2. Firearms (29%) 3. Blood (21%) 4. Hair (18%) 5. Fire Related (14%)	1. Blood (52%) 2. Fingerprints (49%) 3. Firearms (47%) 4. Hair (24%) 5. Semen (23%)

*Excludes drugs, clothing and photos

Submission of Physical Evidence: Procedures and Purposes

Following collection of the physical evidence from the crime scene, hospital or morgue, the evidence is customarily hand carried to the respective police agency's property storage area or the crime laboratory itself. The evidence may remain in the property room for several days, weeks or months when standards (or knowns) are unavailable, when suspects are not yet identified, or generally when the investigation is without leads and is likely to be suspended or terminated. Laboratories prefer that this evidence awaiting examination be stored in a location external to the laboratory since space is at a premium in these facilities. Maintenance of the chain of custody is of foremost concern to the police personnel and the laboratory because a break in the chain may result in the evidence being ruled inadmissible in court. Subsequently, detailed reporting procedures are in place to document the storage and exchange of evidence from the evidence collectors to the examiners.

In rare instances the laboratory may not accept the evidence being submitted on the grounds that it is contaminated or has been compromised in some fashion. A good example would be where clothing from the victim of a homicide and the suspect are both packaged in the same sack. Other perishable evidence, if not stored properly, may putrify or be rendered useless. For the laboratory's own protection and reputation, examiners are careful to evaluate incoming evidence and to note any irregularities so that, subsequently, they will not be charged with carelessness or mishandling of the evidence.

In some situations the crime scene officer's purpose for submitting the evidence is explicitly stated in his report, as in cases where the laboratory is asked to compare "Item A" with "Item B" to determine if they had been in contact with each other or possibly originated from the same source. In most cases, it is possible to infer the purpose by reading the evidence collector's narrative and the reports of the other personnel involved in the investigation. This would be the case in a rape investigation where vaginal swabs and pubic hair samples are collected from the victim and submitted for analysis along with pubic hair and blood samples from a suspect. The laboratories can deduce that the purpose of these submissions are to: one, determine if evidence of spermatozoa or seminal fluid can be found to help substantiate the statement of the victim and establish an element of the crime; and two, to associate the offender with the victim through an examination of the hair samples and through a comparison of the secretor status and blood group of the suspect with the secretor status and blood group exhibited by the semen found in the victim.

In general terms, evidence is submitted for evaluation for one or more of the following reasons:

Establishing an Element of the Crime

Cases of suspected drug possession provide one example where the identification of the substance is one of the crucial items of information required to prove the crime. Another example would be searching for the presence of semen from a rape victim to prove penetration and sexual intercourse. Finally, the finding of an accelerant at the scene of a suspected arson can be used to show the fire is of incendiary origin.

Identification of a Suspect or Victim

Fingerprints most commonly fulfill this objective, such as when the taking of prints from an unidentified homicide victim may lead to his or her identity. Also, the finding of latent fingerprints at the scene of a crime may be used to identify an otherwise unknown offender. Given the problems of searching fingerprint records with a latent fingerprint of an unknown assailant, it is rare that fingerprints are actually successful in identifying an unknown offender.

Associative Evidence

Many types of evidence exist which may be useful in associating victims and suspects with one another, with various physical environments and with tools or instruments of the crime. Most evidence is collected for this reason. While not usually submitted to show a negative association, evidence may also prove to be disassociative and show that the persons in question have not come in contact with one another.

Testing Statements and Alibis

Evidence is also commonly accumulated for the purpose of testing, verifying or refuting statements or alibis provided by victims, witnesses or suspects. For example, paint may be collected from the fender of a suspect's automobile in a case of hit and run to test his claim that foreign paint on the auto's fender is the result of an earlier collision with a neighbor's truck.

Reconstruction

Evidence may also be collected for the primary purpose of determining how a particular crime could have occurred or to reconstruct the movements of the offender, victim, vehicle, or instrument of the crime. A powder pattern on the shirt of a shooting victim, for example, can indicate the distance between the victim and the shooter when the shot was fired.

Corroboration

Evidence may also be submitted to corroborate the information investigators collected from other sources. In fact, many of the preceding reasons can also be classified

as corroborative. For example, a suspect is apprehended at a burglary scene and fingerprints are collected to associate the suspect with that location, but also to corroborate the statements of witnesses.

Case Outcome

Clearance of Cases

All cases reviewed are classified as being one of the following: cleared by arrest, cleared exceptionally, not cleared, and unfounded. The clearance classification given each case by the respective police department is the one employed throughout this report. Unless otherwise indicated, the term clearance includes both clearances by arrest and exceptional clearances.

Oakland - Overall, 84% of the cases reviewed from the Oakland laboratory are cleared (72% by arrest and 12% exceptionally). Ninety-six percent of the rape/sex offenses are cleared, as are 87% of the robberies and assaults. Homicides are cleared at a 70% rate.

Peoria - In all, 78% of the cases reviewed in Peoria are cleared (68% by arrest and 10% exceptionally) with the highest categories being aggravated assaults at 89% and weapons violation cases at 92%. Sexual offenses have the lowest rate of clearance at 62%.

Chicago - In Chicago, 65% of the laboratory cases are cleared (55% by arrest and 10% exceptionally), with sexual offenses having the highest rate of clearance at 90%, followed by weapons violations at 88%. Burglary and property offenses have the lowest rate of clearance at 43%.

Kansas City - Forty-nine percent of the cases reviewed in Kansas City are cleared, 45% by arrest and 4% cleared exceptionally. Kansas City has the lowest rate of exceptional clearances. Homicides and other death cases have the highest rate of clearance with 80%; assaults are next highest at 68%. On the low end of the spectrum, the fraud and forgery cases have a clearance rate of 32%, while arsons have the lowest rate at 12%.

When these rates of clearance are compared with overall rates (See Table III-2) reported by the individual police departments, a major elevation of rates of clearance in the cases where physical evidence is examined is very apparent. The question which immediately comes to mind is: are these higher rates of clearance due to the physical evidence being examined or are other intervening factors at work? This relationship will be explored in detail in the remaining chapters of the report.

Two additional observations are in order at this point:

o Kansas City has the lowest rate of clearance for all major offenses, except for murder, where Oakland has the lowest. The police in Kansas City offer one highly plausible explanation; they employ much more stringent criteria in clearing a case. According to the depart-

TABLE III-2

CRIMES REPORTED TO THE POLICE AND
PERCENT CLEARED *
(1979)

Offense	Jurisdictions				
	Peoria	Chicago	Kan. City **	Oakland	U.S. Average ***
Murder	7 (100%)	856 (79%)	119 (71%)	108 (56%)	21,456 (73%)
Rape	80 (61%)	1,655 (55%)	436 (45%)	373 (53%)	75,989 (48%)
Robbery	351 (34%)	14,464 (45%)	2,651 (23%)	3,072 (20%)	466,881 (25%)
Aggravated Assault	1,352 (71%)	10,832 (68%)	2,736 (51%)	2,513 (65%)	614,213 (59%)
Burglary	3,109 (13%)	33,396 (27%)	12,254 (9%)	12,351 (10%)	3,299,484 (15%)
Larceny	6,691 (16%)	94,087 (37%)	20,275 (15%)	18,923 (18%)	6,577,518 (19%)

* Source of reported crimes and clearances: individual department annual reports and crime statistics.

** Clearance rates in Kansas City are noted as strictly clearances through arrest, i.e., there are no exceptional clearances.

*** Source: Uniform Crime Reports: 1979.

ment, clearance rate statistics published in their annual reports reflect only those offenses cleared by arrest and exclude exceptional clearances.

o Chicago has the highest rates of clearance in many categories, but particularly in robbery, burglary and larceny. In fact, in the crime categories of burglary and larceny, Chicago's clearance rates are more than twice the rates of the other jurisdictions.

It should be noted that the Chicago Police Department recently concluded an internal review of department practices with respect to the "unfounding" of cases -- or the practice of concluding that a crime reported to the police is, in fact, not a crime at all. This review was prompted by an investigative reporter's inquiry which found that Chicago detectives "unfounded" crimes at a rate many times higher than other large city police departments. Chicago police auditors took a random sampling of about 2,400 rapes, robberies, burglaries and thefts unfounded in the first ten months of 1982 and attempted to determine if they had been classified properly by checking with victims, witnesses and other relevant parties. The audit found that about 40% of these offenses had been dismissed improperly as "unfounded," and that only 18% of the unfoundings were considered to be proper (Wattley, 1983). Inspectors were unable to determine if the remaining cases had been properly founded.

The greater percentage of cases unfounded reduces the number of "founded" cases (thus lowering the crime rate); it also diminishes the denominator in computing the clearance rate and drives that percentage

upward. For this reason, the reader must exercise caution in interpreting the clearance rate figures for Chicago.

Prosecution

All cases in the study sample are tracked to their final conclusion at the court level. The dispositions of up to three defendants are recorded for each case. Initial or top charges are recorded for each defendant, as are the charges for which a final disposition is available. The legal procedure invoked, whether dismissal, plea, or trial, is noted, as is the final verdict and the sentence given the defendant(s).

Charging - Charges are filed against defendants in 69% of the incidents in the Peoria physical evidence sample. In all, 271 defendants, or 88% of persons arrested are charged in Peoria. In Chicago, charges are filed in 66% of the incidents where physical evidence is examined in the laboratory. A total of 256 defendants, or 75% of persons arrested are charged in Chicago. In Kansas City, charges are filed in 38% of the physical evidence cases reviewed. A total of 167 defendants are charged in Kansas City, representing 58% of persons arrested. In Oakland, 74% of the incidents result in charges, with 255 or 88% of the 291 persons arrested, being officially charged with a crime.

Convictions - Of the 271 defendants charged with offenses in Peoria, 177 or 65% are convicted of some offense. Ninety-four (53%) of these convictions are through pleas and 83 or 47% through trials. In

Chicago, of the 256 defendants charged, 152 or 59% are convicted. Eighty-seven defendants or 57% plead guilty and an additional 65 or 43% are convicted at trial. The tracking of cases in Kansas City reveals that a total of 75 defendants (45% of the 167 persons charged) are convicted, 62 through a plea (83%), and 13 (17%) at trial. In Oakland, 154 (60%) of the 255 defendants charged are convicted. Seventy-three percent of these convictions are pleas, and the rest are disposed of at trial.

Sentencing - In Peoria, of the 177 defendants convicted of some offense, 100 (56%) are sentenced to jail or prison. One defendant received a death sentence. In Chicago, 104 of the 152 defendants (68%) convicted of crimes are sentenced to jail or prison. Of the 75 defendants convicted in Kansas City, 50 (67%) receive prison or jail terms. There are 154 convicted defendants in Oakland, with 56% receiving jail or prison terms. Two defendants were given death sentences.

Summary

This chapter has introduced the discussion of research results by describing the process which guides the search for and collection of physical evidence. Descriptive information about the 1,600 physical evidence cases in the sample is presented and interjurisdictional differences noted. Explanatory variables are discussed beginning with the commission of the crime, its report to the police and on through the preliminary and follow-up stages of the investigation.

The following incident variables are shown to affect the gathering of physical evidence: the time lapse between the discovery of the crime and its report to/response by police; the extent of physical interaction between the offender and the scene or victim; the type of location where the crime occurs; the presence of witnesses and the identity and whereabouts of suspects. A high percentage of these investigations with physical evidence have a suspect in custody at the time the search for evidence takes place. Approximately one-half of the crimes in the Peoria and Oakland samples, one-third of the cases in Chicago one-fifth of the cases in Kansas City have suspects in custody.

Blood, hair, firearms and fingerprints are the forms of physical evidence most frequently collected and examined in the laboratory. Suspected semen is high on the list of physical evidence collected in sexual assault cases. Evidence submitted to the laboratory in burglary and property crimes usually falls into one of the trace evidence or toolmark categories in addition to fingerprints. Evidence technicians are the primary gatherers of evidence submitted to the laboratory.

Most evidence is submitted to the laboratory for the purpose of establishing an association among offenders, victims, crime scenes, and instruments (weapons, tools). In rapes and arsons, the primary objective of evidence submissions is to identify the suspected semen or volatile liquid to aid in establishing an element of the crime. Evidence is also submitted for the purpose of corroborating or refuting other information gathered by investigators from victims, witnesses and suspects.

The overall rates of clearance, charging and conviction of offenders in cases with physical evidence are reviewed. Very high rates of

clearance are found, ranging from 84% of the cases in Oakland to 49% of the cases reviewed in Kansas City. High rates of charging and conviction of defendants are also the rule. There is a strong indication at this early stage of review that physical evidence cases are quite special, if for no other reason than their success in surviving the numerous screening levels of the criminal justice system. The remainder of the report attempts to explain the reasons for this success.

CHAPTER IV

THE INVESTIGATIVE USES OF PHYSICAL EVIDENCE

Introduction

This chapter begins the discussion of physical evidence usage in criminal investigations by reviewing the priority systems used by laboratories to determine if and when submitted evidence will be examined. It continues with a review of the basic types of information the laboratory may derive through its examinations of various forms of evidence and how this information may be put to use by investigators. A laboratory results classification scheme is outlined which is employed throughout the remainder of this report to classify the empirical data collected during the present study. This discussion is supplemented with several case examples taken from the files of the laboratories participating in the study to illustrate better these laboratory results and their value to an investigation.

Decision to Examine the Evidence

Most laboratories exercise considerable discretion when deciding to examine an item of evidence, depending upon their own scientific assessment of the potential value of such analyses. Laboratories may defer the examination of evidence until a suspect has been located and standards taken. Laboratories will frequently not analyze bloodstains found at the scene of the crime unless a suspect is present from whom a comparative blood sample can be drawn. The laboratory's argument is that

such an examination, without the known blood sample, is pointless and of virtually no benefit to the detective searching for a suspect. Evidence can be refrigerated or frozen to preserve the bloodstain until such time as a suspect is found.

Peoria

Virtually all physical evidence submitted by the Peoria Police Department to the Morton Regional Laboratory receives an examination. The exception to this is the rare occurrence where the prosecutor contacts the laboratory and indicates the defendant has pled guilty and that the evidence is no longer needed. It should be remembered, though, that not all evidence collected from the field by Peoria technicians is automatically submitted to the laboratory for analysis. The evidence technician unit does exercise discretion in deciding which evidence is to be submitted to the state regional laboratory.

Chicago

Chicago resources do not permit all the evidence submitted to the laboratory to be examined. There are sections in the laboratory, however, where almost all submissions are examined--firearms, toolmarks, documents, and drugs for example. It is in the microanalysis section, though, where a large percentage of the cases go unexamined, due primarily to high caseloads and insufficient staff to handle the quantity of evidence submitted. Approximately 96% of the evidence in homicide/death investigation cases is examined. Seventy percent of burglary and rob-

bery evidence submissions is analyzed as is fifty percent of the evidence in assaults. Whereas, all rape kit evidence receives a preliminary evaluation and assessment, only 6% of the evidence from rape kits is fully examined and reported. See Table IV-1 for a complete summary.

Kansas City

Approximately 90% of homicide and drug and narcotic cases, and 100% of fraud/counterfeit cases submitted to the laboratory are examined. Fifty percent or more of aggravated assaults, arsons and rapes are examined, but slightly fewer than half of the robberies. Only about one-quarter of the evidence in burglaries receives an examination. Consult Table IV-2 for a detailed accounting.

Oakland

The Oakland situation is more difficult to interpret, since all examinations are not classified by crime type. The laboratory examines all drug and latent fingerprint cases which they are specifically requested to examine; but this represents only about 60% of suspected drug evidence seized and 40% of the latent fingerprints actually retrieved from the field. However, only about 60% of other general criminalistics and serology cases receive an examination. When "cases examined by crime type" is considered, we see that about 90% of the homicides receive an examination, as do three-quarters of the rapes. Virtually all the evidence submitted from burglaries is examined but

TABLE IV-1

CHICAGO CRIME LABORATORY

Percentage of Physical Evidence Cases Submitted to the Laboratory Which Are Examined

1979

Laboratory Section Evidence Category	Cases Submitted	Cases Examined	% Cases Examined
Firearms (cases with fired evidence	2,127	2,127	100%
Toolmarks	1,120	1,120	100%
Drugs/Narcotics	14,954	13,954	92%
Documents	1,389	1,320	95%
Arson	1,480	Sampled estimate	55%
Microanalysis:			
Rape/Sex offense	3,113	195*	6%
Death/Homicide	1,064	Sampled estimate	96%
Aggravated Ass./Battery	916	" "	49%
Robbery	210	" "	73%
Burglary	135	" "	71%

* In addition to these 195 cases which are completely worked and result in reports, a very high percentage of the remaining 3,000 cases involve the preparation of slides for microscopical analysis and also the administration of a preliminary chemical screening test for the presence of semen.

TABLE IV-2

KANSAS CITY

Percentage of Cases Submitted to the Laboratory
In Which Physical Evidence is Examined

1979

Criminal Offense	Cases Submitted	% of Cases * Examined
Homicide	237	86%
Drugs/Narcotics	1,666	93%
Aggravated Assault	655	59%
Rape	443	50%
Robbery	773	47%
Burglary	2,342	25%
Arson	326	58%
Fraud/Counterfeit	583	100%

* These estimates are calculated by taking a random sample of submitted cases and determining the fraction which has been examined and reported.

this is comprised almost exclusively of fingerprints. See Table IV-3 for a summary of these rates of examination.

Setting Priorities

It is evident from the preceding discussion that not all evidence submitted to crime laboratories is examined. What then are the criteria used to determine which cases will be examined? Although few laboratories have formal, written priority systems - Kansas City and Oakland are exceptions - for determining the order in which evidence will be examined, such systems do develop usually on an ad hoc basis. All other factors being the same, evidence is usually examined in an order which roughly coincides with the order in which it is submitted. This is especially true within major categories of evidence or within classifications of crimes. For example, suspected drugs and narcotics are normally placed in their own queue as they are submitted. Similarly, if one section of the laboratory, such as arson analysis, handles one class of crime exclusively, then these types of cases are placed in a similar, but separate waiting line. If several different samples of a particular evidence type can be examined simultaneously, such as with bloodstains, then the testing may be deferred until a sufficient number of samples are received before the testing is begun.

Crime laboratories have had to contend with lengthy case backlogs as a result of an increase in evidence submissions within recent years without a commensurate increase in staffing and physical resources. Backlogged evidence is stored in an evidence vault until resources are

TABLE IV-3

OAKLAND

Percentage of Cases Submitted to the Laboratory
In Which Physical Evidence was Examined

1979

Evidence Category	Cases Submitted	Cases Examined	% Cases Examined
Drugs/Narcotics	1,311	1,311	100%
Latent Fingerprints	1,205	1,205	100%
General Criminalistics (arson, paint, glass, hair, misc. evidence)	36	22	61%
Serology (blood and semen)	69	42	60%
Firearms	115	95	83%

Crime Category	Cases Submitted	Cases Examined	% Cases Examined
Homicide	98	87	89%
Rape	58	43	74%
Burglary	1,011*	1,003	99%

* About 99% of these burglary cases have latent fingerprints as the only form of evidence.

available to analyze the material. Within a given laboratory, however, one section may be current with incoming cases and providing results within a matter of days, while other sections may be weeks or months behind.

There are five basic considerations, then, which aid laboratory supervisors in setting priorities: Perishability of the evidence; seriousness of the offense; presence of a suspect; pressure applied by attorneys or other officers of the court; and the scientist's personal appraisal of the evidence.

Emergency Cases - Biological fluids are examples of an evidence category generally given automatic higher priority because of their perishable nature. A second example of an emergency case is where a suspect is in custody and an analysis of suspected drugs is required if he is to be held beyond 24 hours. Finally, a case can be going to trial where the district attorney requires an immediate analysis (see below).

Seriousness of the Offense - Cases of an extraordinary nature not only receive a higher priority by the investigations unit of the police department but also by the crime laboratory. Generally speaking, crimes against persons take priority over crimes against property and cases that receive extensive coverage in the media will be given a higher priority by the laboratory.

Suspects - As discussed previously, the presence of a suspect and corresponding standards collected from this person often are responsible for a case receiving higher priority. Depending upon the case and the

type of evidence, the absence of a suspect may result in a much lower priority being given to the evidence or it may mean that the evidence will not be examined at all. While some detectives are critical of the laboratory invoking such a priority system, laboratory supervisors are forced to employ some system and the presence of suspects is commonly one of them.

In Kansas City, for example, the laboratory has informed investigators that they are unable to examine burglary, robbery and aggravated assault evidence if no suspects have been identified. Other laboratories have invoked similar guidelines de facto. However, special requests or circumstances can override any of these priority statements.

Prosecutor and Judicial Requests - The more backlogged and overwhelmed laboratories become the greater the frequency that the decision to examine evidence is a direct result of a request from the prosecutor. Laboratories particularly strapped for resources will defer examinations until they are needed for court. In some respects this is the position in which the microanalysis unit of the Chicago laboratory finds itself. Its primary clientel has shifted from police investigators to prosecutors within the state's attorney's office.

Scientific Evaluation of Evidence - A final basis for assigning priorities to evidence submitted to the laboratory resides with the scientists themselves. Cases are usually given a cursory review upon submission. If this review is undertaken by a scientist who has a particular interest in this type of evidence or who is intrigued from a personal or research standpoint, then the examiner may elect to forsake

other considerations and examine the material. Such a personal assessment of the evidence is not that common in the larger laboratories where the bench worker rarely views the evidence until a decision has already been made by a supervisor to proceed with the examination.

The Kansas City Regional Laboratory uses a system in which the various section supervisors initially review incoming evidence. Then they contact a supervisory detective to determine what priorities the detectives have given these cases. In this way, the assessment by the examiner concerning what is scientifically possible with the evidence is integrated with the knowledge the investigator has about the case and the direction it is taking. The scientist and investigator then agree upon a priority list and the laboratory proceeds to examine the evidence in that order.

The Results of Laboratory Testing

The results of the laboratory examination of evidence is the goal of the evidence recognition and collection process. This section discusses the primary categories into which laboratory results have been classified in this study. This discussion is supplemented with several case examples taken from the files of the laboratories participating in the project, to illustrate better these laboratory results and their value to an investigation.

Identifications and Classifications

These tests enable the examiner to identify a substance, for instance that a stain is blood or white powder is cocaine. Tests also enable the examiner to put the material into a more restricted class identifying, for example, that a stain is human blood of Type A origin. Other examples include where examiners classify a bullet as being shot from a certain caliber firearm or a fiber as being rayon. The identification/classification process may be just the first step in a series of tests performed on an item of evidence.

Our first example discusses the importance of identifying body fluids in a case of suspected rape.

> Example One. Returning home from shopping, the victim left the front door ajar upon entering her apartment. When she returned from the kitchen to close the door, the suspect pushed his way into the apartment. He first demanded money, but, when she stated she only had $8, the offender then told her he was going to rape her. He threatened her with a knife and she undressed. He proceeded to rape her in her bed and then on the couch in the living room. The offender then ransacked the apartment and placed her three-piece stereo set into a green

plastic bag. He cut down her draperies, tied the victim up with the cordage and fled. She then screamed for help. Neighbors took her to a local hospital where she was treated and examined for possible evidence.

A suspect was stopped for routine questioning on the street by a partol officer who became suspicious of the plastic bag he was carrying. At the time, the patrolman was unaware of the alleged rape. During questioning the suspect gave the investigators evasive answers about the stereo equipment and was placed under arrest for suspicion of burglary. In the meantime, the rape investigators obtained a description of the suspect from the rape victim. Upon the suspect's arrest, it was determined that he fit the general description of the rapist. The suspect was placed in a lineup and the rape victim positively identified him as her attacker. Confronted with this information, he told investigators he "wanted to tell the truth" and confessed to the burglary, but denied raping the victim.

The crime laboratory received evidence collected in the rape kit and positively identified semen taken from the victim and her undergarments. This information corroborated the statement offered by the victim that she had been raped and offset the defendant's denial that he had sexually assaulted the victim. The offender was convicted of the rape charge.

Identification of accelerants oftentimes plays a key role in the arrest and prosecution of suspected arsonists.

Example Two. A young man suffering from severe burns ran into a district police station asking for assistance. He was rushed to a hospital where he was treated. He told police he had been working at a nearby printing business when two men with ski masks confronted him, threw some liquid on him and set him afire. At the hospital, however, investigators found a set of lockpicks in his pants pocket which he was unable to explain. The police contacted the caretaker of the building. He reported that his building had been locked for the night and no one had been working there earlier in the evening. Further investigation revealed that the printing company was heavily in debt and that a maintenance man reported delivering a fifty gallon drum of naphtha to the business a few days before.

The young man eventually confessed to the police that he had been offered payment by the owners of the press if he would set a fire. Laboratory examination of

his clothing and debris collected from the fire scene confirmed the presence of accelerants. The suspect, along with the owners of the business, were subsequently charged and convicted of arson.

The most dramatic of all identifications, though, is where an item of evidence found at a crime scene, assists in identifying an offender who would have otherwise remained unknown. Practically speaking, the only form of evidence with this capability is fingerprints.

Example Three. A night clerk was robbed and killed during a Christmas Eve holdup at a local motel. The crime scene unit was called to the scene and latent fingerprints were found on a metal cash box and on various papers that had been removed from the cabinet file safe. The latent prints on the metal surface appeared to be fresh. A latent fingerprint matching the one taken from the metal cash box was found on an envelope next to the body. There were no witnesses to the crime and the detectives had no good suspects.

With these latent prints a search was made of the crime scene unit's approximately 10,000 active suspect/known fingerprint cards. This search proved fruitless. A second general search was then begun of the department's main fingerprint records of over 140,000 individuals. This search paid off when the latent prints were found to match those of a prior criminal offender.

Armed with this information, investigators determined the suspect's current address and searched his room. Several packs of rolled coins reported stolen in the robbery were found in the suspect's bedroom, inside a wool cap. Several dog hairs were found in this same wool cap which were similar to dog hair found on the victim's trousers. Based largely on this physical evidence, the suspect was charged and convicted of first degree murder.

Common Origin

This term is used frequently throughout the remainder of the report and refers to a conclusion by the examiner concerning the origin or

source of two or more items of evidence. In other words, the examiner concludes that the evidence, an item of heretofore undetermined origin, and a standard, an item of known source, once shared a common origin. In so doing, the laboratory is able to associate persons, instruments of the crime and physical environments. The strength of this association varies from conclusive to one of probable or possible common origin. A conclusive association is illustrated by the following:

> Example Four. A robbery in progress call was received by the police. A suspect was apprehended a few blocks from the crime scene. Upon questioning, the suspect admitted the robbery and signed a confession. Subsequently, however, the defendant denied that he had made such an admission or had signed the confession. Handwriting exemplars were collected from his employer and these known handwriting standards were compared with the signatures he had made on each page of the confession. The laboratory, upon examining the signatures and known standards, concluded they had been written by the same individual. He subsequently pled guilty to the robbery charge.

> Example Five. A paraplegic in a motorized wheel chair was struck from behind while moving down the edge of the roadway at night. The victim had been seen by a witness and was found after only a few autos had passed by. The victim was dead on arrival at a local hospital. The body and chair were found some distance from the point of apparent impact.
>
> At first the police had no suspect. Then a citizen called the police and reported his neighbor's automobile fit the general description of the wanted vehicle and that it had been involved in a recent accident. The suspect's vehicle was processed by a crime scene unit and a damaged head light frame was recovered and submitted to the laboratory. Scratchmarks (toolmarks) found on the head light frame from the suspect's vehicle were identified as having been made by cooling fins on the wheel chair's power unit. This constituted a positive linkage between the automobile and the victim's wheelchair. The suspect pled guilty to leaving the scene of an accident involving a death.

Examples Six and Seven. Two equally interesting toolmark-striation cases were reported in another jurisdiction. The first involved a murder victim whose throat was cut with a knife. The trachea of the victim was recovered at the autopsy when distinct, microscopic striations or scratches were observed on this soft tissue. Later, a suspect's knife was submitted for comparative analysis. The microscopic examination of the markings on the trachea and the test marks made with the knife found them to be identical.

A second case involved a particularly brutal double homicide in which the victims were kicked, beaten and stomped to death. Investigators noticed rubber heel-like marks and scratches on the wall directly above where the victims lay. An examination of a suspect's boot revealed that a rivet on the side of the boot produced markings identical to those on the kitchen wall.

While it is primarily fingerprints, handwriting and striation evidence (firearms and toolmarks) which can yield findings of conclusive common origin, blood, hair and other trace evidence may yield results where the examiner states that two items probably or possibly shared a common origin. In the following case, several different items of physical evidence were found to be indistinguishable, and served to supply a strong linkage between the suspect and the crime.

Example Eight. The nude body of a 16 year-old female was discovered in a county park adjacent to a river. The scene revealed little but the body and a trail of blood, which covered more than one hundred feet through a gravel parking lot. A large clump of long blond hairs matted in the blood in the parking lot were later matched to the victim.

After the scene had been documented, the body was wrapped in a sheet and transported to the county morgue. Examination of the body revealed some sixteen stab wounds, in addition to a deep cut across the throat ending at the right ear. The body had suffered numerous abrasions and it was apparent that large quantities of both head and pubic hair had been pulled from the victim.

A further search of the park revealed several items of clothing - a pair of jeans, blouse, scarf, and socks. Some 175 pulled pubic hairs were recovered from these

items, all of which matched the victim. Seven black polypropylene fibers, 4 green nylon 6-6 fibers, and one Caucasian body hair, foreign to the victim, were recovered. In addition, a pink material, probably vomitus, was present on the jeans and formed a 3" wide ribbed pattern.

After about one week the investigation focused on a distant relative of the victim. His truck was searched and several blond pubic hairs were observed between the seat belt retractor and the seat. In addition, black polypropylene fiber floor mats over green nylon carpeting were noted.

A ribbed 3" pattern was observed in the seat design and a pink material was present in the seams of the seat. Small splotches of red material, later shown to be blood, were present on the headlights.

During the course of laboratory examination the pulled pubic hairs found in the suspect's truck were matched to the victim's pubic hair (including blood enzyme typing). The black and green fibers from the victim's clothing were matched to the mats and carpeting in the suspect's truck. The body hair from the victim's blouse was matched to the suspect's chest hair. The pink material from the victim's jeans was shown to be consistent with that from the truck seat in color and composition. In addition, the pattern of the vomitus material on the victim's jeans was shown to be indistinguishable from the pattern of the truck seat. One small splatter of blood from the seat was successfully typed. The type ('O') was the same as the victim's and different from the suspect's.

Two witnesses were identified who were able to state that a truck similar to one owned by the suspect was in the park shortly before the body was found.

The suspect was convicted of murder.

Reconstruction/Corroboration

An examination of the evidence may assist the investigator in determining how a crime has been committed. Such evaluations may indicate the movement and interactions of suspects and victims that might corroborate or refute statements by witnesses, suspects or victims. The

next example is a case where the physical evidence provided critically important corroborative information.

Example Nine. An elderly, semi-senile woman living alone was attacked in her home by three young men, who burst into her house intent on stealing a rumored (and non-existent) large amount of money she had secreted away. When she refused to produce the money, the suspects proceeded to abuse her, striking her about the head, smashing eggs in her face, and finally, tying her up in bed and sexually assaulting her. They then set fire to the bed, leaving their victim to her fate. The victim managed to struggle from the burning house and survived. She sustained minor burns, severe vaginal injuries and mental distress, resulting in her hospitalization in a psychiatric ward.

A neighborhood canvass led to information concerning the possible identities of the suspects, two of whom were subsequently apprehended. One suspect admitted the offense, but denied sexually assaulting the victim. This suspect later pled guilty as charged. A second suspect named by the first as being responsible for the sexual assault, told the investigating officers that he had thrown his bloody clothing in a garbage can behind his home shortly after the offense. Although he admitted being involved in the attempted robbery and physical assault, he denied sexually assaulting the victim. The victim identified the second suspect as having assaulted her, but her credibility was considered marginal because of her mental state.

The laboratory examined a pair of shorts recovered from the dumpster at the suspect's home and found a large bloody stain on the shorts, mixed with semen. Genetic typing of the stain demonstrated that the blood could not have come from the suspect, but was consistent with that of the victim. The combination of genetic markers found in the stain occurs in only approximately 3% of the population. The victim had been bleeding profusely from the vagina as a result of the sexual assault. The position of the blood on the fly of the shorts, and the fact that it was mixed with semen, supported the hypothesis that the stain was related to sexual activity.

The laboratory results served the dual purpose of corroborating the testimony of the complaining witness and of supporting the information from the co-defendent (whose statement could not be used against the suspect under California law).

Trial of the second suspect for rape with great bodily injury, arson, and attempted murder is pending.

This second case shows the value of physical evidence in reconstructing a crime.

Example Ten. Officers searching for a parking lot attendant who had failed to return home after work found his body in the trunk of his car parked several blocks away from his place of employment. His empty cashbox and a bloody knife were later found in a trash bin at the parking lot where he worked.

The victim had been stabbed several dozen times, but there was relatively little blood found in the car, leading the investigators to conclude that the stabbing had occurred elsewhere, possibly at the parking lot itself. Given the nature of the victim's wounds, it was evident that the scene of the stabbing should contain a large amount of blood. But a preliminary search of the parking garage had not revealed obvious blood stains.

At the request of the investigator, laboratory personnel responded to the scene and conducted a more thorough search of the garage. On the dimly lit basement level, they discovered a few heavy crusts of blood in the crack beneath a door that had not been moved apparently for some time. Although there was no visible blood on the exposed floor next to a trailer, several large bloody clots were found underneath the trailer which were not visible unless viewed on hands and knees. From the distribution of the visible blood, it was determined that someone had cleaned all the areas which could be reached without opening the door or moving the trailer.

In order to demonstrate the possible presence of blood in the cleaned areas, the laboratory personnel processed the entire area with luminol reagent. The luminol spray revealed traces of blood covering the entire floor near the trailer and even bloody wipe marks on the door to a height of several feet above the floor.

A pair of coveralls belonging to the suspect were found in a workshed at the garage. Red stains located on the cuffs of the coveralls were identified by

laboratory personnel at the scene as blood, using presumptive tests. Armed with the information that the door appeared to have been cleaned and that blood had been found on the suspect's clothing, the investigator began an intensive interrogation of the suspect. When confronted with the evidence, the suspect confessed to the murder.

Different Origin/Negative Identification

A different origin result is illustrated by a finding where the laboratory examination determines the evidence in question is not of the same origin as a standard taken from a known source. Such a determination tends to disassociate persons, objects and locations. Negative identifications are those laboratory findings which determine that a substance is not what an investigator suspects it to be. For instance, a suspected drug is shown not to be a controlled substance. Or a container thought to contain gasoline turns out not to be holding an accelerant. The final case example shows the importance of such exculpatory evidence.

Example Eleven. The distinctive M.O. of several rape cases committed in the past few months in a neighborhood led investigators to believe that the crimes were the work of a single man. Semen evidence was collected from the victims in three of these cases in sufficient concentrations to allow genetic typing. By combining the results of the typing tests in these three cases, in which the victims were of different types, a genetic profile of the suspect in ABO, PGM, and Pep-A was produced. The combination of types detected in the semen in these cases occurs in approximately 2% of the population.

A man was recently arrested as a suspect in a fourth rape case. Although the M.O. in the case differed somewhat from the series cases, the circumstances were sufficiently similar causing the investigator to ask that the suspect's blood types be compared to the series cases.

> Because of the genetic profile, the laboratory was able to exclude this suspect from the series of rapes. In addition, a second suspect, named by the first as a possible candidate for the series cases, was also excluded as the series rapist on the basis of genetic typing.

These cases illustrate the value of physical evidence as an investigative aid, providing the detective with the ability to eliminate false leads. They also demonstrate the ability of physical evidence to advance the cause of justice by clearing falsely accused persons.

Inconclusive

The inconclusive category includes laboratory results where the laboratory is unable to arrive at a firm conclusion concerning the evidence examined. As with many other techniques employed by police investigators to try to solve crimes and identify offenders, many laboratory examinations fail to yield conclusive results. The next chapter provides a statistical summary of the frequency that different categories of evidence result in inconclusive findings. Chapter V also summarizes the frequency that evidence examinations yield an identification, common origin, reconstruction/ corroboration or different origin/negative identification.

Feedback and Value of Scientific Results to Users

Communicating Laboratory Results

Verbal Results - An immediate, verbal report is sometimes made to the investigator in charge of a case. The examiner may or may not make a record of this communication, either in the form of a notation in the case file or in a more formal memorandum or report. Laboratories have different policies with respect to this type of communication. These policies range from those which encourage communications with investigative staff to those which are more bureaucratic, and require that all such communications be placed in writing and approved beforehand by a supervisor. A verbal report may also be an opportunity for an examiner to request that the investigator search for other types of evidence or collect other standards or knowns.

Written Reports - The formal laboratory report is customarily directed to the detective in charge of the investigation. This report usually expresses results in layman's terms and rarely contains much detail about the scientific examinations conducted. Such detail is reserved for the examiner's laboratory workbook and for the laboratory file on the case. Subsequently if the case should go to trial it is not uncommon for attorneys in the litigation to accept the report as evidence in lieu of an appearance by the examiner. In cases that are disposed of by a plea, it is this written report which provides scientific results to prosecutors and defense attorneys involved in the case.

Court Testimony - Testimony in court is the other primary means in which laboratories convey their findings to judicial decision makers. The management information system used in Kansas City permitted a tabulation of the number of cases in which evidence was examined that the examiner appeared in court. Out of approximately 400 cases reviewed in Kansas City, examiners actually spent time in court in only 8 cases. In a recent national survey of crime laboratories, directors of these laboratories estimate that their examiners tesify in court between 8-10% of cases in which submitted evidence is evaluated (Peterson and Mihajlovic, 1983). (The low figure in Kansas City is not so surprising when the high percentage of cases disposed of by plea bargaining is discussed in Chapter VI.)

The Value of Laboratory Results to Investigators

Physical evidence may be of value to an investigation in a number of ways. For the purposes of this study, the value of laboratory results is classified in one or more of the following categories: associating or disassociating persons, locations and instruments of the crime; establishing an element of the crime; providing corroboration; aiding in reconstruction; or proving to be of no value. These terms are defined earlier in the section discussing "purposes" for submitting evidence to the laboratory.

The next chapter explores the issue of investigator expectations and laboratory results in greater depth. Chapter V also discusses the value of the laboratory results in relation to the purposes for which the evidence is submitted to the laboratory. This comparison should

assist in estimating how frequently the expectations of the investigators are answered or satisfied by laboratory testing. This is an area where detectives are commonly quite outspoken and critical of crime laboratories. It is the belief of many investigators that the laboratory results are typically inconclusive and not of practical assistance to an investigation.

Time Elapsed to Issuance of Laboratory Reports

The time elapsed from the point the laboratory is requested to examine evidence until a laboratory report is issued is monitored. Whereas 14% of the Peoria results and 17% of the Kansas City and Oakland results are reported in one day or less, 57% of the Chicago results are completed within a day. What accounts for this rapid turnaround of laboratory results in Chicago? Almost 80% of the blood examinations, 54% of the firearms cases, and 100% of the toolmark and serial number restoration cases are completed within a day. Whereas all of the firearms cases result in formal reports, the blood and toolmark/serial number restoration cases are not written up as formal reports unless the case is going to trial.

Fifty-eight percent of the Oakland results are reported within a week, in comparison with 52% of the Kansas City results, 25% of the Peoria results, and 63% of the Chicago results. Most Kansas City and Peoria reports are issued in the 8 to 30 day turnaround time category. Forty-one percent of the Kansas City results are reported in this time frame and 37% of the Peoria results. It is clear, therefore, that Chicago has the fastest overall turnaround time.

Summary

Crime laboratories only examine a fraction of the evidence collected from the field. Laboratories employ various priority systems for determining when, and if, the evidence collected from the field will be examined. The nature of the crime, its seriousness, the perishability of the evidence, and the presence of suspects are the primary factors taken into consideration. Several examples drawn from the files of the participating crime laboratories illustrate how the results of the laboratory tests may aid the investigation of various crimes. The results range from cases in which materials are simply identified or classified to those in which conclusive linkages are established between a suspect and the crime. The analysis of physical evidence may also help to exculpate suspects of crimes. This chapter concludes with a discussion of the manner and speed with which laboratory results are conveyed to investigators.

CHAPTER V

PHYSICAL EVIDENCE AND LABORATORY RESULTS

Introduction

The previous two chapters outlined in general terms the process of physical evidence utilization and the types of data gathered during the study. This chapter examines the steps in the physical evidence collection and analysis process which help to explain the types of information criminal investigators can expect to obtain from the examination of various categories of evidence. Specifically:

- The percentage of major offense categories reported to the police which receive a crime scene investigation;
- A summary of crime incident variables associated with the quantity and types of evidence gathered;
- The primary reasons evidence is gathered and submitted for analysis;
- The results of laboratory testing by crime and evidence type;
- The ratio of evidence submitted for analysis which is actually examined; and
- A detailed discussion of fingerprint results derived from a special sampling of cases where only latent fingerprints are gathered from the scenes of crimes.

Percentage of Crimes Reported to the Police Which are Searched for Physical Evidence

One of the first important indicators of the utilization of potential physical evidence in criminal investigations is the ratio of crime scenes searched by evidence technicians. While the failure of a technician to respond to a crime scene does not preclude the opportunity for physical evidence to be used in a case, such as in rapes where evidence is collected from the victim at a hospital, not dispatching a technician to a scene greatly diminishes the prospects for evidence collection in most other crimes. Evidence still may be collected by patrol officers and detectives, but this is an unusual occurrence. The following data summarize the percentage of all major crime scenes in the four study sites searched by a technician.

Whereas technicians process practically all homicide and death-related scenes, the ratio of scenes of other crimes investigated to all crimes reported differs greatly from city to city (see Table V-1). Peoria technicians respond more frequently to rape and robbery scenes than do all other cities, but to few aggravated assault scenes. Chicago technicians respond most frequently to aggravated assault and burglary scenes.

Incident Variables Associated with the Number of Evidence Categories Collected

Table V-2 identifies those incident variables, in personal and property crimes, that have a positive association with the number of categories of physical evidence collected. These relationships are

TABLE V-1

PERCENTAGE OF CRIMES REPORTED TO THE POLICE
WHICH RECEIVED A CRIME SCENE SEARCH
BY AN EVIDENCE TECHNICIAN
(1979)

Crime Classification	Jurisdiction							
	Peoria		Chicago		Kan City		Oakland	
	N*	%	N*	%	N*	%	N*	%
Homicide	10	100%	856	100% (est)	119	92%	108	93%
Rape **	80	82%	1,655	30%	436	85%	373	79%
Robbery	351	25%	14,464	19%	2,651	12%	3,072	***
Aggravated Assault	1,137	2%	10,832	15%	2,736	7%	2,513	***
Burglary	4,174	46%	33,396	55%	12,254	7%	12,351	16%

* The N value refers to the number of crimes of this type reported to the police in 1979.

** The percent of rape scenes processed for physical clues is based on the fraction of rape cases sampled in this study where the crime scene is searched.

*** Not Available

TABLE V-2

INCIDENT VARIABLES WHICH HAVE A POSITIVE ASSOCIATION
WITH THE NUMBER OF EVIDENCE CATEGORIES COLLECTED

Incident Variable	Jurisdiction			
	Peoria	Chicago	Kansas City	Oakland
More Evidence is Collected:				
o In personal, rather than property offenses.	N.S.	***	***	***
o As the injury sustained by the victim in personal offenses increases	***	***	***	***
o When the offender has a physical interaction with the victim and/or scene.	***	***	***	***
o From residential scenes in personal crimes.	**	N.S.	N.S.	*
o From residential scenes in property crimes.	(-) **	*	***	N.S.
o When the suspect is not identified or in custody in personal crimes.	***	N.S.	*	***
o When the suspect is identified or in custody in property crimes	N.S.	**	**	N.S.
o When witnesses are not present in personal crimes.	***	***	***	***
o When detectives/supervisors are present at personal crime scenes.	***	***	***	***
o When detectives/supervisors are present at property crime scenes.	**	**	***	N.A.

N.S.= Not Significant
N.A.= Not Applicable
(-) Indicates negative association

Chi Square Significance
* p < .05
** p < .01
*** p < .001

distinguished by type of crime (personal or property), since the direction and significance of the relationships are sometimes different.

By evidence categories, we mean such primary designations as blood, documents, fingerprints, hair, etc. The reader is referred to Variable 403 of the Project Codebook. (See Appendix A-3 for a complete listing of the thirty-two major evidence categories used in this study.) The term "number of evidence categories collected," used in this and ensuing tables, refers to the number of different categories of physical evidence collected in a particular case investigation.

The chi square test of significance legend at the bottom of Table V-2 indicates the strength of the relationship between the various independent variables (type of crime, seriousness of injury, etc.) and the dependent variable, number of evidence categories collected. A relationship which is found to be significant means that the null hypothesis (complete independence between the independent and dependent variables) is rejected. In other words, there is a relationship between the two variables. The p value ($< .05$, $< .01$, or $< .001$) gives the approximate probability one would find such an association by chance (when, in fact, the two variables are truly independent of one another) is less than 5 in 100 (*), 1 in 100 (**) or 1 in 1000 (***).

Crime Classification

In all cities, except for Peoria, significantly more evidence is gathered in crimes against persons than in crimes against property. This relationship basically reflects the fact that police investigators (including evidence technicians) will usually go to greater lengths

collecting information to attempt to solve personal crimes than they will for property crimes. In Oakland, for example, four or more evidence categories are collected in 70% of the personal crimes, while in just 14% of property offenses. In 36% of the property offenses just a single evidence category is collected, versus only 9% of the personal crimes. In Peoria, the quantity of physical evidence collected in property crimes is not significantly different from the number of categories collected in personal crimes. The reader should recall that none of these single evidence category cases involves only fingerprints. These cases are considered as a separate category and are discussed later in this chapter.

Personal Injury

In personal crimes (murder, rape, assault, robbery) in all jurisdictions, the amount of evidence collected is highly associated with the seriousness of physical injury suffered by the victim. When the victim receives either a minor injury not requiring medical treatment or no injury at all, only one or two categories of evidence are collected in a majority of the cases. But as the degree of injury becomes more severe, the quantity of evidence collected steadily increases. See Table V-3 which illustrates this steady progression in Kansas City. The exception is Oakland where high quantities of evidence are collected in even the least serious offenses.

This relationship is probably due to the following: the quantity of evidence created during the commission of the crime - with more violent crimes producing more evidence; and, secondly, the added motiva-

TABLE V-3

KANSAS CITY

CRIMES AGAINST PERSONS
EXTENT OF INJURY BY
NUMBER OF PHYSICAL EVIDENCE CATEGORIES COLLECTED
(Cell Entries are Row Percentages)
(N = 207)

	Number of Evidence Categories Collected				
Personal Injury	1	2	3	4 or more	Row Total
None/Minor	27	29	20	24	34
Moderate	0	10	13	77	19
Serious	11	27	35	27	22
Fatal	0	0	4	96	25
Column Total	11	18	18	53	100

Chi Square Significance: $p < .001$

tion of technicians to collect evidence when investigating more serious personal offenses.

Interaction Between Offender and Scene and/or Victim

Not all personal crimes involve struggle or physical contact between the offender and the victim. Robberies frequently do not involve physical interaction between offender and victim. In such cases, one would not expect to find or recover the same quantity of physical evidence as in cases where there is such interaction. The data from all the cities support this theory, with statistically significant associations ($p < .001$) between interaction and number of evidence categories collected. For example, in Peoria 52% of the cases with a physical interaction result in four or more categories of evidence being collected, but only 6% of the incidents without such an interchange result in four or more categories being collected.

Location of the Offense

In personal crimes, more evidence is usually gathered from residential crimes scenes than from commercial scenes or incidents occurring on the street or out-of-doors. This relationship is strongest in Peoria, while the weakest relationship is in Chicago where no association is found. The results for property crimes are not consistent across all the cities. Peoria evidence technicians tend to gather more evidence at non-residental locations, but the opposite is true in the other cities.

Status of the Identification of the Suspect

This relationship is consistent in three of the four study jurisdictions. Basically, more physical evidence categories are collected in personal crimes when the least information about the identity or whereabouts of the suspect is available. The fewest categories of evidence are gathered when a suspect is in custody. This pattern of collecting less physical evidence when a suspect is in custody is understandable because such cases practically always have a witness to corroborate the suspect's involvement. This reduces the need for physical evidence to link a suspect with the crime. Technicians make an extra effort when suspects are not in custody or identified in some fashion.

Chicago is the only exception to this pattern. The amount of evidence collected appears to be insensitive to the status of the identification of the suspect. Chicago also generally collects the fewest categories of evidence per crime of all the jurisdictions (See Table V-7).

The opposite trend is true for crimes against property where more evidence is collected in offenses with a suspect in custody, and significantly so in Chicago and Kansas City. Given the low probability of solving property offenses when a suspect is neither in custody nor identified at the beginning of the investigation, technicians may have learned through experience that there is little payoff in collecting many categories of evidence in such cases. When a suspect is in custody, though, the technician is presented with an opportunity to

corroborate that suspect's involvement through physical evidence, (e.g. to place a suspect apprehended on the street inside a dwelling through fingerprints or trace evidence). This may be particularly important in burglary/property crimes since witnesses are rarely present.

Witnesses to the Crime

As in the preceding variable, it is found that in crimes against persons more evidence is usually collected when there are no eyewitnesses to the crime. In property offenses, as with the suspect identification variable, more evidence is collected where there are one or more witnesses. In other words, the better the information police have to start the investigation of a property crime, the more likely evidence will be collected.

Police Personnel at the Scene

The relationship between evidence gathered and the presence of detectives and other supervisory personnel at the crime scene is also examined. The data support the theory that technicians collect more evidence when these personnel are present. This significant relationship suggests that technicians respond to pressures from higher ranking police officers just as other personnel do, and will perform a more exhaustive search in their presence. This relationship is also probably affected by the fact that detectives and supervisors will more likely be present at the more serious offenses. The seriousness of the offense has already been shown to be associated with more evidence being collected.

Collecting Agent

When the types of police personnel collecting evidence in the case are cross-tabulated by the number of evidence categories collected, patrol officers are shown to have a decreasing likelihood of collecting multiple forms of evidence. Evidence technicians, detectives and medical personnel are the primary collectors of multiple categories of evidence. The following Table (V-4) illustrates this relationship for personal crimes in Kansas City. A patrol officer is a collecting agent in only 17% of the cases where four or more categories of evidence are collected. The next table (V-5) shows the percentage of time in which the various types of personnel are collectors of evidence in cases where four or more categories of evidence are collected.

Categories of Physical Evidence Collected

The reader is referred to Table III-1 in Chapter III which enumerates the top five evidence categories collected in the crimes of homicide, rape, robbery, assault, and burglary. These additional observations are in order:

- Biological fluids and firearms dominate as evidence forms collected in crimes of violence:

- Fingerprints, trace evidence and toolmarks dominate as the evidence collected in property crimes;

TABLE V-4

KANSAS CITY
CRIMES AGAINST PERSONS
NUMBER OF PHYSICAL EVIDENCE CATEGORIES COLLECTED
BY COLLECTING AGENT

(Cell Entries are Row Percentages)
(N = 207)

Number of Evidence Categories	Personnel Collecting Physical Evidence				
	Police Officer	Detective/ Supervisor	Evidence Specialist	Medical Personnel	Row Total
1	71%*	8%	25%	8%	12%
2	24%	32%	68%	16%	18%
3	16%	49%	89%	19%	18%
4 or more	17%	66%	94%	74%	52%
Column Total	25%	50%	81%	46%	100%

* This value should be read, "A police officer was one of the collecting agents in 71% of the cases in which one category (blood, trace, etc.) of evidence was collected."

TABLE V-5

PERCENTAGE OF THE TIME VARIOUS POLICE PERSONNEL ARE COLLECTING AGENTS IN CASES IN WHICH FOUR OR MORE CATEGORIES OF EVIDENCE ARE COLLECTED

Collection Agent	Jurisdiction			
	Peoria	Chicago	Kansas City	Oakland
Police Officer	20%	32%	17%	42%
Detective/Supervisor	86%	81%	66%	66%
Evidence Specialist (Technicians, Criminalists)	93%	79%	94%	68%
Medical Personnel (Medical examiner, doctors, nurses)	77%	80%	74%	69%

- Oakland has the highest percentage of personal crimes with blood evidence and firearms; Peoria has the lowest percentage of cases with blood evidence:

- Chicago has the lowest percentage of crime laboratory analyzed cases with fingerprints and trace evidence, while Kansas City has the highest percentage of cases with those same evidentiary items.

Seriousness of the Offense and Evidence Collected

As the seriousness of the personal offense increases so does the likelihood that biological fluids will be collected. This same relationship is particularly strong in the areas of trace evidence and fingerprints, as well. There are no clear relationships between the dollar loss sustained in a property offense and the types of evidence collected.

Interaction and Evidence Collected

Interaction between the offender and victim predictably generates not only more biological evidence, but also more trace evidence and fingerprints. The only countertrend here is found with firearms since there is a greater likelihood that firearms will be submitted in incidents where physical interaction has not occurred. In such cases a firearm is used as the weapon to intimidate or, possibly, shoot a victim, but the offender does not personally engage in an altercation with

the victim. Here firearms may also constitute the source of some other type of evidence, such as fingerprints or bloodstains, which may be deposited on a weapon.

Biological and trace evidence are found only in those property crimes involving an interaction between the offender and the crime scene. On the other hand, fingerprints and tools are collected more frequently in offenses in which no appreciable interaction between the offender and scene has taken place.

Reasons for Submitting Evidence for Analysis

Table V-6 summarizes the various reasons that evidence is submitted to the laboratories for analysis in the study sites. The reader should note that the N values in this table refer to the various reasons that evidence is submitted in a case. Since individual cases often involve more than a single category of evidence and since a category of evidence may be submitted for more than one reason, the N values are greater than the number of cases sampled in each jurisdiction.

Element of the Crime

An examination of the cases sampled in the present study shows that evidence is submitted for the purpose of establishing an element of an offense from 8%-10% of the time. Drug and narcotic offenses are not included in this accounting because they are addressed individually in a later chapter of this report. However, cases in which drugs are submitted as evidence incidental to the major crime category are included such

TABLE V-6

REASONS FOR SUBMISSION OF EVIDENCE

Reasons	Jurisdictions			
	Peoria N = 862	Chicago N = 1139	Kansas City N = 1139	Oakland N = 715
Element	8%	9%	10%	9%
Associative	62%	44%	52%	63%
Offender/Scene	35%	28%	55%	32%
Offender/Victim	23%	9%	8%	24%
Firearm related	34%	43%	24%	38%
Victim/Scene	4%	8%	12%	5%
Tools	2%	1%	1%	-
Documents	-	9%	-	-
Reconstruct	13%	32%	32%	13%
Corroborate	4%	6%	5%	10%
Operability (firearms)	13%	9%	1%	5%
TOTAL	100%	100%	100%	100%

as when drugs are found in the automobile of a robbery suspect. Therefore, rape and arson are the two primary crime categories in which evidence is submitted to establish an element of the crime. In such cases, suspected seminal fluid and flammable substances are submitted for reasons of identification.

Associative Evidence

The primary reason evidence is submitted in the cases sampled in all jurisdictions is to associate persons, instruments of the crime (firearms, other weapons and tools), and locations where offenses occur. Peoria (62%) and Oakland (63%) have the greatest percentage of evidence submitted for this purpose, while Kansas City (52%) and Chicago (44%) have evidence submitted for this purpose to a lesser degree.

Within the association category, the submissions in Peoria and Kansas City are primarily intended to associate offenders with the scenes of crimes. In Chicago and Oakland, the majority of the submissions are firearms related and are intended to associate these weapons with their owners, with the offenders, or with the victim of the crime. There is a substantial difference between the study cities in the fraction of submissions where the intent is to associate the offender with the victim of the crime. Approximately one-quarter of this associative evidence in Peoria and Oakland has the objective of linking an offender with a victim, while less than 10% of the associative evidence in Chicago and Kansas City is submitted for that purpose. This is, in part, a reflection of the higher percentage (80%) of personal crimes in the Peoria and Oakland samples, compared with Chicago and Kansas City

where only about 70% and 60%, respectively, of the cases are personal crimes.

Reconstruction

About 2 1/2 times more cases are submitted in the Chicago and Kansas City samples where one of the primary reasons for submission is reconstruction. This reflects the fact than many cases examined in Chicago and Kansas City lack standards. For example, bloodstain evidence from a crime scene is examined, but no blood sample is submitted from a known source (i.e., the victim or offender). In such cases, the examination can provide information about the blood type of the individual who shed the blood, but can not associate it with anyone.

Corroboration

Evidence is submitted between 4% - 10% of the time to test the statements of witnesses and victims and the alibis of suspects. This is a common reason for submitting evidence in cases of rape where testing the evidence taken from the victim would support or refute the statements she has given the police.

Operability/Open Case File Check

A substantial volume of firearms evidence in Peoria and Chicago has been examined for the purpose of checking the operation of the weapon and comparing the weapon against open case files in order to see if the

gun may have been involved in previous crimes. Almost 10% of the Peoria caseload sample involves unlawful use of weapons. In order to prosecute, the laboratory has to verify that the gun is in operating condition.

Ratio of Evidence Examined to Evidence Collected

Table V-7 details the average number of discrete evidence categories collected and examined by type of offense in the four cities. The fraction in the columns beneath each city divides the average number of evidence categories examined per case by the average number of categories collected per case. Peoria examines the highest percentage of categories collected in four crime categories. Oakland examines the lowest percentage of evidence categories collected in all five primary offenses. In homicide, Oakland evidence technicians collect an average of 6.3 categories of evidence per investigation, but the laboratory only examines an average of 1.8 categories per case. The Oakland laboratory examines, on the average, only 1.4 categories of evidence in rape cases (the lowest of all the cities) but technicians gather 5.2 categories per case (the highest of all the cities, along with Kansas City). The sparse scientific resources available in Oakland, in relation to the volume of crime and number of evidence technicians, help to explain these low ratios.

It is also interesting to note that in all cities, except for Kansas City, the highest ratio of evidence examined to evidence collected is in burglary/property offenses. The lowest ratio of evidence examined/collected is in homicides. This is undoubtedly related to the higher than average quantities of evidence collected in those very

TABLE V-7

PERCENT OF PHYSICAL EVIDENCE CATEGORIES COLLECTED

WHICH ARE EXAMINED BY CRIME TYPE

Crime Classification	Jurisdiction							
	Peoria		Chicago		Kan City		Oakland	
	N*	Percent	N	Percent	N	Percent	N	Percent
Homicide	2.2/4.3	51%	2.0/4.0	50%	3.3/5.8	57%	1.8/6.3	29%
Sex Crimes	2.4/3.2	75%	1.8/2.8	64%	2.7/5.2	52%	1.4/5.2	27%
Robbery	1.4/2.0	70%	1.5/2.2	68%	1.5/3.0	50%	1.3/3.4	38%
Assault	1.4/1.9	74%	1.3/2.1	62%	1.3/1.9	68%	1.1/3.0	37%
Burglary	1.4/1.7	82%	1.1/1.5	73%	1.5/3.0	50%	1.1/1.7	65%
Arson	---	---	1.1/2.2	50%	1.3/2.3	57%	---	---

* Fraction represents mean number of evidence categories examined divided by the mean number of evidence categories collected.

serious offenses. It appears though that laboratories screen out much of this evidence from their examination procedures.

Laboratory Results

Laboratory Results by Crime Classification

Table V-8 tabulates the results of laboratory testing in each jurisdiction by personal and property crimes. The N values in the table refer to the number of evidence categories submitted and analyzed by the laboratory in the sample of cases from each jurisdiction. The percentage totals for each crime classification exceed 100% because the survey instrument records up to three results for each major category of evidence collected. Although an infrequent occurrence, a case might involve several different blood samples submitted from various locations at a crime scene. In such a case, one sample might prove inconclusive, while another is typed and associated with a suspect. However, most cases have a single result.

If the examination results in the identification of the evidence (e.g., the stain is blood, the liquid is a flammable), or a classification (the stain is Type A human blood, the flammable is gasoline) it is included in the identify/classify category. Chicago has the highest percentage of results in both the personal and property crime category when the results are so classified.

Initially, most types of evidence are identified or classified even if the evidence is compared subsequently with a standard, thus yielding a conclusion of common origin. If a blood sample is first grouped and

TABLE V-8

RESULTS DERIVED FROM THE LABORATORY
EXAMINATION OF PHYSICAL EVIDENCE

Laboratory Result	Jurisdiction							
	Peoria		Chicago		Kan City		Oakland	
	Pers. (N=421)	Prop. (N=97)	Pers. (N=411)	Prop. (N=123)	Pers. (N=431)	Prop. (N=161)	Pers. (N=332)	Prop. (N=48)
Identify/ Classify	36%	20%	58%	49%	41%	29%	42%	17%
Negative ID.	5%	2%	5%	11%	3%	9%	8%	0%
Common Origin	44%	54%	21%	5%	29%	12%	35%	27%
Different Origin	5%	12%	1%	2%	7%	7%	16%	31%
Reconstruct	6%	0%	10%	2%	14%	16%	6%	2%
Inconclusive	24%	20%	20%	38%	20%	47%	13%	25%

* The N value in this table refers to the total number of categories of evidence analyzed by the laboratory of the cases included in the study sample.

then compared with blood that has been grouped from another source, and a statement of common origin results (in the above example, the two samples possibly have a common origin), both the "identify/classify" and the "common origin" results are noted.

The second row notes negative identifications. For example the evidence is determined not to be the substance it was thought to be upon submission. The primary evidence forms here would be substances suspected to be seminal fluid, flammable liquids, controlled substances, and bloodstains. A small percentage of the time a packet of suspected heroin, for example, turns out to be nothing more than milk sugar. In other situations, the laboratory may be unable to detect the presence of the substance due to the small quantity or contamination/deterioration of the sample.

The percentage of results which possibly, probably or conclusively link evidence with a standard are categorized under common origin. Results from the examination of cases in Peoria are in the common origin category more often than the cases from the other cities. Forty-four percent of the results in personal crimes and fifty-four percent of the results in property crimes are of the common origin category. Chicago has the lowest percentage of results classified in the common origin category, with 21% of the results from personal crimes and 5% of the results in property crimes. Kansas City and Oakland are comparable in the personal crime category results, but Oakland has about twice the percentage of common origin results in the property crime category as does Kansas City. One should note the sample sizes in these property offense comparisons; the two cities with the lowest percentage of common origin results process the greatest number of cases, by a factor of two

to three. Peoria and Oakland generally reserve their property crime examinations for cases in which both evidence and standards are supplied, while Kansas City and Chicago examine cases lacking standards where scientific results may aid in deciphering how a crime was committed, but would not lead to a common origin conclusion.

The Oakland laboratory has the highest percentage of laboratory reports which conclude that two items of evidence do not have a common origin. It appears the policy in Oakland is for their examiners to be much more explicit in their laboratory reports about the failure of two items to match with one another and, thereby, indicate they do not share a common source. There is a tendency in the other laboratories to declare inconclusive results in such cases. The low percentage of different origin results in a city such as Chicago is also a reflection of the smaller percentage of cases submitted with known "standards."

Different origin results constitute valuable information, for they may demonstrate to investigators that they are pursuing the wrong suspect or are operating under a faulty hypothesis as to how the crime occurred.Evidence submitted in property crimes is more likely to result in a different origin result than that submitted in personal crimes.

The reconstruction category basically includes examinations which may assist in determining how a crime was or was not committed. These are commonly cases where evidence alone is submitted for examination with an accompanying inquiry; "Does the evidence indicate a crime occurred?" or "Was it committed in this way?" Informing investigators that a lock was or was not picked would be an example of reconstructive information aiding an investigation.

Inconclusive results occur when laboratory findings fail to yield an informative statement or conclusion.

Laboratory Results by Evidence Category

Tables V-9 through V-12 summarize the results of laboratory testing for each jurisdiction by evidence category. The N values correspond to the number of times a category of evidence is submitted in personal and property crimes. Given the infrequency that some evidence categories appear in certain crime categories, percentages are given only when the N is equal to five or more cases.

The rate at which bloodstain testing results in a conclusion of common origin ranges from a high of 40% in Oakland to a low of 6% in Chicago. Blood is rarely present in property crimes in Peoria, Kansas City and Oakland. But, in Chicago (N=25), blood links an offender with a scene or victim 8% of the time.

Chicago has the highest rate (79%) of positive identifications of suspected semen evidence in rape or other sex-related crimes. The rate of positive identifications is close to the 70% mark in the other laboratories.

Although the number of hair submissions in Oakland is small (N=12), in two-thirds of the cases this evidence results in a conclusion of possible or probable common origin. The N of cases in Peoria and Kansas City with hair is about the same (N=60). Common origin results develop in from one-quarter to one-third of the instances in which this evidence is submitted.

The percentage of submissions in which firearms evidence results in a common origin is comparable in personal crimes from city to city, with Peoria having the highest rate at 62%. Peoria also has the highest rate of toolmark cases in property crimes - eighty-two percent have a common

TABLE V-9

PEORIA

LABORATORY RESULTS BY EVIDENCE CATEGORY AND CRIME CLASSIFICATION

Evidence Category	Crime Class.	N * of cases	Laboratory Results					
			Identification	Negative Ident.	Common Origin	Different Origin	Reconstructive	Inconclusive
Blood	Pers.	(N = 86)	90%	2%	29%	1%	1%	12%
	Prop.	(N = 4)	-	-	-	-	-	-
Semen	Pers.	(N = 43)	67%	32%	5%	0%	0%	2%
	Prop.	(N = 0)	-	-	-	-	-	-
Hair	Pers.	(N = 56)	20%	0%	32%	20%	13%	20%
	Prop.	(N = 1)	-	-	-	-	-	-
Firearms	Pers.	(N = 149)	7%	0%	62%	1%	14%	49%
	Prop.	(N = 14)	36%	0%	21%	0%	0%	64%
Toolmarks	Pers.	(N = 3)	-	-	-	-	-	-
	Prop.	(N = 22)	9%	0%	82%	9%	0%	14%
Prints	Pers.	(N = 42)	2%	0%	81%	14%	0%	2%
	Prop.	(N = 15)	0%	0%	53%	13%	0%	33%
Trace/ Transfer	Pers.	(N = 14)	14%	0%	57%	21%	0%	14%
	Prop.	(N = 21)	0%	0%	62%	33%	0%	0%
Drugs	Pers.	(N = 25)	76%	24%	0%	0%	0%	0%
	Prop.	(N = 11)	82%	18%	0%	0%	0%	0%
Flammable Explosives	Pers.	(N = 3)	-	-	-	-	-	-
	Prop.	(N = 0)	-	-	-	-	-	-
Impressions/ Patterns	Pers.	(N = 10)	10%	0%	60%	0%	40%	10%
	Prop.	(N = 9)	0%	0%	78%	11%	0%	11%

* Values where N < 5 cases are not computed.

TABLE V-10

CHICAGO

LABORATORY RESULTS BY EVIDENCE CATEGORY AND CRIME CLASSIFICATION

Evidence Category	Crime Class.	N * of cases	Laboratory Results					
			Identification	Negative Ident.	Common Origin	Different Origin	Reconstructive	Inconclusiv
Blood	Pers.	(N = 139)	95%	4%	14%	0%	1%	1%
	Prop.	(N = 25)	96%	4%	8%	0%	0%	0%
Semen	Pers.	(N = 48)	79%	17%	0%	0%	0%	4%
	Prop.	(N = 0)	-	-	-	-	-	-
Hair	Pers.	(N = 19)	79%	0%	11%	11%	0%	16%
	Prop.	(N = 0)	-	-	-	-	-	-
Firearms	Pers.	(N = 157)	26%	0%	34%	2%	25%	37%
	Prop.	(N = 14)	7%	0%	7%	7%	7%	79%
Toolmarks	Pers.	(N = 5)	40%	0%	0%	0%	0%	60%
	Prop.	(N = 21)	67%	0%	0%	0%	5%	29%
Prints	Pers.	(N = 23)	0%	0%	39%	4%	0%	57%
	Prop.	(N = 23)	0%	0%	13%	0%	0%	87%
Trace/ Transfer	Pers.	(N = 2)	-	-	-	-	-	-
	Prop.	(N = 1)	-	-	-	-	-	-
Drugs	Pers.	(N = 3)	-	-	-	-	-	-
	Prop.	(N = 0)	-	-	-	-	-	-
Flammable Explosives	Pers.	(N = 13)	46%	54%	0%	0%	0%	15%
	Prop.	(N = 34)	56%	35%	0%	0%	0%	24%
Impressions/ Patterns	Pers.	(N = 2)	-	-	-	-	-	-
	Prop.	(N = 3)	-	-	-	-	-	-

*Values where N < 5 cases are not computed.

TABLE V-11

KANSAS CITY

LABORATORY RESULTS BY EVIDENCE CATEGORY AND CRIME CLASSIFICATION

Evidence Category	Crime Class.	N * of cases	Laboratory Results					
			Identification	Negative Ident.	Common Origin	Different Origin	Reconstructive	Inconclusive
Blood	Pers.	(N = 70)	100%	0%	6%	0%	4%	0%
	Prop.	(N = 8)	100%	0%	13%	0%	0%	12%
Semen	Pers.	(N = 44)	75%	23%	0%	0%	2%	7%
	Prop.	(N = 0)	-	-	-	-	-	-
Hair	Pers.	(N = 61)	18%	0%	26%	20%	28%	21%
	Prop.	(N = 2)	-	-	-	-	-	-
Firearms	Pers.	(N = 102)	39%	0%	45%	1%	37%	18%
	Prop.	(N = 0)	-	-	-	-	-	-
Toolmarks	Pers.	(N = 5)	60%	0%	40%	0%	20%	0%
	Prop.	(N = 10)	50%	0%	10%	0%	40%	10%
Prints	Pers.	(N = 115)	2%	0%	46%	14%	0%	46%
	Prop.	(N = 72)	0%	0%	7%	10%	0%	83%
Trace/ Transfer	Pers.	(N = 11)	36%	0%	27%	18%	0%	27%
	Prop.	(N = 13)	0%	0%	31%	23%	0%	46%
Drugs	Pers.	(N = 15)	67%	27%	7%	0%	0%	0%
	Prop.	(N = 5)	80%	20%	0%	0%	20%	0%
Flammable Explosives	Pers.	(N = 2)	-	-	-	-	-	-
	Prop.	(N = 47)	62%	28%	8%	4%	45%	17%
Impressions/ Patterns	Pers.	(N = 6)	33%	0%	33%	0%	33%	0%
	Prop.	(N = 4)	-	-	-	-	-	-

*Values where N <.5 cases are not computed.

TABLE V-12

OAKLAND

LABORATORY RESULTS BY EVIDENCE CATEGORY AND CRIME CLASSIFICATION

Evidence Category	Crime Class.	N * of cases	Laboratory Results					
			Identification	Negative Ident.	Common Origin	Different Origin	Reconstructive	Inconclusiv
Blood	Pers.	(N = 60)	65%	8%	40%	8%	0%	13%
	Prop.	(N = 3)	-	-	-	-	-	-
Semen	Pers.	(N = 54)	70%	30%	2%	2%	0%	5%
	Prop.	(N = 0)	-	-	-	-	-	-
Hair	Pers.	(N = 12)	25%	8%	67%	8%	0%	0%
	Prop.	(N = 5)	-	-	-	-	-	-
Firearms	Pers.	(N = 120)	41%	1%	48%	12%	14%	14%
	Prop.	(N = 5)	50%	0%	20%	0%	20%	20%
Toolmarks	Pers.	(N = 0)	-	-	-	-	-	-
	Prop.	(N = 1)	-	-	-	-	-	-
Prints	Pers.	(N = 67)	1%	0%	37%	44%	0%	19%
	Prop.	(N = 16)	0%	0%	25%	63%	0%	19%
Trace/ Transfer	Pers.	(N = 1)	-	-	-	-	-	-
	Prop.	(N = 15)	13%	0%	33%	7%	0%	47%
Drugs	Pers.	(N = 9)	56%	44%	0%	0%	0%	0%
	Prop.	(N = 2)	-	-	-	-	-	-
Flammable Explosives	Pers.	(N = 0)	-	-	-	-	-	-
	Prop.	(N = 0)	-	-	-	-	-	-
Impressions/ Patterns	Pers.	(N = 9)	33%	0%	11%	22%	33%	11%
	Prop.	(N = 6)	0%	0%	50%	50%	0%	0%

* Values where N< 5 cases are not computed.

origin result. None of the twenty-one toolmark cases sampled in Chicago result in a common origin finding. The Chicago toolmarks section examines many more cases than does Peoria. But, because it usually fails to receive a tool to compare with the toolmarks, examinations usually only yield information as to the type of tool which may have been used. This may help the investigator subsequently to locate the proper suspect.

Peoria, once again, has the highest rate of trace/transfer evidence resulting in a common origin in both personal and property crimes. The Oakland samples include no trace evidence (glass, hair, fibers, etc.) in personal crimes and the Chicago sampling has too few to tabulate.

The presence of drug evidence in cases where other physical evidence is submitted is tabulated as well. Suspected drugs are identified as controlled substances between one-half and three-quarters of the time. This identification ratio is slightly lower than when only drugs are submitted in a case (see Chapter VI).

Impression and pattern evidence has been reviewed in a very small number of incidents in all cities, with Peoria and Chicago having the most cases. This evidence has a high rate of positive outcome, with the results either demonstrating a common or different origin or, perhaps, helping to reconstruct the offense.

The final category included on the table is suspected accelerants and explosives. The rates of identification in Chicago and Kansas City (50% - 60%) are comparable. Suspected arson accelerants are very rarely examined in Peoria and Oakland.

Questioned documents are not included in the tabulation since they are examined only by the Chicago Crime Laboratory. Chicago is the only

facility capable of examining documents for the purpose of determining their authenticity and authorship (origin). A check of Chicago results reveals that in 16% of the incidents, a statement of common origin (conclusive, probable, or possible) is made. These are principally cases linking handwriting on a document (fraudulent check, credit card) to a specific individual. In another 24% of the cases, examiners are able to classify the make or model of a typewriter used to type a document or, possibly, to determine that some currency is counterfeit. In about half the cases, however, no definitive results are reported.

Value of Evidence - Resolving the Question of Association

Table V-13 presents data which expresses the percentage of time in which the analysis of various categories of evidence resolve the question of possible association among suspects, victims, crime scenes, and instruments of the crime. Only those evidence categories which are commonly considered to have associative value are included in this table. Such items as drugs, flammables, explosives, and semen evidence are excluded, because the standard laboratory procedure in these cases is primarily to identify the substance. Since the initiation of the study in 1979, most of the laboratories have begun programs to determine the blood group of the semen donor, which should enhance the associative power of this rape evidence.

An example of how the table may be read is as follows: blood evidence is examined in 93 cases in Peoria in which the purpose for submission is to associate persons, a person and a location, or possibly a person and an instrument of the crime. In 31% of these cases, blood-stain evidence either confirms or refutes this association.

TABLE V-13

PERCENT OF TIME LABORATORY RESULTS ARE SUCCESSFUL IN DETERMINING IF PERSONS/OBJECTS ARE ASSOCIATED WITH ONE ANOTHER

Evidence Category	Crime Type	Jurisdiction (N) Peoria	(N) Chicago	(N) K.C.	(N) Oakland
Blood	Personal	(93) 31%	(76) 33%	(24) 38%	(53) 36%
	Property	(4) 50%	(26) 8%	(5) 40%	(3) 0%
Hair	Personal	(75) 39%	(6) 50%	(52) 50%	(11) 36%
	Property	(1) 100%	(0) 0%	(15) 7%	(0) 0%
Fingerprints	Personal	(48) 65%	(34) 24%	(151) 48%	(81) 64%
	Property	(18) 61%	(38) 3%	(156) 7%	(24) 54%
Firearms/ Toolmarks	Personal	(104) 86%	(138) 49%	(112) 70%	(129) 71%
	Property	(33) 70%	(38) 5%	(9) 22%	(3) 33%
Trace/ Transfer	Personal	(17) 59%	(2) 100%	(8) 38%	(1) 100%
	Property	(25) 64%	(3) 33%	(12) 50%	(15) 53%

The percentages in this table are derived by dividing the number of times laboratory results either associated or disassociated persons, weapons, tools, scenes of crimes by the number of times evidence is submitted to the laboratory for that purpose (the N value).

Rather than comparing percentages for evidence categories between cities it is probably more useful to examine the relative rates of success that evidence categories enjoy in all jurisdictions. This approach reveals the following:

In personal crimes:

- Firearms evidence is far and away the category of evidence which has the greatest success in resolving the question of association;
- Bloodstain evidence is at the bottom of the rankings in three of the four cities in its ability to show a positive or negative association;
- Fingerprints rank high in comparison to most other evidence categories, placing either second or third in all cities.

In property crimes:

- Trace evidence is successful in resolving the issue of association more than half the time;
- Toolmarks associate tools with crime scenes from a high of 70% to a low of 5% of the time;
- In contrast to personal crimes, fingerprints have a much poorer record in associating and disassociating persons in property offenses.

Laboratory Results Where Only Fingerprints are Collected and Examined

In a very high percentage of burglary scenes processed only fingerprints are gathered. Since these cases constitute one of the major activities of crime scene units and represent a significant fraction of all cases where physical evidence is collected, they deserve special treatment. They have not been discussed up to this point because fingerprint identification is usually handled by a unit external to the crime laboratory. Information on cases involving fingerprints as the

only category of physical evidence has been collected in Peoria, Chicago and Oakland. The sample has not been collected in Kansas City because of recordkeeping limitations. Table V-14 compares the utilization of fingerprint evidence in three separate types of cases:

- o Burglary/property crimes where only fingerprints are collected;
- o Burglary/property crimes where other physical evidence is examined in the crime laboratory; and
- o Other, non-burglary, crimes with physical evidence examined in the crime laboratory.

The second and third categories of cases described above may or may not have had fingerprints collected in addition to the evidence examined in the laboratory.

In Table V-14, the column giving the average number of physical evidence categories collected refers to the average number collected per case. The third row lists the percentage of cases in that group which have fingerprint evidence collected so naturally 100% of the FP-Burglary group have fingerprint evidence collected. The fourth row, marked "analyzed", records the average number of physical evidence categories receiving scientific analysis per case. In the FP-Burglary cases, only fingerprints have been examined so the average is 1.00 in all cities. Finally, the last column gives the percentage of cases in each group which have fingerprint evidence examined.

This table clearly illustrates that crimes considered more serious than burglaries, specifically, murder, rape, robbery, and assault, result in more evidence collection and laboratory analysis. Not only is more evidence collected in the more serious crimes (which has been shown previously in this chapter), but the quality of the evidence appears to

TABLE V-14

UTILIZATION OF FINGERPRINT EVIDENCE

City	Sample	Number of Cases	Average Number Collected	% Cases With Fingerprint Collected	Average Number Analyzed	% Cases With Fingerprint Analyzed
Peoria	FP-Burg	34	1.12	100%	1.00	100%
	Ev-Burg	62	2.03	32%	1.56	26%
	Ev-Other	219	2.79	32%	1.84	21%
Chicago	FP-Burg	42	1.00	100%	1.00	100%
	Ev-Burg	80	1.86	34%	1.25	24%
	Ev-Other	296	1.74	22%	1.57	14%
Oakland	FP-Burg	33	1.18	100%	1.00	100%
	Ev-Burg	43	2.07	53%	1.20	40%
	Ev-Other	229	4.77	49%	1.45	29%

be enhanced. As shown in Table V-15 when fingerprints are collected in the more serious crimes, standards are more likely to be collected as well. Also, the laboratory appears to be better able to reach a common origin result through the evidence analysis.

In Peoria, for example, the fingerprints of a suspect are compared with prints from a crime scene in only 32% of the burglary cases where only fingerprints are collected. In burglaries, when other evidence is examined in the laboratory, fingerprint standards are available in 69% of the cases where latent prints are recovered. In crimes other than burglary, fingerprint standards are available in 87% of the cases. One can see that, as the rate of standards present increases, so does the rate of common origin fingerprint results (i.e. the latent print is matched with a particular person).

In Chicago, only 10% of the fingerprint-only burglaries have standards available. In other words, the prints of particular suspects are checked against the unknown latent fingerprints recovered in the field in only 10% of these crimes. This is the primary reason why fingerprints are matched with an individual only 5% of the time in these cases.

In Oakland, we see that while latent prints are compared with suspect fingerprints in 42% of cases, they only match up 7% of the time (see the far right hand column). This indicates that the quality of suspect names given the fingerprint identification section in Oakland is not nearly as good as the suspect names provided in the other jurisdictions.

TABLE V-15

RESULTS OF FINGERPRINT ANALYSES

City	Sample	Number of Cases	% Fingerprint with Both Evid & Stds	% Fingerprint with Common Origin	% Common Origin with Both Evid & Stds
Peoria	FP-Burg	34	32%	24%	75%
	Ev-Burg	16	69%	50%	72%
	Ev-Other	47	87%	77%	89%
Chicago	FP-Burg	42	10%	5%	50%
	Ev-Burg	19	16%	16%	100%
	Ev-Other	40	25%	23%	90%
Oakland	FP-Burg	33	42%	3%	7%
	Ev-Burg	17	82%	18%	21%
	Ev-Other	67	91%	36%	39%

Summary

This chapter may be summarized as follows:

o There are a number of characteristics of a criminal act which influence the collection of evidence, among them: the type of offense; the level of interaction between suspect and scene or victim; the seriousness of injuries suffered by the victim; the location of the crime (residential versus non-residential); the presence of witnesses; the identity of suspects; and the presence of higher ranking police personnel at the crime scene.

o Biological fluids and firearms dominate as the primary evidence categories collected and analyzed in personal crimes, while fingerprints, trace evidence and toolmarks are the leading categories of evidence examined in property crimes.

o The principal reason evidence is submitted to the laboratory, putting drug evidence aside, is to associate persons, weapons, tools, and locations with one another.

o On the average, many more categories of evidence are collected in personal crimes than in property crimes.

o Only a fraction of evidence collected from the field is analyzed, with the highest ratio being examined in property crimes and the smallest in personal crimes.

o The jurisdiction which gathers the greatest quantity of evidence from the scenes of crimes (Oakland) also examines the fewest categories of evidence in those cases.

o The percentage of laboratory results leading to a statement of common origin is highest in personal crimes; on the other hand, property crimes return the highest number of different origin results.

o Peoria has the greatest success in determining the origin of firearms, toolmarks, fingerprints and trace evidence. Oakland has the highest rate of success in determining the origin of bloodstains and hair evidence. Chicago and Kansas City have the highest rates of identification of semen evidence in sexual crimes.

o Firearms, bloodstains and toolmarks are the leading evidence categories in personal crimes that successfully resolve questions of association among persons and locations. Trace and toolmark evidence are the primary categories in property crimes which resolve the question of association.

o Fingerprint evidence is most successful in identifying persons when it is collected in conjunction with other evidence in non-burglary/property crime cases. It is successful the smallest percentage of the time when it is the only item of evidence gathered in property crimes.

CHAPTER VI

THE ROLE OF SCIENTIFIC EVIDENCE IN THE CLEARANCE AND PROSECUTION OF CRIMINAL CASES

Introduction

The previous chapters have examined patterns of evidence collection, examination and usage. Chapter VI carries the treatment of scientific evidence and its effects on police investigations several steps closer to the heart of the analysis which will be presented in Chapter VII.

This chapter:

- Contrasts the rates of clearance, charging and conviction for robbery, assault and burglary cases where physical evidence is collected and examined with cases where it is not;

- Examines the manner in which these same cases are disposed of at the court-level while controlling for laboratory results;

- Reviews the outcomes of a special sample of burglary cases where fingerprints were the only form of evidence collected and analyzed;

- Looks at a sample of drug cases, highlighting differences in rates of identification, clearance and conviction in the four cities; and

- Examines the outcomes of homicides, rapes and arsons included in the study sample, while controlling for the results of physical evidence examined in these cases.

The Evidence and No-Evidence Samples

First of all, the reader should note important characteristics of the evidence and no-evidence samples. As in the foregoing chapters, the evidence cases are those where physical evidence was collected and examined in the laboratory.

Secondly, two basic approaches were taken in the sampling of the "no evidence" cases. In Peoria and Chicago, evidence technician reports were reviewed and cases were selected at random where the technician failed to find any physical evidence. In Kansas City and Oakland, a review of police incident reports was made and cases were randomly selected where no physical evidence was collected and submitted for analysis. These cases included both incidents where technicians were called to the scene, but did not retrieve any physical evidence, as well as cases where technicians did not make a search for evidence (see Appendix A for a complete discussion of the sampling procedures).

The no evidence sample is restricted to the crime categories of robbery, assault/battery and burglary, and excluded such offenses as homicide and rape which usually had some type of physical evidence

collected. Table VI-1 presents the total four city sample sizes for the evidence and no evidence cases.

Physical Evidence and Clearance Rates

The police clearance codes for the evidence and no evidence cases were recorded directly from the relevant police file and classified as either cleared through arrest, cleared exceptionally, not cleared or unfounded. Approximately 3.0% of the cases in the Chicago sample, 2.5% of the Peoria cases, and 1.0% of the cases in Kansas City and Oakland were unfounded and are not included in this analysis. The exceptional clearances include cases where the police release a defendant to another jurisdiction, where the defendant is prosecuted for another offense, is deceased, or some other situation exists where "some element beyond law enforcement control precludes taking the defendant into custody" (Uniform Crime Reports, 1981: 180). Clearances through arrest comprise 88% of all clearances recorded in the four study sites. Because of this high percentage and to permit credit for those arrests which result in clearing multiple crimes (often considered one of the benefits of collecting physical evidence), clearance has been designated as the primary measure of case outcome.

Figure VI-1 and Table VI-2 display the clearance rates for the evidence and no evidence cases in the four study sites. In Peoria, for example, 69% of the robberies where physical evidence is examined are cleared, compared with 20% of the robberies where no physical evidence is collected. This difference is significant at the .001 level. Differences in the rates of clearance for the remaining crime categories in

TABLE VI-1

TOTAL FOUR CITY EVIDENCE AND NO-EVIDENCE SAMPLES *

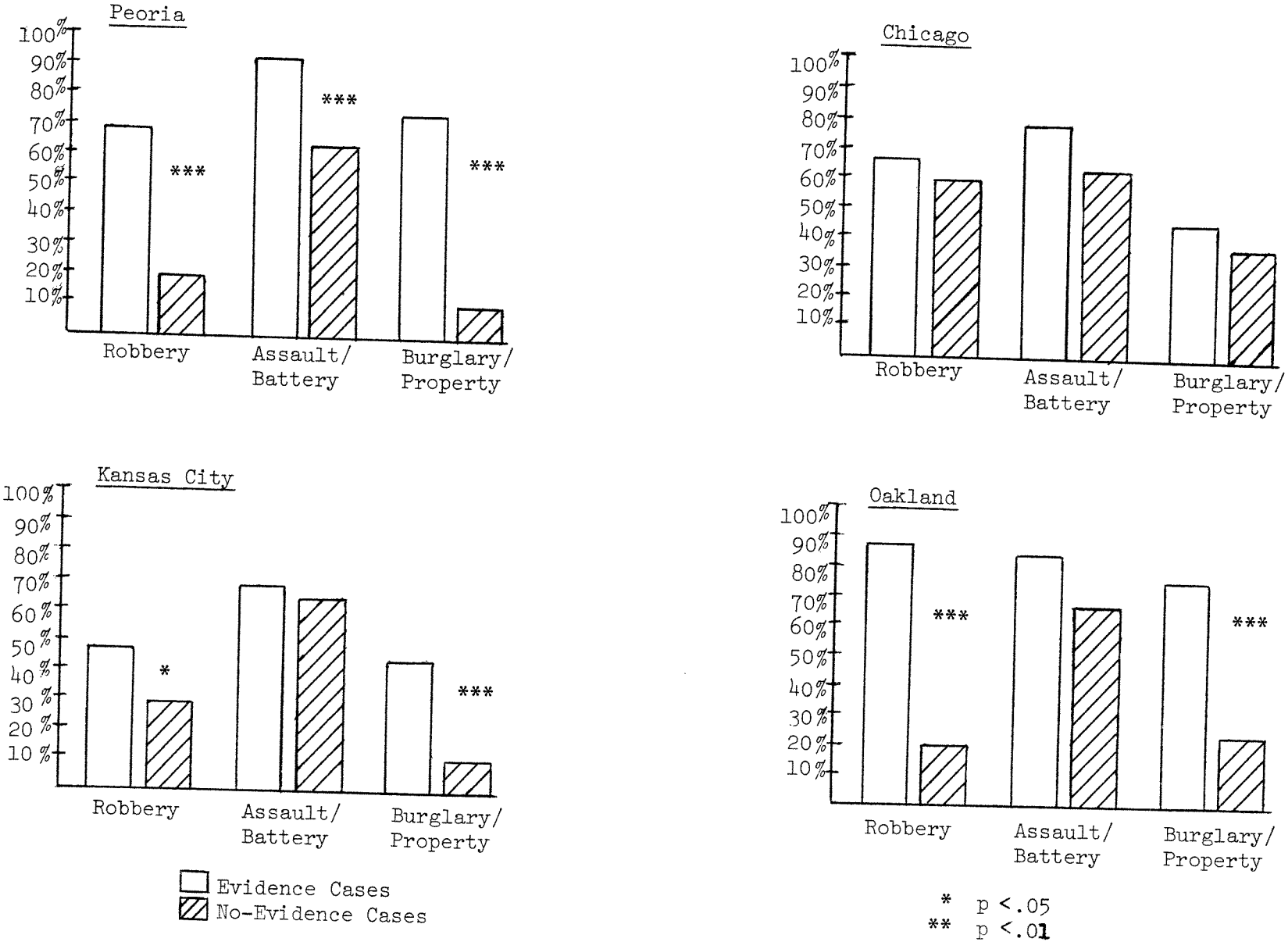
Crime	Study Sites								Total
	Peoria		Chicago		Kan City		Oakland		
	Evid.	No-Evid.	Evid.	No-Evid.	Evid.	No-Evid.	Evid.	No-Evid.	
Robbery	16	65	35	54	56	113	39	99	477
Assault/ Battery **	64	78	59	50	49	84	33	103	520
Burglary/ Property **	54	102	77	89	52	147	42	99	662
Total	134	245	171	193	157	344	114	301	1659

* Totals for these offense categories are based on the number of crimes where clearance information is available on the case. In all, approximately 2% of the cases sampled lacked this information and these are excluded from this analysis.

** In excess of 99% of the offenses in the assault/battery category are of the aggravated assault and aggravated battery variety. Eighty-seven percent of the offenses in the burglary/property offense category are, in fact, burglaries.

FIGURE VI-1

CLEARANCE RATES FOR EVIDENCE AND NO-EVIDENCE CASES



* p <.05
** p <.01
*** p <.001

TABLE VI-2

CLEARANCE RATES FOR EVIDENCE AND NO-EVIDENCE CASES
(N of Cases)

Crime	Sample	Clearance Rates			
		Peoria	Chicago	Kan City	Oakland
Robbery	Evidence	69% (16) ***	66% (35)	46% (56) *	87% (39) ***
	No-Evidence	20% (65)	59% (54)	27% (113)	20% (99)
Assault/Battery	Evidence	91% (64) ***	78% (59)	67% (49)	84% (33)
	No-Evidence	63% (78)	62% (50)	64% (84)	67% (103)
Burglary/Property	Evidence	74% (54) ***	43% (77)	42% (52) ***	76% (42) ***
	No-Evidence	9% (102)	37% (89)	9% (147)	24% (99)

Chi Square Significance:
* p < .05
** p < .01
*** p < .001

Peoria are also highly significant. The situation is similar in Kansas City and Oakland where the evidence cases (with the exception of assaults) are cleared at significantly higher rates. In Chicago, on the other hand, no significant differences are present, although the general trend is for evidence cases to be cleared at a slightly higher rate.

The reader is referred to Appendix C for a complete summary of the chi-square values for tables included in this chapter. Given the relatively small "n's" in these tables, a "continuity correction" (Blalock, 1972: 285)was made to compensate for the fact that a continuous distribution is being employed to represent the discrete distribution of sample frequencies.

It is inviting to conclude from this initial set of observations that physical evidence has a positive effect on the clearance of these types of offenses, at least in Peoria, Kansas City, and Oakland. However, as subsequent analysis reveals, these evidence and no evidence cases differ in other respects which also helps explain the differences in clearance rates. The task now is to identify these differences and to try to isolate the effect of the evidence alone on the outcome of the case.

The literature on policing and criminal investigation has identified several 'information elements' or 'solvability factors' which are associated with the clearance of cases (Greenberg, 1973; Greenwood, 1975; and Eck, 1979). Three such factors which are considered in the analysis of data in this chapter are: elapsed time between the discovery of the offense and its report to, or response by, the police; the taking into custody or naming and placing of a suspect at the preliminary investigation stage; and the presence of witnesses who viewed

the crime and/or offender. Of these factors, none has been shown to be of greater importance in clearing cases than the information provided to the police about the identity and location of possible suspects.

Table VI-3 presents the percentage of physical evidence and no evidence cases in which suspects were either taken into custody immediately at the scene of the crime or were "named and placed," i.e., where the police were provided with a suspect's name and place of business or residence. Such cases represent those incidents where police are required to do little or no investigation in resolving the case and where the likelihood of arrest and clearance are high. This table shows that suspects are in custody or are named and placed at a higher percentage of cases where physical evidence is gathered and analyzed than in those where it is not. The difference is most apparent in the burglary and property crimes where in Peoria, for example, suspects are in custody or are named and placed in 54% of the evidence cases but in only 8% of the no evidence cases. In Kansas City, the rates of suspect identification are 25% and 7% for the evidence and no evidence cases respectively. In Chicago, however, the rates of suspect identification are virtually the same in cases with and without physical evidence.

It is clear that physical evidence is not instrumental in the identification of an otherwise unknown suspect in situations where suspects are in custody or named and placed at the time the physical evidence is gathered. However, the evidence may still be important in corroborating information provided to the police by the victim or a witness and may assume greater importance if the case is prosecuted. Having the suspect in custody may also serve as an added incentive for crime scene investigators to collect evidence, since they have the

TABLE VI-3

POLICE KNOWLEDGE OF SUSPECTS AT OUTSET OF INVESTIGATION
(N of Cases) #

Crime	Sample	Suspect 'In Custody' or 'Named & Placed'			
		Peoria	Chicago	Kan City	Oakland
Robbery	Evidence	31% (16)	29% (35)	13% (56)	31% (39) *
	No-Evidence	9% (65)	15% (54)	9% (113)	13% (99)
Assault/Battery	Evidence	71% (62)	75% (59) **	51% (49)	58% (33)
	No-Evidence	68% (78)	46% (50)	46% (82)	72% (103)
Burglary/Theft	Evidence	54% (50) ***	32% (77)	25% (51) ***	55% (40) ***
	No-Evidence	8% (102)	30% (89)	7% (147)	19% (99)

For approximately 1% (n=11) of cases in Table VI-1, the "police knowledge of suspects" values were missing.

Chi Square Significance: * p < .05
** p < .01
*** p < .001

potential of providing the laboratory with evidence and standards. For example, glass chips imbedded in the shoes of a suspect may be compared with the glass taken from a broken window at a crime scene. The presence of both the evidence (material with an unknown origin) and standards (material with a known source) greatly facilitates the work of the forensic examiner whose primary aim is to determine if two evidential items once shared a common origin and, thereby, associate persons and locations.

The elapsed time variable is examined in Table VI-4. For Peoria and Oakland, the time between the discovery of the crime and its report to the police is recorded, while in Chicago and Kansas City the time from the discovery of the crime until police arrive at the scene is taken from the police reports. As noted earlier in this report, these elapsed time values were dichotomized into 10 minutes or less, and more than 10 minutes. In all crime categories in all jurisdictions, except for burglary in Chicago, a higher percentage of the physical evidence cases are reported (responded to) within 10 minutes after discovery of the crime than are the cases with no physical evidence. None of the differences in Chicago is statistically significant. These findings are consistent with the theory that the rapid report of a crime and the response of the police lessens the opportunity for the destruction of physical evidence and increases chances for its recovery. Deterioration of the evidence is not the only factor at work, however, since the crimes which are reported quickly are also those associated with taking suspects into custody. This, in turn, serves to stimulate the recovery of evidence and standards.

TABLE VI-4

TIME ELAPSED FROM DISCOVERY OF CRIME TO REPORT TO POLICE/POLICE RESPONSE

(N of Cases) #

Crime	Sample	Time Elapsed 10 Minutes or Less			
		Peoria	Chicago	Kan City	Oakland
Robbery	Evidence	87% (16) *	68% (34)	58% (55) **	62% (39) **
	No-Evidence	51% (65)	48% (54)	37% (112)	33% (97)
Assault/Battery	Evidence	90% (63) ***	78% (59)	49% (49) *	75% (32) ***
	No-Evidence	63% (78)	65% (49)	28% (83)	31% (102)
Burglary/Property	Evidence	68% (53) ***	35% (72)	41% (51)	51% (39) **
	No-Evidence	28% (99)	46% (85)	26% (146)	24% (97)

For approximately 2% (n=30) of cases in Table VI-1, the "elapsed time" values were missing.

Chi Square Significance: * $p < .05$
** $p < .01$
*** $p < .001$

Table VI-5 presents information on the percentage of cases in which the police are able to locate witnesses to the crime. A note of explanation is needed here, however, to interpret these data properly. The data collection instrument used in the review of the physical evidence cases gathered more detailed information on the police investigation than the instrument used to code the no evidence cases. Whereas both instruments code the status of the suspect's description, identity and whereabouts at the time of the initial crime scene investigation, the no evidence instrument does not record the number of witnesses questioned by the police. A cross-tabulation of the "suspect description" variable against the "witness" variable on the physical evidence sample reveals that "no description of the suspect" correlates with "no witness" 90% of the time in Kansas City, 92% of the time in Chicago, and 95% of the time in Peoria and Oakland. Therefore, to present an approximation of the presence and absence of witnesses in evidence and no evidence cases, this surrogate measure is being used, with the qualification that it is reliable only 90% to 95% of the time.

Examination of these data show that witnesses are able to provide information to the police in about 90% of robberies and assaults and batteries. In most cases, if the victim cooperates with the police and provides information, he or she is considered a witness, so the high rate is not surprising. It is quite a different matter in burglary and property crimes, however. In Peoria, Kansas City, and Oakland, in particular, there are major differences in the physical evidence and no evidence cases with the evidence cases having witnesses a higher percentage of the time. As with the other variables, there are no significant differences in Chicago, not even in the crime of burglary.

TABLE VI-5

WITNESS INFORMATION PROVIDED TO POLICE AT OUTSET OF INVESTIGATION
(N of Cases)

Crime	Sample	Witness Information Provided			
		Peoria	Chicago	Kan City	Oakland
Robbery	Evidence	88% (16)	94% (35)	98% (56)	100% (39)
	No-Evidence	92% (65)	100% (54)	97% (113)	98% (99)
Assault/Battery	Evidence	92% (64)	97% (59)	86% (49)	88% (33)
	No-Evidence	87% (78)	94% (50)	89% (84)	96% (103)
Burglary/Property	Evidence	67% (54) ***	48% (77)	40% (52) ***	67% (42) **
	No-Evidence	19% (102)	39% (89)	11% (147)	35% (99)

Chi Square Significance: * $p < .05$
** $p < .01$
*** $p < .001$

In summary, the data show that the cases with physical evidence have a much higher rate of clearance. This can be explained, in part, because of other characteristics which increase the likelihood of a successful case outcome. The exception is Chicago where the evidence and no evidence cases are practically the same in all other respects. The task now becomes one of finding the marginal effect of the evidence alone. In order to tease this marginal effect into the open, evidence and no evidence clearance rates are compared while controlling for report/arrival time, suspect in custody or named and placed, and the availability of witnesses.

The clearance rates of evidence and no evidence cases, while controlling for police knowledge of suspects, is examined in Table VI-6. In Peoria it can be seen that the cases with physical evidence have higher clearance rates in two of the three crime categories where suspects are identified or are in custody. But the greatest differences are observed where suspects are <u>not</u> identified or in custody. In robberies and burglaries without suspects, the differences are significant at the .001 level. Focusing, again, on these same two crime categories in Kansas City and Oakland, the cases with evidence are cleared at significantly higher rates. In the assaults and batteries, the differences are significant in two jurisdictions: in Peoria in all cases and in Chicago where suspects are in custody or named and placed. It appears, therefore, that the presence of physical evidence generally has the greatest impact in robberies and burglaries which have the poorest information to begin with about possible suspects.

Table VI-7 controls for the time elapsed between discovery of the crime and its report to the police or the arrival of the first patrol

TABLE VI-6

CLEARANCE RATES CONTROLLING FOR
POLICE KNOWLEDGE OF SUSPECTS AT OUTSET OF INVESTIGATION
(N of Cases)

Crime	In Custody or Named & Placed	Sample	Clearance Rates			
			Peoria	Chicago	Kan City	Oakland
Robbery	Yes	Evidence	80% (5)	90% (10)	100% (7)	100% (12)
		No-Evidence	83% (6)	100% (8)	100% (10)	85% (13)
	No	Evidence	64% (11) ***	56% (25)	39% (49) *	82% (27) ***
		No-Evidence	14% (59)	52% (46)	19% (103)	10% (86)
Assault/ Battery	Yes	Evidence	98% (44) **	100% (44) **	96% (25)	100% (19)
		No-Evidence	77% (53)	78% (23)	89% (38)	78% (74)
	No	Evidence	78% (18) **	13% (15)	37% (24)	64% (14)
		No-Evidence	32% (25)	48% (27)	43% (44)	38% (29)
Burglary/ Property	Yes	Evidence	93% (27) **	100% (25)	85% (13)	100% (22)
		No-Evidence	38% (8)	93% (27)	80% (10)	95% (19)
	No	Evidence	65% (23) ***	15% (52)	29% (38) ***	56% (18) ***
		No-Evidence	6% (94)	13% (62)	4% (137)	8% (80)

Chi Square Significance: * $p < .05$; ** $p < .01$; *** $p < .001$

TABLE VI-7

CLEARANCE RATES CONTROLLING FOR TIME ELAPSED
FROM CRIME DISCOVERY TO REPORT TO/RESPONSE BY THE POLICE*
(N of Cases)

Crime	Time Elapsed 10 Minutes Or Less	Sample	Clearance Rates				
			Peoria	Chicago	Kan City	Oakland	
Robbery	Yes	Evidence	64% (14)	61% (23)	53% (32)	83% (24)	
			*		*		***
		No-Evidence	21% (33)	61% (26)	24% (41)	25% (32)	
	No	Evidence	100% (2)	73% (11)	39% (23)	93% (15)	
							***
		No-Evidence	19% (32)	57% (28)	28% (71)	18% (65)	
Assault/ Battery	Yes	Evidence	91% (57)	78% (46)	79% (24)	83% (24)	
		No-Evidence	82% (49)	59% (32)	78% (23)	84% (32)	
	No	Evidence	83% (6)	77% (13)	56% (25)	100% (8)	
		No-Evidence	31% (29)	65% (17)	60% (60)	59% (70)	
Burglary/ Property	Yes	Evidence	83% (36)	64% (25)	67% (21)	90% (20)	
			***		***		**
		No-Evidence	14% (28)	69% (39)	16% (38)	48% (23)	
	No	Evidence	59% (17)	32% (47)	23% (30)	58% (19)	
			***		*		***
		No-Evidence	7% (71)	13% (46)	7% (108)	18% (74)	

Chi Square Significance: * p < .05; ** p < .01; *** p < .001

officer. In Oakland, the robbery and burglary cases with physical evidence are cleared at a significantly higher rate, regardless of elapsed time. The greatest differences between evidence and no evidence cases occur when more than 10 minutes have elapsed, representing incidents which traditionally have the lower clearance rates.

The trends in the remaining cities are not completely consistent with the findings in Oakland. The differences are greatest in Peoria and Kansas City in the burglary and property category, where police receive the call/arrive at the scene within ten minutes of the discovery of the crime. The differences are also significant, but to a lesser extent, in Peoria and Kansas City in the 10 minutes or less classification for the crime of robbery.

Controlling for witnesses also reveals interesting results (Table VI-8). Due to the small number of robberies and assaults and batteries without witnesses, the only differences which are significant in these crimes are when witness information is provided. Consistently, the evidence cases are cleared at a higher rate than the no evidence cases. The burglary and property crime category permits a comparison of results when witnesses are absent; in Peoria, Kansas City, and Oakland the evidence cases are cleared at significantly higher rates than the no evidence cases. The differences are not significant in Chicago.

Disposition of Arrests

As noted in Chapter II of this report, there is little information in the literature which discusses the impact of physical evidence on the decision to charge or convict. The best treatment to date is contained

TABLE VI-8

CLEARANCE RATES CONTROLLING FOR WITNESS
INFORMATION PROVIDED TO POLICE AT OUTSET OF INVESTIGATION
(N of Cases)

Crime	Witness Information Provided	Sample	Clearance Rates			
			Peoria	Chicago	Kan City	Oakland
Robbery	Yes	Evidence	71% (14) ***	67% (33)	47% (55) *	87% (39) ***
		No-Evidence	22% (60)	59% (54)	27% (110)	21% (97)
	No	Evidence	50% (2)	50% (2)	0% (1)	0% (0)
		No-Evidence	0% (5)	0% (0)	0% (3)	0% (2)
Assault/ Battery	Yes	Evidence	95% (59) ***	81% (57)	79% (42)	93% (29) *
		No-Evidence	68% (68)	66% (47)	70% (74)	68% (99)
	No	Evidence	40% (5)	0% (2)	0% (7)	25% (4)
		No-Evidence	30% (10)	0% (3)	20% (10)	50% (4)
Burglary/ Property	Yes	Evidence	94% (36) ***	84% (37)	76% (21)	93% (78) ***
		No-Evidence	21% (19)	83% (35)	56% (16)	60% (35)
	No	Evidence	33% (18) **	5% (40)	19% (31) **	43% (14) ***
		No-Evidence	6% (83)	7% (54)	3% (131)	5% (64)

Chi Square Significance: * $p < .05$; ** $p < .01$; *** $p < .001$

within the What Happens After Arrest? study by Forst et al., (1977). This study successfully isolated certain activities of and information collected by the police which have a substantial impact on the rates of conviction. These are: locating witnesses to the crime, making prompt arrests (within 24 hours of the commission of the offense) and collecting tangible evidence. Unfortunately, the definition of "tangible evidence" used in this study is imprecise and it is unknown what fraction of such evidence is actually scientifically analyzed (forensic) evidence.

The following two tables present the rates of prosecutorial charging and conviction for the evidence and no evidence cases. The rates in Table VI-9 are computed by calculating the percentage of persons arrested for the crimes of robbery, assault, or burglary who were subsequently charged. The offense with which the arrestee is charged may have been upgraded or downgraded from that which appeared on the police arrest report.

There are differences in the rates of charging for the crime categories of robbery, assault/battery, and burglary/property. The differences are most evident in Kansas City, where 70% of the robbery arrests with physical evidence, but only 10% of the no evidence arrests, result in a prosecutorial charge. About twice as many burglary arrests with evidence analyzed (65% versus 33%) have formal charges filed as do the arrests without physical evidence, but due to the small sample size the difference is not significant. Kansas City and Oakland also have higher rates of charging in the assault and battery category, but the rates are not materially different in Peoria and Chicago. Interestingly enough, in the robbery category in Chicago and the burglary category in Oakland,

TABLE VI-9

PERCENT OF ARRESTS LEADING TO FORMAL CHARGES BEING FILED FOR EVIDENCE AND NO-EVIDENCE CASES

(N of Arrests)

Crime	Sample	Charging Rates			
		Peoria	Chicago	K. C.	Oakland
Robbery	Evidence	94% (18)	73% (41)	70% (40) ***	85% (52)
	No-Evidence	67% (6)	91% (46)	10% (42)	80% (15)
Assault/Battery	Evidence	78% (69)	91% (53)	45% (33)	94% (35) *
	No-Evidence	80% (40)	84% (32)	27% (60)	74% (47)
Burglary/Property	Evidence	86% (69) *	73% (48)	65% (43)	62% (45) *
	No-Evidence	50% (8)	85% (52)	33% (15)	92% (26)

Chi Square Significance: * $p < .05$
** $p < .01$
*** $p < .001$

cases without physical evidence are charged at a higher rate than those with evidence.

One possible explanation for these lower rates of charging in the cases with physical evidence, is the nature of laboratory results in those cases. The most common evidence category examined in robberies in Chicago is blood. Blood, however, only results in a common origin laboratory result in 14% of personal offenses in Chicago. While there may have been sufficient "testimonial" evidence to arrest an individual, the absence of definitive laboratory results linking the suspect with the crime may have influenced the prosecutor not to prefer formal charges.

In Oakland, fingerprints are the leading evidence category examined in burglaries, but they are linked to their original source only 37% of the time in property crimes, the lowest of all jurisdictions. In addition, in Oakland burglaries, latent prints are found to be of different origin from a standard (suspect) 44% of the time, the highest of all cities in the study. The low rates of common origin and high rates of different origin results may serve to discourage prosecutors from filing charges against persons arrested.

The next table (Table VI-10) looks at the percentage of arrests which actually result in a conviction. As with the charging rates, these percentages are computed by finding the ratio of arrests which result in a conviction on any charge. (In the final section of this chapter, the effects of evidence on plea bargaining and downgrading of charges will also be examined.) The major differences are, again, in the crime categories of burglary and robbery in Kansas City. Thirty-three percent of the robbery arrests result in convictions in

TABLE VI-10

PERCENT OF ARRESTS LEADING TO CONVICTIONS
EVIDENCE AND NO-EVIDENCE CASES

(N of Arrests)

Crime	Sample	Conviction Rates			
		Peoria	Chicago	Kan City	Oakland
Robbery	Evidence	72% (18)	51% (41)	33% (40) ***	60% (52)
	No-Evidence	33% (6)	61% (46)	0% (42)	33% (15)
Assault/Battery	Evidence	48% (69)	36% (53)	12% (33)	34% (35)
	No-Evidence	53% (40)	31% (32)	7% (60)	30% (47)
Burglary/Property	Evidence	58% (69)	42% (48)	40% (43) *	36% (45)
	No-Evidence	38% (8)	60% (52)	7% (15)	27% (26)

Chi Square Significance: * $p < .05$
** $p < .01$
*** $p < .001$

Kansas City for the evidence cases, but none (0%) of the 42 robbery arrests with no evidence result in a conviction. In the burglary and property category, 40% of the evidence-based arrests result in a conviction, while only 7% of the no evidence cases.

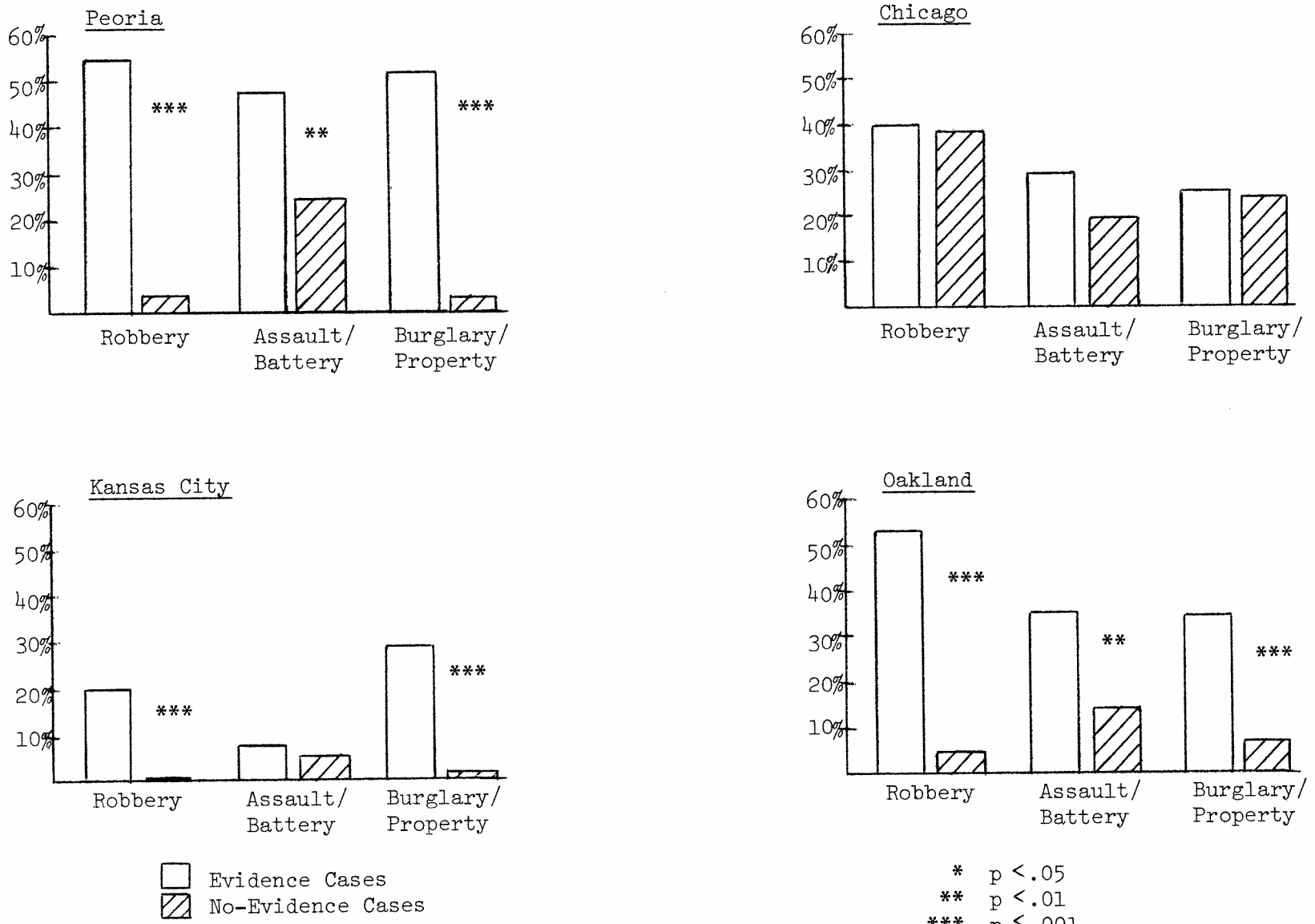
This table is also interesting since it shows: there is virtually no difference in the rates of conviction in evidence and no evidence cases in the crime of assault across all the jurisdictions; and the differences in conviction rates for robbery and burglary are significant only in Kansas City. The absence of controls for other variables, however, may be clouding the results.

Figure VI-2 and Table VI-11 present the likelihood that a robbery, assault/battery, or burglary/property incident will result in at least one conviction. These percentages are calculated for the evidence and no evidence samples by finding the ratio of incidents in the initial sample (see Table VI-1) which lead to at least one conviction. The differences which are detected at the intermediate levels of case processing are greatly magnified in this final tabulation. It shows very significant differences in the rates of conviction (using incidents as the base) for all three crime categories in Peoria and Oakland, as well as in the robbery and burglary/property categories in Kansas City.

In Chicago, the differences are minimal in the categories of robbery, burglary and assault. This can best be attributed to two factors: the characteristics of the cases themselves and the laboratory results. The evidence and no evidence samples in Chicago are very similar with respect to the percent of time witnesses are present, suspects are in custody or identified and the elapsed time until police arrival is 10 minutes or under. There are substantial differences in these variables

FIGURE VI-2

PERCENT OF INCIDENTS RESULTING IN AT LEAST ONE CONVICTION



* $p < .05$
** $p < .01$
*** $p < .001$

TABLE VI-11

PERCENT OF INCIDENTS RESULTING IN AT LEAST ONE CONVICTION

(N of Cases)

Crime	Sample	Conviction Rates (Incidents Leading to a Conviction) Peoria	Chicago	Kan City	Oakland
Robbery	Evidence	56% (16) ***	40% (35)	20% (56) ***	53% (36) ***
	No-Evidence	3% (65)	39% (54)	0% (113)	4% (102)
Assault/Battery	Evidence	48% (64) **	29% (59)	8% (49)	35% (34) **
	No-Evidence	24% (78)	20% (50)	5% (84)	13% (106)
Burglary/Property	Evidence	52% (54) ***	25% (77)	29% (52) ***	34% (32) ***
	No-Evidence	3% (102)	24% (89)	1% (147)	7% (103)

Chi Square Significance: * $p < .05$
** $p < .01$
*** $p < .001$

in the other jurisdictions, with the evidence cases usually having witnesses and suspects present and quicker report/response rates. Secondly, the absence of differences in Chicago may also be attributed to the smaller percentage of examinations yielding laboratory results which associate the defendant with the crime scene or victim.

In Peoria, on the other hand, convictions are attained in 56% of the robbery incidents in which physical evidence is collected and examined. Only 3% of robberies without physical evidence result in a conviction. The differences are comparable in the burglary and property crime category where 52% of the incidents with evidence result in a conviction compared with 3% of the no evidence incidents. Assault/battery cases with physical evidence are twice as likely to result in a conviction as those without evidence.

An examination of the cases in Kansas City and Oakland yields similar results. None of the robbery cases in Kansas City without physical evidence results in a conviction, and only one of the 147 burglary/property crimes ends with a conviction. The likelihood of a conviction in these same two crime categories when evidence is examined is 20% and 29% respectively. In Oakland, in addition to significantly higher rates of conviction in the crimes of robbery and burglary, the rates of conviction in assault cases are significantly greater.

Plea Bargaining and Charge Reduction

A discussion of court dispositions would be incomplete without an examination of the manner in which these cases are adjudicated (dismissals, pleas, trials) and how the final charges for which the defendant is

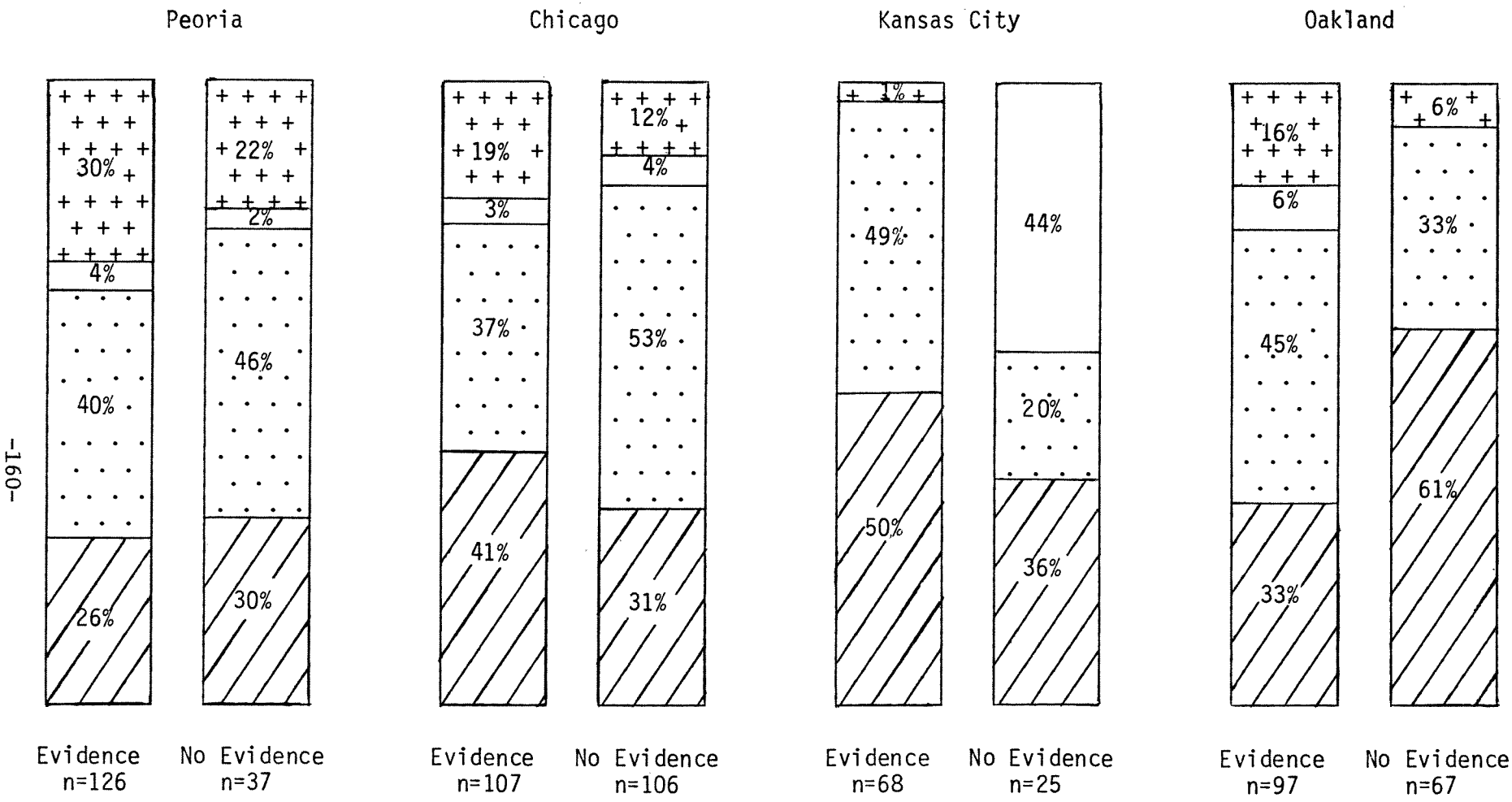
convicted compare with the initial or top charges filed against the defendant. Due to the small number of defendants arrested, charged, and convicted in each of the four jurisdictions, the robbery, assault and burglary defendants have been combined into evidence and no evidence categories for each city.

Figure VI-3 depicts how these evidence and no evidence cases are resolved. In Peoria, for example, 26% of the persons initially charged in cases with evidence analyzed, are not prosecuted and are dismissed. This compares with 30% of the defendants in cases with no evidence. Another 40% of the evidence defendants are convicted through guilty pleas, while 46% of the no-evidence defendants offer guilty pleas. Thirty-four percent of the evidence defendants' cases go to trial, compared to 24% of the no evidence defendants. Eighty-eight percent of the defendants in cases with evidence who go to trial are convicted, which represents 30% of all defendants charged, while 12% of the defendants who go to trial, 4% of all defendants charged, are acquitted. The fraction of convictions and acquittals for no evidence cases is similar. Therefore, a total of 70% (40% plus 30%) of all defendants charged are convicted for some offense. The no evidence rate is very comparable, but with a slightly higher rate of guilty pleas. None of these differences is statistically significant, however.

In Chicago, a higher percentage of evidence defendants (41%) are dismissed than are no evidence defendants (31%). But a higher percentage, 53%, of the no evidence defendants are convicted through guilty pleas than are evidence defendants at 37%. These differences are not significant. Interestingly enough, in Kansas City more than twice the percentage of evidence defendants plead guilty than do no evidence

Figure VI-3

Judicial Outcome of Cases Where the Prosecutor Filed Charges (Defendant Based)



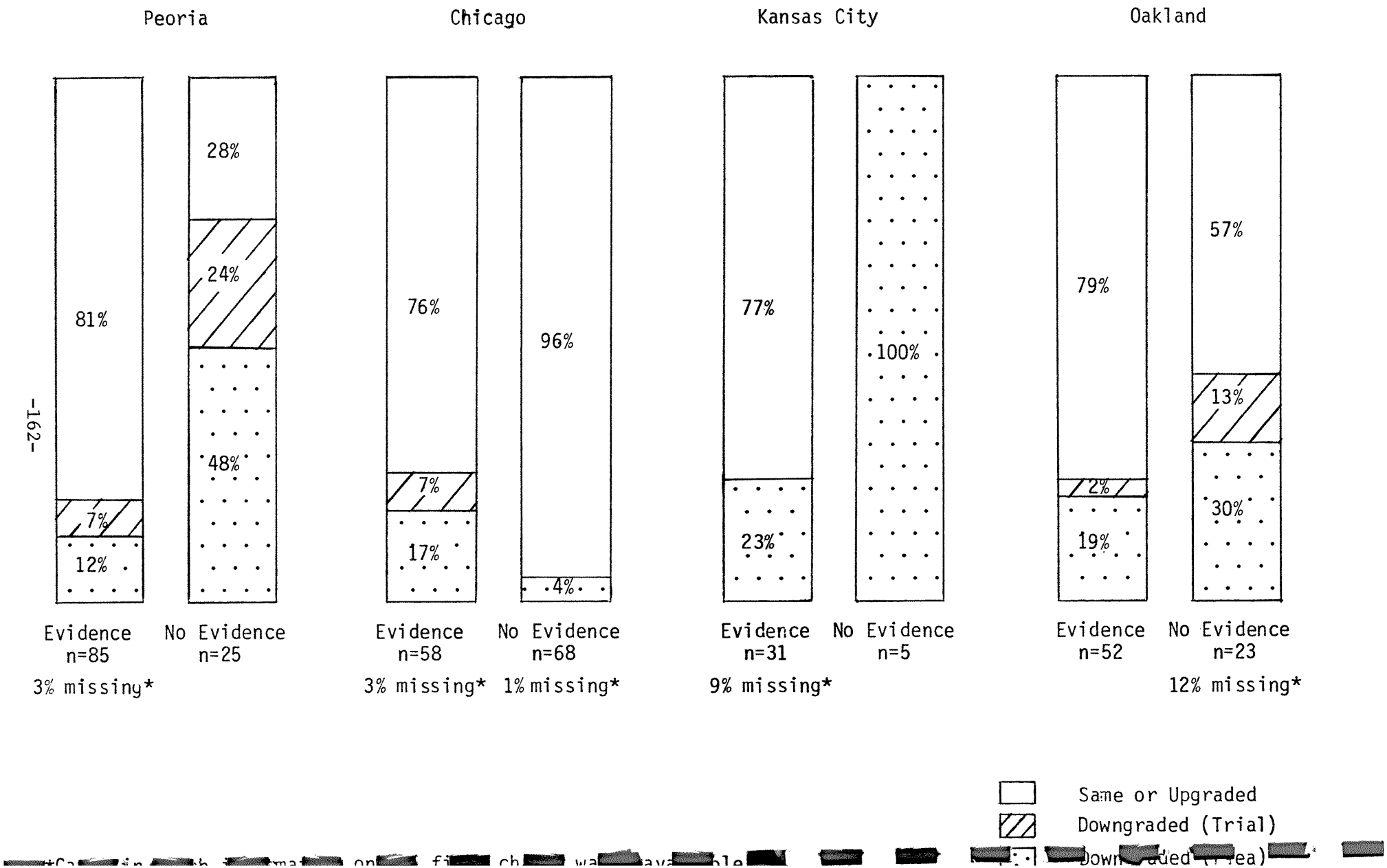
defendants (49% to 20%) and this difference is significant at the .001 level. But of the eleven defendants who went to trial in cases with no physical evidence, all were acquitted. There was only one defendant who went to trial in a case with physical evidence and he was convicted.

Almost twice the percentage of defendants with no evidence (61%) in Oakland have their cases dismissed in comparison to cases with physical evidence (33%). This difference is significant at the .001 level. A higher percentage of the evidence defendants plead guilty (45% to 33%). The evidence defendants' cases are more than three times as likely to go to trial than the no evidence defendants.

The next figure (Figure VI-4) illustrates the percentage of convictions, including pleas and trials, in which the final charges are reduced from the initial charge for which the defendant had been arrested. A conviction is classified as being reduced when, as defined in the relevant criminal statute, the final charge for which the defendant is convicted carries with it a possible penal sanction which is <u>less</u> than the potential penalty prescribed in the initial charge. With the exception of Chicago, where evidence cases are downgraded at a higher rate ($p < .01$), evidence cases generally have lower rates of charge reduction than cases without evidence. In Peoria, 19% of the evidence convictions are reduced, compared with 72% of the no evidence cases (significant $p < .001$ level); Kansas City 23% compared with 100% ($p < .001$); and, in Oakland, 21% compared to 43% ($p < .05$). The data also suggest that this increase in downgrading of charges in the no evidence cases is related to the higher proportion of no evidence cases that are plea bargained.

Figure VI-4

Percent of Convictions in Which the Arrest Charge was Downgraded



The fact that cases which are plea bargained are also more likely to have the charges reduced is a well documented phenomenon. The question remains, though, is there reason why the presence of physical evidence should be associated with cases taken to trial?

A recent national study, Prosecutorial Decision Making (Jacoby et al., 1982), presents results derived from the examination of decision-making patterns in fifteen prosecutor's offices. The study identifies factors taken into consideration by prosecutors in making various decisions. These decisions include setting priorities for case prosecution, disposing of cases by guilty pleas or by trial, and disposing of cases at a reduced level. While this study found a great amount of interjurisdictional variation in the disposition of cases by guilty plea, it also found that guilty pleas tend to occur primarily in less serious cases and where the evidence is marginal. "As the evidentiary strength of a case weakens, the case is more likely to be disposed of by a plea of guilty . . . . As the strength of a case increases disposition by trial is more likely." (Jacoby, 1982:40)

Figure VI-3 showed that cases with physical evidence are more likely to go to trial than are cases without such evidence. But it is also interesting to see if the strength of laboratory results, expressed in terms of the ability of the evidence to link an offender with a crime scene or victim, is associated with cases going to trial or, for that matter, the nature of the judicial outcome. Figures VI-5 through VI-8 display these results.

Figure VI-5

Peoria

Results of Laboratory Testing by
Type of Judicial Disposition

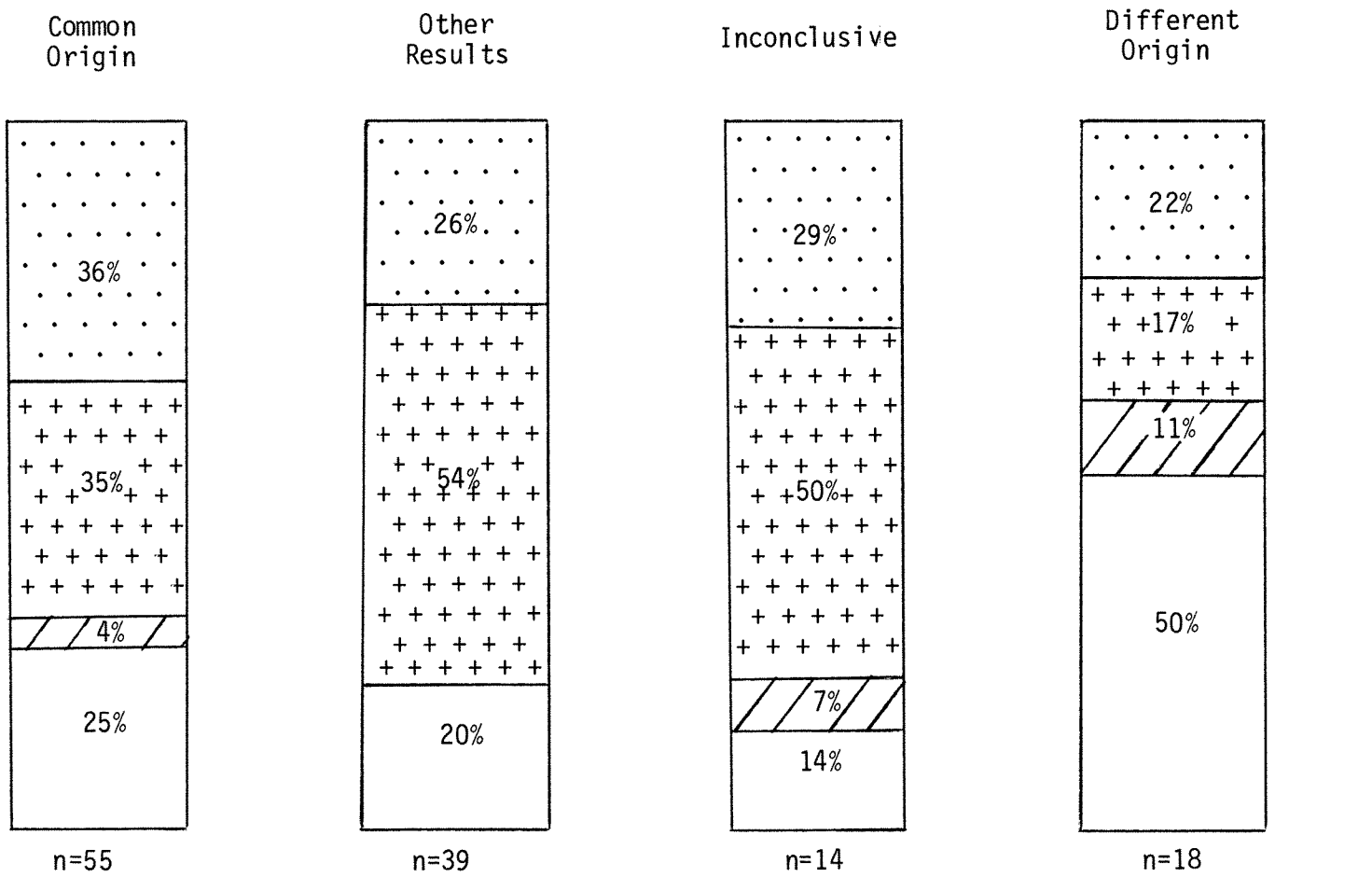


Figure VI-6

Chicago

Results of Laboratory Testing by
Type of Judicial Disposition

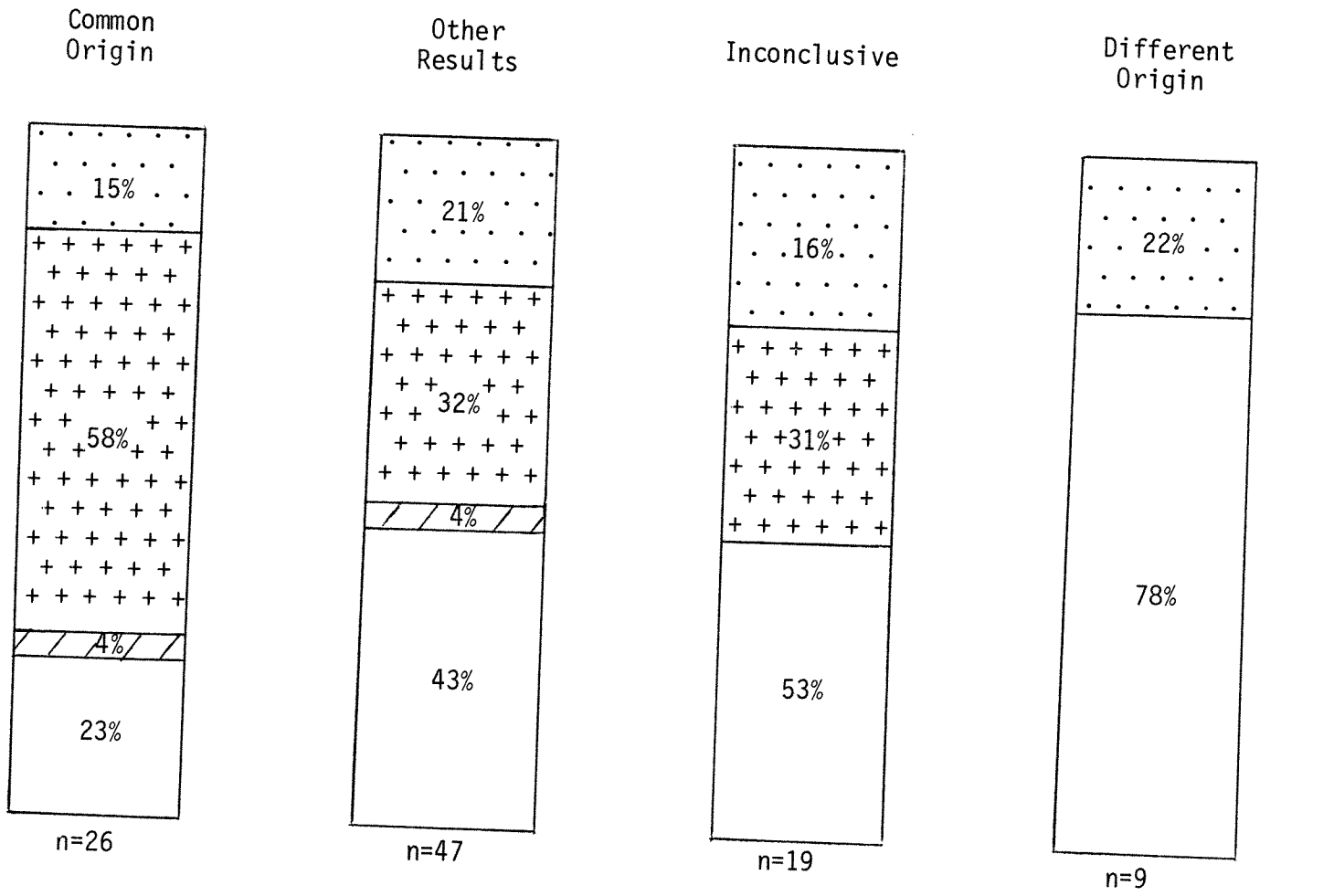


Figure VI-7

Kansas City

Results of Laboratory Testing by
Type of Judicial Disposition

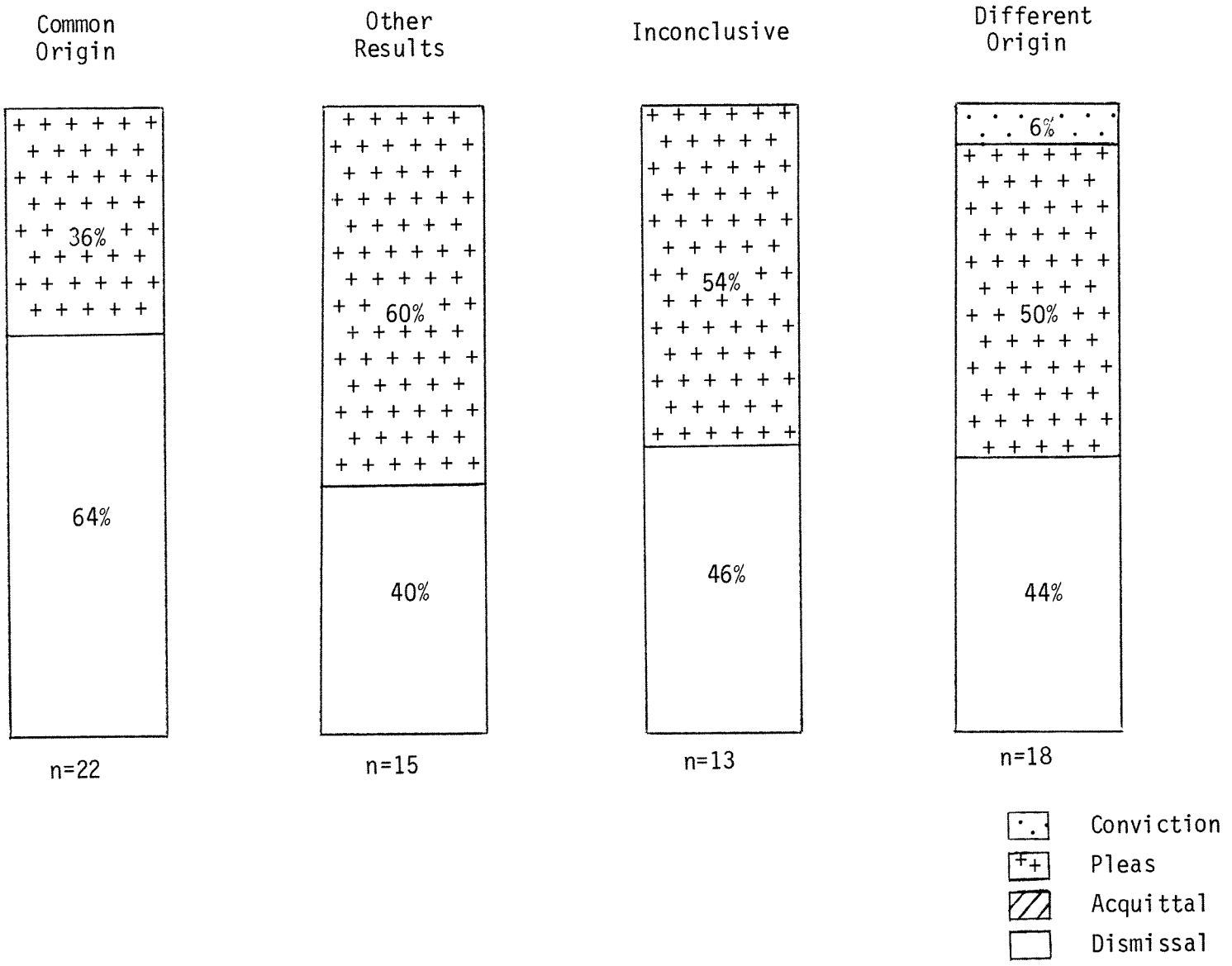
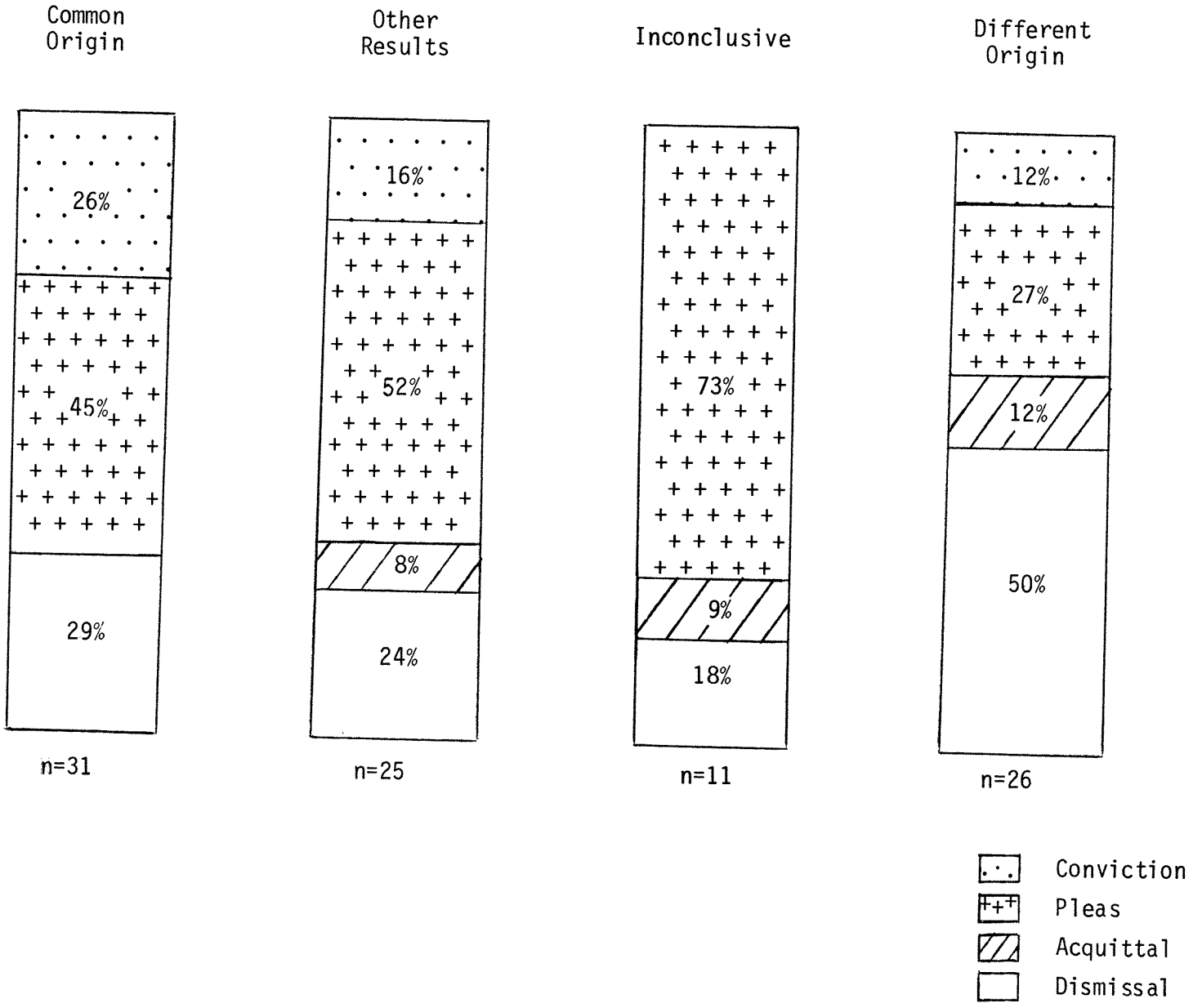


Figure 8

Oakland

Results of Laboratory Testing by
Type of Judicial Disposition



Different Origin Results - In cases in which the laboratory results disassociate or, at a minimum, fail to associate the offender with the scene or victim, there is a higher rate of dismissals. In Peoria, for example, 50% of the charges are dismissed in cases where the laboratory results are of different origin compared with 22% of other cases, ($p < .05$).

Common Origin Results - In Peoria and Oakland a slightly higher percentage of cases with common origin laboratory results go to trial rather than being disposed of in some other fashion. In Chicago, about 19% of the common origin result cases are disposed of at trial compared with about 26% of cases having some other finding. None of the differences noted in any of these three cities is statistically significant, however. In Kansas City, only one of the 68 physical evidence cases go to trial, so there is no basis for a comparison of adjudication trends controlling for laboratory results.

Utility of Fingerprint Evidence in Burglaries

In addition to the evidence and no evidence samples drawn in the study cities, a special "fingerprint-only" sample has been drawn in Peoria, Chicago and Oakland. In such cases fingerprints are the only type of physical evidence examined.

Fingerprints are the oldest, most well-known and frequently used category of physical evidence. In many respects, too, fingerprint evidence is perceived as the most conclusive physical evidence. We operate under the assumption that the fingerprints of each individual are unique and unchanging through time. Examiners use the most indubitable language when they report their findings; either the latent print is that of the person in question (a conclusive common origin), or it is not (a conclusive <u>different</u> origin). Since fingerprints may play such a critical role in the investigation and prosecution of criminal cases, especially burglaries, it is important to contrast the outcome of cases where fingerprints are collected with incidents where other types of physical evidence are examined and, also, with crimes where no physical evidence at all is gathered.

In this section, cases are divided into three categories:

No-Evidence: Cases having no laboratory analyzed physical evidence.

Fingerprint-Only: Cases having fingerprints, but no other physical evidence.

Evidence: Cases having other forms of laboratory analyzed physical evidence. These cases may or may not have fingerprints in addition to the other types of evidence.

Only burglary/property crimes are included in the following analysis. Table VI-12 presents summary statistics for the three levels of cases in

TABLE VI-12

CASE OUTCOME STATISTICS
BURGLARY/PROPERTY CRIMES
CONTROLLING FOR FINGERPRINTS AND OTHER EVIDENCE

City	Sample	N of Cases	Clearance Rate	Cases With An Arrest	Cases With Charges Filed	Cases With Convictions
	No-Evid	106	9%	8%	4%	3%
Peoria	FP-Only	34	26%	29%	15%	12%
	Evid	62	71%	74%	69%	47%
	No-Evid	93	37%	38%	31%	23%
Chicago	FP-Only	42	14%	17%	12%	7%
	Evid	80	45%	43%	33%	24%
	No-Evid	103	24%	21%	21%	7%
Oakland	FP-Only	33	18%	18%	15%	9%
	Evid	43	77%	77%	56%	30%

the three cities. One might expect that as one proceeds from no evidence, to fingerprint-only, to evidence cases, there should be higher rates of clearances, arrests, charging, and convictions. In general, the data support this theory, although not without exception in one of the jurisdictions.

There are four dependent variables presented in Table VI-12 that will be used to measure the results of cases. Each is an incident based dichotomous variable. While data on arrests, charging and convictions has been collected on up to three suspects/offenders for each case, this information has been collapsed into an incident based variable. Thus, "Cases With an Arrest" indicates the percentage of cases with at least one offender arrested for the crime. Likewise, "Cases With Charges Filed" indicates the percentage of cases with charges filed against at least one offender, and "Cases With Convictions" the percentage of cases with at least one offender convicted, but not necessarily of the initial charge. In general, police and prosecutors have the least success in clearing and prosecuting burglaries with no evidence, and the greatest success in the burglaries with evidence beyond simple fingerprints.

Table VI-13 presents a more detailed description of the type of cases occurring at each level in the three cities. The first item measures whether the crime was reported within ten minutes of its discovery (in Peoria and Oakland) or whether police arrived within ten minutes of its discovery (in Chicago and Kansas City). It is clear in Peoria and Oakland that when there is a delay in the reporting of the crime it is less likely that evidence will be collected and analyzed.

If one or more witnesses are mentioned in the police report, this is indicated in the next column of Table VI-13. The suspect identifica-

TABLE VI-13

DESCRIPTIVE STATISTICS FOR EVIDENCE,
NO EVIDENCE AND FINGERPRINT ONLY CASES

City	Sample	Rept/Arr ≤ 10 Mins	Witnesses	Suspect Identification	Minutes to Apprehension *
Peoria	No-Evid (N=106)	28%	20%	8% ID/Cust 11% Some Desc 80% No Desc	1% Up to 10 7% Over 10 92% Not Appr
	FP-Only (N=34)	39%	29%	24% ID/Cust 12% Some Desc 64% No Desc	9% Up to 10 21% Over 10 71% Not Appr
	Evid (N=62)	64%	52%	53% ID/Cust 20% Some Desc 27% No Desc	27% Up to 10 47% Over 10 26% Not Appr
Chicago	No-Evid (N=93)	44%	40%	30% ID/Cust 10% Some Desc 60% No Desc	30% Up to 10 8% Over 10 62% Not Appr
	FP-Only (N=42)	25%	17%	14% ID/Cust 7% Some Desc 79% No Desc	5% Up to 10 12% Over 10 83% Not Appr
	Evid (N=80)	35%	37%	31% ID/Cust 16% Some Desc 53% No Desc	19% Up to 10 24% Over 10 57% Not Appr
Oakland	No-Evid (N=103)	24%	33%	18% ID/Cust 18% Some Desc 64% No Desc	16% Up to 10 5% Over 10 79% Not Appr
	FP-Only (N=33)	29%	45%	12% ID/Cust 15% Some Desc 73% No Desc	9% Up to 10 9% Over 10 82% Not Appr
	Evid (N=43)	50%	49%	56% ID/Cust 15% Some Desc 29% No Desc	40% Up to 10 37% Over 10 23% Not Appr

* The follow-up apprehension rates (over 10 mins) discussed on the previous page were computed after first removing the incidents resulting in immediate apprehensions (up to 10 mins).

tion variable can assume three levels: no description of the suspect; some description (meaning anything from a general description (race or sex or clothing) to actual naming of a suspect), and identified/in custody where the suspect was immediately taken into custody or else was named and placed. It is interesting to observe that evidence cases have high rates of "ID/In Custody" while most no evidence and fingerprint-only cases begin with neither a suspect in custody or named and placed.

The time to apprehension of suspects gives some indication of how many cases are eventually solved where the suspect is not apprehended within ten minutes of the discovery of the crime. In cases that are not solved immediately by apprehension of the suspects one might expect those with physical evidence to be solved at a higher rate than those with no physical evidence. In general this is found to be true. For example, no evidence burglaries in Peoria result in an arrest in only about 7% of the cases not solved immediately. For fingerprint-only cases the percentage of cases not solved immediately (apprehensions made within 10 minutes) which result in a follow-up arrest is 23%, while the follow-up arrest rate for the evidence cases is 64%. The respective rates for Chicago are 11%, 13%, and 30%, while for Oakland they are 6%, 10%, and 62%. (See footnote at bottom of Table VI-13 for explanation.)

In Chicago, an interesting pattern emerges; the cases where only fingerprints are collected and examined are, in terms of other investigative information, inferior when compared with those where either other kinds of evidence are examined, or even those where no evidence at all is found. The fingerprint-only cases are responded to slower, and have fewer witnesses and/or suspects than do the cases with no evidence collected. Although the case sample is far too small to make any firm

judgments, one plausible explanation emerges. The collection of fingerprints in burglaries under the circumstances where information about suspects and witnesses is lacking can be classified as a true "longshot" attempt by investigators to identify a suspect.

These may also represent cases in which patrol officers and detectives call evidence technicians to the scenes of crimes which will probably be suspended or closed but where the police officer wants to "give the victim some service." Such "service" may include a search for physical evidence even though the chances for a fingerprint identification or match are extremely remote. It is not at all uncommon for technicians, in all of the jurisdictions, to be used as "public relations" officers and, in particular, not to disappoint crime victims who have grown to expect a search for physical evidence by virtue of watching police television programs where this is standard procedure.

The Role of Physical Evidence in Drug Cases

Several studies have noted the proliferation of drug evidence into forensic laboratories (Benson et al., 1970; Parker and Gurgin, 1972). It is not unusual for more than 50% of all cases handled by a laboratory to be controlled substance related. Drug evidence is unique in that scientific analysis of the physical evidence (the questioned substance) is necessary to establish that a crime has been committed. Typically, a suspected user or dealer cannot be convicted of the crime until the laboratory has shown the substance he or she possessed is controlled by statute.

A sample of approximately 50 drug cases has been selected in each of the four study cities. An examination of the descriptive statistics for those cases (Table VI-14) reveals several interesting characteristics.

Note the high rate of police initiated involvement, along with the high percentage of "street-outside" crime scene locations. In the typical scenario for a drug case, police stop a person on the street for a traffic violation, perhaps, or in response to a minor disturbance call and discover the suspected drug. In over 90% of cases in Peoria and Oakland the evidence is found in a search of the suspect or in his/her vehicle. This figure is about 70% in Chicago and Kansas City.

Often the scene of a drug offense is a private residence. This may result from a police raid with a warrant or on an informant's tip, but it also occurs when police respond to an unrelated call, such as a family disturbance, and discover the drugs while in the premises.

More than 90% of the time the suspect is placed in custody immediately or else identified and located (an address or place of business provided) in three of the cities. In Kansas City there is an "ID/In Custody" in 82% of the cases. Arrests are made in 88% or more of the cases in each of the four cities, and charges filed in at least two-thirds of the cases (89% in Oakland).

The rates of conviction, however, vary markedly from jurisdiction to jurisdiction. An offender is convicted in 46% of the drug <u>incidents</u> in Peoria. This represents almost two out of every three cases where charges are filed. In Chicago, on the other hand, only 15% of the cases result in a defendant being convicted, which represents only one of every five cases where charges are filed. About one-third of the Kansas

TABLE VI-14

DRUG CASES
(Descriptive Statistics)

Variable	Response	Peoria (N=52)	Chicago (N=53)	Kansas City (N=46)	Oakland (N=73)
Who Initiated Report	Police	63%	57%	63%	88%
	Other	37%	43%	37%	12%
Location Crime Committed	Street-Outside	62%	43%	59%	65%
	Residential	21%	40%	25%	26%
	Non-Residential	17%	17%	16%	9%
Location Evid Collected	Suspect	96%	68%	69%	92%
	Resid Scene	12%	32%	9%	4%
	Other	8%	8%	22%	4%
Results of Lab Analysis	Identification	86%	79%	94%	85%
	Neg-Ident	12%	13%	4%	12%
	Other	2%	8%	2%	3%
Description of Susp at Search	ID/Custody	92%	98%	82%	95%
	Some Desc	8%	2%	18%	5%
Apprehension Time	Up to 10 Mins	54%	92%	78%	80%
	Over 10 Mins	35%	2%	13%	15%
	Not Apprehend	12%	6%	9%	5%
Clearance Rate		85%	92%	83%	97%
Incidents With an Arrest		88%	94%	91%	95%
Incidents With Charges Filed		73%	77%	67%	89%
Incidents With a Conviction		46%	15%	35%	26%

City cases result in conviction and, in Oakland, one in four cases. Although not a part of our data base, there are a number of possible explanations why defendants in such cases may not be convicted of a drug charge. Some cases are lost or nolle prossed due to exclusionary rule violations; in other cases, defendants may be successful in getting charges dismissed in exchange for supplying information to police or prosecutors about other crimes. Beyond these considerations, many courts will divert these defendants to special drug counseling programs and, if the defendant successfully completes the program, a conviction will not appear on the official court record.

Some of the variation in conviction rates may be attributed to differences in laboratory results. In 79% of the Chicago cases, the suspected drug is identified as a controlled substance, while in Kansas City there is a positive identification 94% of the time. However, as seen in Table VI-15, even when selecting only those cases where the substance is identified, there is still wide variation in conviction rates. The rate of conviction in Peoria is practically three times the rate in Chicago; this difference is largely attributable to characteristics of the local criminal justice system, plus also the small city - large city phenomenon where it is common to find more severe sanctions issued for similar crimes in less urbanized areas (Illinois Department of Corrections, 1983).

Homicides, Rapes and Arsons

Although unable to control for the presence and absence of physical evidence in cases of homicide, rape, and arson, the dispositions of such

TABLE VI-15

CONVICTION RATES FOR DRUG CASES
WITH LABORATORY IDENTIFICATION

(N = Persons Charged)

	Peoria (N=31)	Chicago (N=31)	Kansas City (N=31)	Oakland (N=54)
Conviction Rate	65%	23%	52%	31%

cases where evidence is examined in the laboratory is nonetheless interesting. This section addresses the percentage of these cases which survive various screening levels in the judicial process. It is also possible to examine the outcome and downgrading of these cases while controlling for laboratory results.

Rates of Disposition

The first table (VI-16), describes the percentage of arrests in which charges are filed and, of these cases, the fraction that result in: charges being dismissed; pleas of guilty; and trial verdicts. The percentage of convictions and acquittals are also tabulated for trial verdicts.

One-third of the homicide cases in Kansas City in which charges are filed are dismissed by the prosecutor, judge or through a motion of the defense counsel. Oakland has the highest percentage of homicide cases resulting in a guilty plea (51%). Peoria has the highest fraction of cases that go to trial (78%) and, of these, 90% result in convictions.

Similar patterns of case processing are also evident in rape/sex-related offenses (see Table VI-17). Approximately 90% of all arrests with physical evidence result in charges being filed by the prosecutor. The dismissal rates of these charges are the greatest in Kansas City. More than half (54%) of the cases in which charges are filed result in guilty pleas in Oakland. Chicago and Peoria have the greatest percentage of cases that go to trial, 58% and 51% respectively, and of these, 69% and 74% result in convictions, respectively. Although a smaller percentage of the cases go to trial in Oakland (17%), a higher percentage (92%) of cases result in convictions.

TABLE VI-16

OUTCOME OF HOMICIDE CASES IN WHICH
PHYSICAL EVIDENCE IS ANALYZED

(N = Persons Arrested)

Disposition of Cases	Jurisdiction			
	Peoria N = 33	Chicago N = 73	Kansas City N = 47	Oakland N = 63
Charges Filed	82%	63%	85%	81%
Dismissed	15%	20%	33%	14%
Other Terminations*	0%	7%	9%	2%
Guilty Plea	7%	35%	35%	51%
Trial	78%	46%	18%	41%
Convicted	90%	76%	71%	89%
Acquitted	10%	24%	29%	11%

* This category includes those few cases where defendants are prosecuted for other offenses, found incompetent to stand trial, where the defendant died, or where the defendant is still at large in the community.

TABLE VI-17

OUTCOME OF RAPE/SEX-RELATED OFFENSES
IN WHICH PHYSICAL EVIDENCE IS ANALYZED

(N = Persons Arrested)

Disposition	Jurisdiction			
	Peoria N = 39	Chicago N = 66	Kansas City N = 36	Oakland N = 79
Charged	95%	91%	86%	89%
Dismissed	24%	15%	52%	29%
Guilty Plea	24%	27%	19%	54%
Trial	51%	58%	29%	17%
Convicted	74%	69%	78%	92%
Acquitted	26%	31%	22%	8%

Only two of the jurisdictions, Chicago and Kansas City, analyzed a sufficient number of fire-related cases to permit a comparison. Of the thirty-eight incidents sampled in Chicago and the forty-three cases reviewed in Kansas City, only 18 individuals were arrested in Chicago and 10 in Kansas City. The prosecutor filed charges in two-thirds of the arrest cases in Chicago and eighty percent of cases in Kansas City. Convictions were obtained in about 60% of the Chicago cases and 50% of the Kansas City cases (see Table VI-18).

Homicides: Laboratory Results and Judicial Outcome

For the purposes of this discussion, judicial results have been consolidated into two categories, convictions (guilty pleas and trial convictions) and nonconvictions (dismissals and acquittals). In homicides, the laboratory results have been separated into cases with common origin laboratory results versus all others. In rapes, cases where semen is identified are combined with cases where laboratory results showed a common origin. These are contrasted against all other cases, principally incidents where semen was suspected to be present but was not detected.

Table VI-19 displays rates of conviction, controlling for laboratory results. In general, the only jurisdictions where the rates are substantially different are in Oakland ($p < .01$) and Kansas City. The differences in Kansas City are not statistically significant, however.

TABLE VI-18

OUTCOME OF ARSON OFFENSES IN WHICH PHYSICAL EVIDENCE IS ANALYZED

(N = Persons arrested)

Disposition	Jurisdiction	
	Chicago N = 18	Kansas City N = 10
Charged	67%	80%
Dismissed	42%	50%
Guilty Plea	42%	25%
Trial	17%	25%
Convicted	100%	0%
Acquitted	0%	100%

TABLE VI-19

RATES OF CONVICTION FOR PERSONS ARRESTED
FOR MURDER, CONTROLLING FOR LABORATORY RESULTS
(N = Persons Arrested)

Laboratory Results	Jurisdiction			
	Peoria (N = 33)	Chicago (N = 74)	Kansas City (N = 47)	Oakland (N = 63)
No Common Origin	63% (8)	40% (48)	17% (6)	48% (29)
Common Origin	52% (25)	50% (26)	44% (41)	82% (34) **

Chi Square Significance ** $p < .01$.

Rapes: Laboratory Results and Judical Outcome

In rapes, the laboratory identification of semen or a result of common origin appear to be important in gaining convictions, as can be seen in Table VI-20. The rates of conviction are higher in all jurisdictions where there is semen and/or a common origin laboratory result. But the only cities where the results are significant are Chicago and Oakland ($p < .05$).

Controlling for victim/suspect relationship would appear to be crucial in rape convictions because of the impact of finding seminal fluid or other associative evidence. That is, in cases where the victim was previously associated with the assailant, the suspect commonly does not deny sexual involvement with the victim and states that she was a willing participant. Here evidence showing sexual contact between the defendant and victim may prove to be irrelevant.

The finding of semen in stranger to stranger rapes has a greater effect on conviction rates than it does in cases where the victim knew the defendant in Peoria and Chicago. In Chicago, where the victim and suspect are strangers, the odds of conviction increase twelve-fold when semen is found, compared with cases where semen is not found. In Kansas City and Oakland, the differences are not significant.

Summary

This examination of cases with and without physical evidence has revealed substantial differences in rates of arrest and clearance, charging, conviction, plea bargaining and charge reduction in robbery,

TABLE VI-20

RATES OF CONVICTION FOR PERSONS ARRESTED FOR RAPE, CONTROLLING FOR LABORATORY RESULTS

(N = Persons Arrested)

Laboratory Results	Jurisdiction			
	Peoria (N = 39)	Chicago (N = 66)	Kansas City (N = 37)	Oakland (N = 79)
Negative I.D./ No Common Origin	45% (20)	23% (13) *	22% (9)	44% (36) *
Semen I.D.'ed/ Common Origin	68% (19)	66% (53)	39% (28)	67% (43)

Chi Square Significance * $p < .05$

assault/battery, and burglary/property offenses. In the categories of robbery and burglary/property crimes, in particular, cases with physical evidence are disposed of with greater success than cases without physical evidence. At the police clearance level, the evidence and no evidence cases are examined while controlling for the following variables: identification of a suspect at the outset of an investigation; availability of witness information; and time elapsed between the discovery of the crime and its report to (arrival of) the police. In general, even in cases where such other traditionally significant information is absent, the cases with physical evidence are cleared at significantly higher rates in three of the four cities.

At the court level, cases with physical evidence result in conviction significantly more often than in cases without this evidence. Cases with evidence tend to go to trial at a higher rate than cases that do not. In two of the cities, cases with physical evidence result in guilty pleas at a higher rate than those without, but the reverse is true in the other two jurisdictions.

In three of the four jurisdictions, cases without physical evidence result in substantially more charge reduction than do cases with physical evidence. When the results of laboratory testing are incorporated into the analysis, a trend emerges in cases where results fail to associate offenders with victims or scenes; these cases are more likely to be dismissed than are cases with other types of laboratory results. In two of the cities, cases involving common origin results are more likely to be adjudicated at trial than through a guilty plea.

The presence or absence of physical evidence cannot be controlled in homicides, rapes and arsons. However, the various dispositions of

such cases where physical evidence was examined have been compared controlling for laboratory results. Rates of conviction in homicide cases with common origin laboratory results are substantially higher in two jurisdictions, Kansas City and Oakland, but are statistically significant in only one, Oakland. In rape cases, the identification of semen proved to be significantly associated with conviction in two jurisdictions: Chicago and Oakland.

CHAPTER VII

ESTIMATING THE EFFECTS OF PHYSICAL EVIDENCE ON CLEARANCE AND CONVICTION USING LOG-LINEAR ANALYSIS *

Introduction

In the previous chapter we investigated the marginal effects of physical evidence on clearance and conviction while controlling for the effects of such factors as knowledge of a suspect, elapsed time from discovery of the crime to police report or response, witnesses, type of offense, and jurisdiction. Typically, an analysis was accomplished by calculating clearance and conviction rates for the evidence and no evidence cases with the control variables at specified levels. For example, see Table VI-2 in the previous chapter. A question arises as to whether the lack of control in Table VI-2 for suspect and witness variables causes the results to be misleading.

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* We wish to acknowledge the assistance of Dr. Dennis Gilliland, Professor of Statistics and Probability at Michigan State University, for his assistance with the log-linear analysis and the writing of this chapter.

In this chapter the results of a more sophisticated (log-linear) analysis of the data are reported using Everyman's Contingency Table Analysis (ECTA)* to quantify and model the simultaneous joint effects of several independent variables or factors on selected dependent or response variables. Each of the three models presented includes physical evidence as one of the independent variables and clearance or conviction as a dependent variable. The advantage of this approach is that interactions and differential effects of evidence on the response variable that might otherwise go undetected can be estimated. Also it allows for the fitting of various models to the data for the purpose of testing various theories on the effect of evidence.

Because of the relatively small sample sizes for the number of independent variables examined, the data analysis and model fitting

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* Everyman's Contingency Table Analysis (ECTA) is a computer program developed to carry out the log-linear analysis developed by Goodman and Fay (1973).

is largely descriptive in nature. (Statistical results which depend on large sample sizes, such as the estimates of standard deviations of lambda effects, are discounted.) However, these results are illuminating and provide interesting sample descriptions of the effect of evidence on clearance and convictions along with the interaction of evidence with other factors. Terms such as "impact" and "effect" may be used in this chapter in discussing what is more properly called "association".

The remainder of this chapter is divided into two sections, the first addressing the effect of evidence on clearance and the second the effect of evidence on conviction. All variables employed in the analyses are defined (see Tables VII-1 and VII-4) in this chapter. The tables which display the raw frequencies used in the analysis are included in Appendix D.

The Effects of Physical Evidence on Clearance

The first model discussed employs CLEARANCE as the response or dependent variable. The independent variables included in the analysis are:

a) EVIDENCE - The presence or absence or scientifically examined physical evidence is controlled in accordance with the sampling procedures discussed in Chapter VI.

b) TIME - This variable fundamentally measures the speed with which offenses are reported to/responded to by the police: either 10 minutes or less, or greater than 10 minutes.

c) WITNESS-SUSPECT - Originally WITNESS and SUSPECT were to have been treated as two separate variables, basically corresponding to the presence or absence of witnesses and suspects at the preliminary investigation level. However, insufficient data are available for the combination where witnesses are absent yet suspects are in custody or named and placed. For this reason a single, three-level composite variable has been created.

d) OFFENSE - All cases are classified by offense type: robbery, assault or burglary. The robbery classification includes both armed and unarmed robberies; the assault categories is principally composed of aggravated assaults and aggravated batteries; and the burglary classification contains primarily burglaries and a small percentage of miscellaneous property crimes. In Chapter VI, the simple bi-variate analyses demonstrated that it is necessary to control for offense type in estimating the effects of evidence.

e) JURISDICTION - The analyses in the previous chapter also showed that major differences in clearance and conviction rates are present in the various jurisdictions, so controlling for jurisdiction of case origin is necessary.

The reader is referred to Table VII-1 for a summary of the variables, their corresponding notations and number of levels.

The data employed in the analysis consist of 1,650 cases, each of which is cross-classified for all the variables described in Table VII-1 (see notations in column 4 of the table):

(Variables)	C E T W O J	
(Levels)	(2) (2) (2) (3) (3) (4)	= 288 cells

The number in parentheses beneath each variable refers to the number of levels of that particular variable. The product of these levels (288) represents all the possible combinations by which a given case could be classified.

Tables D-1 and D-2 in the Appendix give all the raw frequencies for these 288 cells. C (CLEARANCE) is the response variable, and these tables provide the empirical odds for clearance for those cases where the variables are at specified levels. See Table D-2 in the Appendix

TABLE VII-1

VARIABLES FOR LOG-LINEAR ANALYSIS
USING CLEARANCE AS THE DEPENDENT VARIABLE

VARIABLE NUMBER	VARIABLE	TYPE	NOTATION	NUMBER OF LEVELS	LEVELS
1	Clearance	Response	C	2	1= Cleared 2= Not Cleared
2	Evidence	Factor	E	2	1= No Evidence 2= Evidence
3	Time	Factor	T	2	1= Response 10+ minutes 2= Response 10- minutes
4	Witness-Suspect	Factor	W	3*	1= No Witness & No Suspect 2= Witness & No Suspect 3= Witness & Suspect
5	Offense	Factor	O	3	1= Robbery 2= Assault 3= Burglary
6	Jurisdiction	Factor	J	4	1= Peoria 2= Chicago 3= Kansas City 4= Oakland

* Originally Witness and Suspect were to have been treated as separate factors with each at two levels. No data are available in the No Witness-Suspect combination so the single composite variable has been created.

where the empirical odds for clearance in Peoria (J=1) assault (O=2) cases are 12/2 (12 cleared, 2 not cleared) where there is at least one witness but no suspects (W=2), the case has physical evidence (E=2) and the elapsed reporting time to the police is 10 minutes or less (T=2). Appendix D contains further aggregations of these clearance odds across offense categories and across jurisdictions (see Appendix, Tables D-4 and D-5).

First of all, the log-linear analysis tests the independence of C (CLEARANCE) and E (EVIDENCE) and finds that they are not independent, while controlling for the other variables. This analysis also determines that considerable variation in odds for clearance is explained by EVIDENCE, in addition to variations explained by the other factors (TIME, WITNESS, OFFENSE and JURISDICTION). The next objective is to find a simple model that fits the data well so that the relationship between CLEARANCE and EVIDENCE can be quantified.

A rough quantification of the effects of the different variables on CLEARANCE is made possible by a preliminary additive model. Table VII-2 presents the estimated increase in odds for clearance attributable to each variable individually, while controlling for the effects of all the other variables. The WITNESS variable clearly has the greatest effect on clearance. Moving from Level 1, where there are neither suspects nor witnesses identified at the preliminary investigation, to Level 3, where there are both witnesses and suspects, demonstrates the increase in the odds for clearance by a factor of almost 28. The EVIDENCE variable is associated with a three fold increase in odds for clearance by moving from the no-evidence level to the evidence level. This increase in odds is comparable to the increase which results when the WITNESS variable

TABLE VII-2

ADDITIVE EFFECTS OF VARIABLES
E T W O on CLEARANCE

Variable	Improvement in Clearance Odds By Moving From Level X to Level Y		Increase in Odds
	Level X	Level Y	
WITNESS	1	3*	27.90
	2	3	7.73
	1	2	3.61
EVIDENCE	1	2	3.12
OFFENSE	1	2	1.77
	1	3	1.02
	2	3	.58
TIME	1	2	1.63

* See Table VII-1 for a description of variables and levels. In this case the witness variable has moved from Level 1 (no witness/no suspect) to Level 3 (both witness and suspect).

moves from Level 1 to Level 2 -- going from a situation with no suspect and no witness to one with no suspect, but with at least one witness.

More rigorous testing reveals that describing the effects of EVIDENCE on CLEARANCE depends upon the levels of the other factors - WITNESS, OFFENSE and JURISDICTION. That is, the effect of EVIDENCE on CLEARANCE cannot be explained adequately unless the levels of WITNESS, OFFENSE and JURISDICTION (Table VII-1) are included.* The simplest model that fit the data well is:

(M1) ETWOJ/CEWO/CEWJ/CT

(See Appendix D for a full discussion of how this model was derived).

This interactive model reveals an "increase in odds" for CLEARANCE when physical evidence is available over when it is not. The increase in odds is evident for each of the 3x3x4 = 36 combinations of levels of the factors WITNESS, OFFENSE and JURISDICTION. See Table VII-3.

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* It was found that the variable TIME has a direct effect on odds for clearance and does not interact with the other factors in its effect on clearance. Cases where the response time is 10 minutes or less have 1.5 times greater odds for clearance than offenses where the response time exceeds 10 minutes.

The value 5.13 (first column, first row) may be interpreted as the estimated increase in odds for clearance for having physical evidence over having no physical evidence when there are no witnesses and no suspects for robberies in Peoria. In other words, robbery offenses in Peoria with physical evidence, but where no witnesses or suspects are in custody or named and placed, are five times as likely to be cleared as similar robbery offenses without physical evidence. The .99 value in column one, row two shows that assault cases with no immediate suspects or witnesses have virtually the same odds for clearance where evidence is present as where it is absent.

Peoria and Oakland show very similar results. Evidence has its greatest association with clearance in these jurisdictions followed by Kansas City and, then, Chicago. Where there are no suspects in custody or named and placed at the preliminary investigation, physical evidence has its greatest association with clearance for burglary, and, to a lesser degree, for robbery. Little effect is evident on assault. With a suspect present, evidence has its greatest association with clearance for the crime of assault. On an offense by offense basis, the following conclusions can be drawn:

Robbery - In all jurisdictions, except for Chicago, physical evidence has its greatest effect when there are no witnesses and there are no suspects. The victim of a robbery is considered to be a witness if he/she provides information to the police about the offender, e.g., a description of the suspect or the crime. There are very few cases with no witnesses and no suspects in the sample. Therefore, we focus on the second level where a witness is identified, yet there is no suspect. In

TABLE VII-3

Estimated Effect of Evidence on Odds for Clearance for Model (M1)

Witness-Suspect Variable	Offense	Jurisdiction			
		Peoria	Chicago	Kan City	Oakland
No Witness; No Suspect	Robbery	5.13	.92	3.67	5.45
	Assault	.99	.18	2.41	1.06
	Burglary	7.86	1.41	2.38	8.34
Witness; No Suspect	Robbery	17.36	.96	2.45	17.71
	Assault	5.95	.33	.84	6.07
	Burglary	19.04	1.05	2.68	19.43
Witness; Suspect	Robbery	1.26	1.22	.39	1.59
	Assault	6.77	6.57	2.12	8.56
	Burglary	3.40	3.29	1.06	4.29

this configuration, Peoria and Oakland have odds for clearance more than seventeen times higher where evidence is present. The odds more than double in Kansas City. In Chicago, the presence of the physical evidence has no significant effect on the odds for clearance.

Assault - In three jurisdictions, Kansas City being the exception, evidence appears to have the greatest impact when there are both witnesses and suspects identified or in custody at the outset of the investigation. The odds for clearing an assault in Chicago, where there are no witnesses and suspects, are much less when evidence is gathered than when it is not. This suggests that the types of evidence routinely collected in these assaults, firearms and bloodstains, are not helpful in locating suspects or closing such hard to solve cases. We see, though, that the only jurisdiction where evidence seems to make a difference in these problematic cases is in Kansas City, the jurisdiction with the highest incidence of firearms evidence examined in this offense category (see Table III-3).

Burglary - Evidence has its greatest impact when a witness is located, but no suspects are immediately identified or placed. The exception to this is Chicago, where the increase in odds for clearance is greatest when both witnesses and suspects are present. In Peoria and Kansas City, however, there is an eightfold increase in odds for clearance even when there are neither witnesses nor suspects at the preliminary investigation. These, of course, represent cases which are the most difficult to clear. Without physical evidence, these cases would probably be suspended or terminated.

Table VII-3 is rich in other information concerning effects of factors and factor combinations on odds for clearance.

The Effects of Physical Evidence on Conviction

In this section two separate log-linear analyses are reported. For each analysis, the data base is composed of the 664 incidents where arrests are made.

Table VII-4 defines the variables used in the analysis. DISPOSITION (D) has two levels: arrest and no conviction (D=1) and arrest and conviction (D=2). The results of laboratory testing of the evidence are introduced in this model, since we can be certain the results have been reported prior to the final disposition of the case. The EVIDENCE variable, therefore, has three levels: no evidence (E=1); evidence where the laboratory result does not fall in the common origin category (E=2); and evidence where the laboratory result does fall in a common origin category (E=3). The hypothesis presented is that a common origin laboratory result which links an offender with a victim or location should have a stronger association with conviction than one which does not. While the previous section looked only at the evidence/no evidence dichotomy and its relationship to clearance, this three-tiered variable provides a more precise measure of forensic evidence by incorporating the results of laboratory testing.

In addition to the EVIDENCE variable, five other independent variables were included in the analysis. These variables were selected based upon a review of recent court research, while keeping in mind the limitations of the information available in our data base as well as overall sample size. A new RELATION variable was added which controls

TABLE VII-4

VARIABLES FOR LOG-LINEAR ANALYSES
USING CONVICTION AS THE DEPENDENT VARIABLE

VARIABLE NUMBER	VARIABLE	TYPE	NOTATION	NUMBER OF LEVELS	LEVELS
D	Disposition	Response	D	2	1= No Conviction 2= Conviction
E	Evidence	Factor	E	3	1= No Evidence 2= Evidence and No C.O. 3= Evidence and C.O. *
R	Relation	Factor	R	2	1= Suspect: Family/ Friend 2= Suspect: Stranger
T	Time	Factor	T	2	1= Arrest 10+ min. 2= Arrest 10- min.
W	Witness	Factor	W	2	1= No Witness 2= Witness
O	Offense	Factor	O	3	1= Robbery 2= Assault 3= Burglary
J	Jurisdiction	Factor	J	4	1= Peoria 2= Chicago 3= Kansas City 4= Oakland

* Lab analysis of evidence resulted in a statement of common origin

for the prior relationship between the suspect and the victim and is dichotomized: R=1, where the suspect and the victim have a prior relationship and are known to one another; and R=2, where either they are strangers or their relationship is unknown. A number of studies in the courts area have shown the victim-defendant relationship to be important in forecasting case outcome (Vera, 1977 and Forst, 1977).

A new TIME variable is included, measuring time elapsed from report of the crime to when the arrest is made. Research conducted by INSLAW (Forst et al., 1982) has shown this to be an important variable in explaining the convictability of a given arrest; i.e., the shorter time lapse between the crime and arrest, the greater the likelihood the arrest will result in a conviction. The TIME variable has two levels: T=1, where the arrest is made more than 10 minutes after the crime occurred; and T=2, where the arrest is made in 10 minutes or less.

A WITNESS variable was initially considered for inclusion in the model, in which the presence or absence of witnesses was to be controlled. This variable had to be dropped from the analysis since only 42 of the 664 arrest cases in the sample had no witnesses. The OFFENSE and JURISDICTION variables are the same as those used in the previous CLEARANCE model.

Since the sample size is not nearly large enough to support a log-linear analysis of all the variables simultaneously, two separate analyses have been performed: one, examining the effects of evidence on conviction while controlling for offense, jurisdiction and victim-suspect relationship; and the other, examining the effects of evidence on conviction while controlling for offense, jurisdiction and time to arrest. Given our primary interest in the EVIDENCE variable and because

our prior model demonstrated the importance of controlling for OFFENSE and JURISDICTION, these three variables are maintained in both the subsequent models, with RELATION and TIME used alternately in the fourth variable position. See the raw empirical odds for conviction in Appendix Table D-8. The raw data are then aggregated to produce contingency tables (D-9 and D-10), for the D E R C J and D E T O J analyses.

The preliminary additive model provides a rough approximation of the effects of different variables on CONVICTION. Table VII-5 presents the estimated increase in odds for each variable, by moving from one level to another. Crimes involving strangers are twice as likely to lead to a conviction as are those involving friends, family or acquaintances. Arrests made within ten minutes of the offense have 1.6 greater odds for conviction than those made after ten minutes have elapsed. An arrest with evidence resulting in a common origin finding has 1.66 greater odds for leading to a conviction than arrests with no evidence collected.

As in the prior models, a test of conditional independence of the EVIDENCE and the response variable -- CONVICTION -- finds them not to be independent of one another. The analysis also demonstrates a great improvement in the fit of the data when two-at-a-time interactions among the independent variables are included: the relationship between EVIDENCE and CONVICTION cannot be explained well without taking into account how EVIDENCE interacts with RELATIONSHIP, TIME and OFFENSE in its effect on CONVICTION.

Two fairly simple models show:

(M2) EROJ/DEO/DEJ/DOJ

(M3) ETOJ/DEO/DEJ/DTJ/DOJ

(See Appendix D for a full discussion of how these models were derived).

(E) EVIDENCE is found to interact with both (O) OFFENSE and (J) JURISDICTION in its effect on (D) CONVICTION. Using this model it is possible to calculate the estimated improvement in odds for conviction, contrasting evidence at its three levels.

The next three tables display the differences in odds for conviction, contrasting the three levels of the evidence factor. Tables VII-6 and VII-7 show that the effects of evidence on odds for conviction are greatest in Kansas City, regardless of the laboratory result. In Chicago, the odds for conviction are actually poorer in situations where the laboratory processes physical evidence - but is unable to determine the origin of the evidence in question - than in cases without evidence (Table VII-6). The same is true in Peoria concerning assault and burglary, but to a lesser extent than in Chicago.

Moving to Table VII-7, which contrasts the odds for conviction in cases having common origin laboratory results with cases where no physical evidence was collected, we see a general improvement in odds for conviction. This is most pronounced in the offense categories of robbery and burglary in Peoria, Oakland and Chicago. Assault, though, is a different matter: a common origin laboratory result has little effect on the odds for conviction.

Table VII-8 summarizes the improvement in odds for conviction for cases with physical evidence, moving from a noncommon origin laboratory

TABLE VII-5

Additive Effects of Variables
E R T O on Conviction

Variable	Improvement in Conviction Odds By Moving From Level X to Level Y		Increase in Odds
	Level X	Level Y	
Relationship	1	2	2.00
Time	1	2	1.60
Evidence	1	3	1.66
	2	3	1.42
	1	2	1.17
Offense	2	1	1.33
	2	3	1.25
	3	1	1.07

TABLE VII-6

MODEL (M2)
Estimated Effect on Odds for Conviction of
Evidence With No Common Origin Over No Evidence

	Peoria	Chicago	Kansas City	Oakland
Robbery	1.43	.94	9.56	2.34
Assault	.72	.47	4.80	1.17
Burglary	.84	.55	5.60	1.37

TABLE VII-7

MODEL (M2)
Estimated Effect on Odds for Conviction of
Evidence With Common Origin Over No Evidence

	Peoria	Chicago	Kansas City	Oakland
Robbery	2.38	1.37	5.36	3.36
Assault	.86	.49	1.93	1.21
Burglary	2.36	1.36	5.32	3.34

TABLE VII-8

MODEL (M2)
Estimated Effect on Odds for Conviction of
Evidence with Common Origin Over Evidence with No Common Origin

	Peoria	Chicago	Kansas City	Oakland
Robbery	1.67	1.45	.56	1.44
Assault	1.20	1.04	.40	1.03
Burglary	2.83	2.46	.95	2.43

result to one where the origin of the evidence is determined. With the exception of Kansas City, the odds for conviction are clearly better in burglary cases, marginally better in robbery cases but no different in assaults.

An unexpected result has been found in Kansas City in the crime categories of robbery and assault. The odds for conviction are only half as great where the laboratory makes a common origin determination, as compared with cases where the laboratory fails to make such an association. Although it is impossible to say for sure why these differences in odds for conviction run counter to conventional wisdom and the trends found in the other cities, there are some possible explanations. First, we recall in Chapter VIthat Kansas City has the highest rates of plea bargaining of all the jurisdictions. Only 1% of the cases with physical evidence where charges are filed go to trial. This compares with 30% of the Peoria cases, 19% of the Chicago cases and 16% of the Oakiand cases. It is possible that cases adjudicated outside of the courtroom are not as sensitive to laboratory results as those adjudicated at trial.

Second, in the cases that are plea bargained in Kansas City we do see greater downgrading of charges in the cases where laboratory results are of the noncommon origin variety. The difference in rates of downgrading are not statistically significant, however. The downgrading of charges could not be controlled for in the log-linear analysis.

The third item to remember is that physical evidence has the greatest overall effect on judicial outcome in Kansas City, regardless of laboratory results (See Tables VII-6 and VII-7). It is possible that the noncommon origin laboratory findings produced in the Kansas City

laboratory are just as helpful to prosecutors in bargaining with defendants as are those showing positive linkages. Whatever the explanation, it is certain this phenomenon merits further study. This would require a detailed review of court cases in which decision makers are queried as to how various types of laboratory results affect their decisions.

The final model (M3) using the time to arrest variable (T) shows, initially, that evidence and conviction are not conditionally independent and that evidence interacts with both offense and jurisdiction separately in its effect on conviction. Evidence does not interact with the time variable, however, in its effect on conviction. The following three tables (VII-9, 10, 11) display the improvement in odds for conviction for the three contrasting levels of evidence. The trends which are seen in these tables are very similar to those found in the preceding three tables where instead of controlling for time to arrest we controlled for victim - suspect relationship.

TABLE VII-9

MODEL (M3)
Estimated Effect on Odds for Conviction of
Evidence with No Common Origin Over No Evidence

	Peoria	Chicago	Kansas City	Oakland
Robbery	1.21	.83	8.62	2.02
Assault	.65	.45	4.61	1.08
Burglary	.85	.59	6.09	1.43

TABLE VII-10

MODEL (M3)
Estimated Effect on Odds for Conviction of
Evidence With Common Origin Over No Evidence

	Peoria	Chicago	Kansas City	Oakland
Robbery	2.62	1.30	5.01	3.24
Assault	.88	.44	1.69	1.09
Burglary	2.66	1.33	5.09	3.29

TABLE VII-11

MODEL (M3)
Estimated Effect on Odds for Conviction of
Evidence With Common Origin Over Evidence with No Common Origin

	Peoria	Chicago	Kansas City	Oakland
Robbery	2.17	1.56	.58	1.60
Assault	1.38	.99	.37	1.01
Burglary	3.12	2.25	.84	2.30

Summary

The results of the log-linear analyses demonstrated that:

1) Clearance and conviction rates are not explained by models where independent variables (e.g. knowledge of a suspect, presence of witnesses, victim-suspect relationship) and physical evidence act in simple additive ways on the odds for successful case outcome.

2) The effect of physical evidence on clearance and conviction depends upon the type of offense and the jurisdiction involved.

3) Moreover, physical evidence also interacts with witnesses and suspects in terms of its effect on clearance.

4) The presence of physical evidence is associated with the greatest increase in odds for clearance in Oakland and Peoria, followed by Kansas City and, then, Chicago.

5) For the offenses of robbery and burglary, physical evidence has its greatest effect on increasing the odds for clearance when suspects are neither in custody or named and placed at the preliminary investigation stage.

6) The presence of physical evidence is associated with the greatest increase in odds for conviction in Kansas City followed by Oakland, Peoria and Chicago.

7) Physical evidence which results in a common origin laboratory finding generally has a greater, but not statistically significant, effect on odds for conviction than cases which do not.

CHAPTER VIII

CONCLUSIONS, POLICY RECOMMENDATIONS AND FUTURE RESEARCH

Conclusions and Recommendations

The findings, observations and analyses of data presented in the preceding seven chapters lead to several conclusions and recommendations for police agencies, crime laboratories and related criminal justice agencies. The recommendations which follow are organized into six basic sections:

- o Patrol operations;
- o Crime scene/evidence gathering;
- o Criminal investigations;
- o Crime laboratory;
- o Prosecution;
- o Police administration.

Patrol

Patrol officers play very important roles in the effective use of physical evidence. Standard police texts emphasize crime scene preservation responsibilities, but generally neglect to consider other important decisions patrol officers make with respect to physical evidence. Patrol officers should have the ability to recognize potential evidence in and around the crime scene and victim.

This capability may be developed through basic recruit level and in-service training courses. While such training is usually offered through a department's training academy, the crime laboratory must take an active role in the preparation and delivery of course instruction. Training material quickly becomes out of date and the laboratory is in the best position to describe its current capabilities and programs. For example, a new technique in fingerprint development and enhancement from surfaces which could never before be processed with conventional fingerprint powder needs to be communicated quickly to all departmental personnel. The thrust of the training programs should not be on how to collect or process evidence (with the possible exception of fingerprints which is discussed later) but, rather on how to recognize potential evidence and prevent it from becoming contaminated.

Most important of all, the patrol officer should know <u>when</u> to request the services of an evidence technician. The patrol officer must take into account his or her own assessment of the crime scene environment while implementing official department guidelines specifying the types of situations in which technicians are to be summoned. Few departments have explicit policies or guidelines in this area; most are too ambiguous (example: "a technician should be called whenever physical evidence is present" or in "all serious crimes"). Usually these guidelines are unrealistic when compared with resources available in the department. The net result is that patrol officers are forced to use their own discretion in calling for assistance, except in the most obvious situations, as in a homicide investigation or other very serious crimes.

Every police agency should develop guidelines which reflect available technical resources and which also take several other factors into consideration. Generally, an evidence technician should be requested:

- o When physical evidence is recognized by the patrol officer;
- o When it is clear the offender has had a physical confrontation with the victim or has had appreciable contact with the crime scene environment;
- o When the condition of the scene or victim suggests evidence has been likely transferred to the offender;
- o When witnesses can provide detailed descriptions of the movements and activities of the offender at the crime scene; or
- o When suspects are apprehended or are named and placed at the preliminary investigation.

If any of the above conditions are satisfied, a technician should ideally be summoned. The police agency may wish to introduce a weighting system to give higher priority to certain types of offenses over others - e.g., a rape versus a petty theft. While the serious crimes in a community practically always receive a follow-up investigation, it should be remembered that the gravity of the offense has little or nothing to do with the availability of potential physical evidence. Because there will always be differences of opinion as to what constitutes a "serious" case, criteria employed in calling for technical assistance should be based principally on the potential evidence, not the value of property stolen or the extent of injuries to the victim.

Another important consideration for the patrol officer is the likelihood that the case will receive a followup investigation. While this decision may not be made by the detective division for several

hours or days after the preliminary report is taken, the patrol officer should have access to the criteria used by investigators. If it is clear the case will not receive a follow-up investigation, calling for the services of an evidence technician is probably a waste of resources. Exceptions to this would be when the police department has the ability to make 'cold searches' of its fingerprint files using latent prints recovered from crime scenes, or when the patrol officer recognizes the crime apparently is one in a series of offenses committed by the same individual. In such cases, the physical evidence may prove very useful in linking such offenses together and ultimately to the identity of the offender.

If a technician is called, a patrol officer should remain at the scene until the evidence technician arrives. If the case merits a search for evidence, it also merits a patrol officer remaining at the scene to provide the technician with the necessary background information on the case. If possible, the patrol officer should remain with the technician throughout the search of the crime scene.

If fingerprints are the only items of evidence thought to be present, one may question the necessity of calling for the services of a technician. Patrol officers should be able to search for fingerprints if they are properly trained in searching for and lifting latent fingerprints. Care must be exercised, and a situation avoided, where patrol officers are given this assignment strictly for its so-called "public relations" value. As with evidence technicians, if the case is not to be investigated and the department lacks the ability to make cold fingerprint searches, then the location of latent fingerprints at the scene will probably prove futile.

A final note on the public relations issue should be made. It is important for the crime scene search function to be elevated to a higher professional level within the context of criminal investigations. Evidence technicians should not be used as public relations officers. There is no question, however, that physical evidence can help to foster a favorable public image, particularly when it aids in solving a crime or securing a conviction. But, too often, technicians are dispatched principally because victims have come to expect it. More and more, however, police departments have had to curtail various types of services to the public for lack of resources, including the investigation of minor property offenses and crimes where prospects for solution are remote. The citizenry will understand and accept such service limitations if properly informed. These same citizens also have the ability of understanding the technical resource limitations of any agency which may limit the search for physical evidence at every crime scene.

Crime Scene Search Operations

The crime scene units of a police department constitute the very heart of a comprehensive evidence utilization program. Equal attention should be paid to these staff - their recruitment, training, and supervision - as to the scientists in the laboratory or the investigators in the detective division. The discovery and judicious selection of physical evidence from the scenes of crimes is a major challenge and can spell the difference between an adequate program, where only the most obvious evidence is collected and examined in the laboratory, and a

truly superior program which capitalizes on both conventional and unconventional forms of evidence in the investigation of crimes.

The evidence technicians in a department must be well-trained and aware of the capabilities of the laboratory to which they are submitting evidence. Continuous training and refresher courses are essential. The technicians must also have frequent and personal contact with laboratory examiners in order to remain completely up-to-date on the latest laboratory procedures and capabilities.

For these and other reasons, it is important for the crime scene programs to be placed within the same organizational unit as the crime laboratory. Many resource, training, supervisory and motivational problems arise when the technicians are located in distant units, such as the patrol division, where there is oftentimes a lack of interest in technicians' evidence gathering activities and continuous pressure to use them for other purposes. The work of technicians needs to be closely monitored by supervisors who are both knowledgeable in the use of physical evidence and the operations of the crime laboratory. These supervisors must also be in a position to provide feedback to the technicians concerning the quality of evidence gathered and the results of scientific testing on the evidence they have collected.

The need to supply feedback to technicians merits further comment. It is common for technicians not to learn of the results of the evidence they collect except in the most unusual cases, principally those where they are called to testify in court. This is one of the surest ways to lower the morale of these officers and to promote crime scene investigations which are perfunctory and which result in the indiscriminate collection of physical materials. Technicians should receive some

feedback on every case where they collect evidence. This not only permits the technician to evaluate his/her own performance, but also serves as a useful device for supervisors to monitor the performance of technicians.

The investigative aspects of the technician's responsibilities should be emphasized and miscellaneous technical and evidence courier assignments minimized. Very often evidence technicians are assigned such technical duties as photographing lineups, traffic accidents and corpses; operating breathalyzers; and transporting evidence from hospitals and morgues to the laboratory. In many police departments it is not uncommon for technicians to spend as much time performing these miscellaneous duties as they actually spend in the field investigating crime scenes. Many of these so-called technical functions could be performed by other quasi-professional staff or even evidence clerks. Maintaining the chain of physical evidence is unquestionably important, but the crime scene responsibilities of evidence technicians are far too important for them to spend the majority of their time performing these miscellaneous functions.

In contrast to the above activities, it is the investigative role of the crime scene technician which should be developed. Evidence technicians are the logical members of the department to serve in a liaison capacity between street detectives and laboratory scientists. They should have comparable status with detectives and scientists in the departmental hierarchy. When the crime scene investigator is not in the field he should be evaluating evidence. A very productive activity found in the Peoria site and other smaller departments is where crime scene investigators assume responsibility for searching fingerprint

files of known offenders to compare with prints collected from crime scenes. In larger departments, technicians can play an important role in developing geographical or repeat offender fingerprint files, against which latent prints can be checked. Technicians may also help in establishing physical evidence M.O. files, organizing and cataloguing the physical evidence offenders leave behind at the scenes of crimes. This work, of course, would be coordinated with the crime laboratory and the fingerprint identification units of the department. Giving technicians the opportunity to follow through with this evidence into the examination stage and allowing them to gain the satisfaction of making a "match" or "identification" of evidence improves morale and performance in the field.

Investigations

Detectives in the various agencies studied in this project generally support the use of physical evidence, and recognize its importance in clearing cases and gaining convictions. Discussions with technicians, however, revealed a different side to this relationship. Many technicians are skeptical of the commitment of detectives to physical evidence usage. On those occasions where physical evidence is instrumental in solving a case, technicians report that detectives are either indifferent or display overt jealousy of this evidence, the technicians who collected it and the laboratory scientists who examined it. For example, a homicide investigation in one of the cities was stymied until a latent fingerprint recovered from the scene of the crime was found to match a former offender in the department's fingerprint

file. The suspect was arrested, charged and convicted. The crime scene unit received considerable department-wide praise. Still, the detectives involved in the case, who had devoted hundreds of hours in searching for a suspect but to no avail, were resentful of the work of the crime scene unit. The official department file on the case did not even reflect that it was the latent print which was responsible for identifying the offender.

Other scientists have related what they believe to be a gap in training and philosophy between detectives and scientists. Detectives gather information principally from people, through interviews, interrogations and the skillful manipulation of facts and information. Reliance on physical evidence is a totally different way of approaching cases; here faith is placed in lifeless physical objects and scientific tests which are immune to persuasion and which oftentimes result in inconclusive findings. The answers to the scientific tests are out of the detectives' control and in the hands of scientists who stress their impartiality and place as much value on evidence that exonerates suspects as on evidence that links offenders to their crimes.

As detective units move toward greater use of rational, statistically based decision criteria to select cases for follow-up investigations (Eck, 1979), they may become more receptive to the inclusion of physical evidence as a reliable means for making case decisions. For example, latent fingerprints have been shown to be one of the key solvability factors in forecasting case outcome. On the same issue, the detective's decision to investigate a case must be closely coordinated with the evidence technician's function. The availability of potential information at a scene, and evidence technicians who are able to recog-

nize and develop it, may prove to be factors in a detective's decision to initiate, continue or re-open an investigation.

There is wide variation among the cities in the frequency with which suspects are searched for physical evidence. Whereas the crime scene is basically the evidence technician's domain, suspects are largely the province of detectives. If a suspect is to be searched for physical evidence, it is primarily up to the detective to arrange for the search. There were many cases reviewed in the study where potential evidence was found at the crime scene or on the victim, but corresponding standards were never collected from suspects. This is a critical link in the total evidence process which cannot be overlooked.

The major recommendation to be made with respect to investigators concerns their request that evidence collected from the field is examined in the laboratory. Much of the time evidence lays dormant in a property room until a detective requests an examination. The most timely and productive scientific examinations are conducted when investigators are in close contact with laboratory examiners. An effective practice is when the scientific examiner and investigator collaborate and make a <u>mutual</u> decision as to the order in which cases should be examined and the types of information which should be sought. These contacts need to be coordinated through detective and laboratory supervisors since each individual detective may wish that his particular case receive top priority. Supervisors should make at least weekly contacts with the heads of laboratory sections to review recent evidence submissions and update examiners on the status of ongoing investigations.

Crime Laboratory

The major recommendations to be made in this section concern the responsibility of crime laboratories to: establish policies defining the types of physical evidence to be collected from the field and the situations in which this evidence is to be examined; and to establish better management reporting systems to evaluate on a continuing basis laboratory results and the effects of scientific evidence on case outcome.

First, the crime laboratory must be active in informing patrol officers, evidence technicians and investigators about the analyses they can perform on various forms of evidence. Similarly, they must acknowledge resource limitations so that false expectations are not planted in the minds of investigators. The laboratories must work closely with the patrol and technician units in developing guidelines to be used by these units in deciding which incidents should be searched for physical evidence and in determining which types of evidence yield the most definitive results.

Second, laboratories must see to it that they provide feedback on all examinations they perform to submitting technicians. Copies of laboratory reports should be routed to the submitting technician as well as the case detective. As noted earlier, this would be greatly facilitated if the laboratory and crime scene unit were in the same organizational division of the department.

Third, the laboratory, in conjunction with the detective division, should develop and disseminate criteria as to the conditions under which they will examine submitted evidence. These criteria should be clearly

stated and communicated to all personnel in the department. If evidence will not be examined in a robbery, for example, unless a suspect is in custody, then all investigators should be made aware of this requirement. Although different sections of the laboratory may have different priority systems, they should all be coordinated with and sanctioned by the head of the laboratory.

Fourth, the examination of evidence should be coordinated with the detective in charge of the particular investigation. Laboratories must strive to examine evidence in cases which are currently under investigation. While scientific analyses completed weeks or months after the investigation is closed may be useful from a prosecutor's perspective, they are of little use to an investigator. As will be discussed in the final section of this chapter, the police agency must insure that the laboratory receives the necessary resources to examine evidence on a timely basis; in other words, as the case in being investigated.

Fifth, crime laboratory administrators must strive to balance the demands of processing the volume of cases flowing into their operations with the need to examine individual cases in sufficient depth to extract the maximum information from the evidence. Crime laboratories must attempt to avoid an assembly line approach to evidence evaluations where analyzing many cases takes precedence over analyzing fewer cases well. This project illustrated clearly that the value of evidence depends upon the depth of analyses conducted and the detail of results derived. Laboratories must guard against examining cases superficially, which is likely to result if incoming case volume is high and there is pressure to turn around laboratory results as quickly as possible.

Sixth, laboratories must recognize the need to put into practice an adequate management reporting system to permit an ongoing evaluation of the effectiveness of its examinations in clearing cases and prosecuting offenders. For every case examined, the laboratory should maintain the following information:

- o Offense category
- o Types of physical evidence and standards collected
- o Types of physical evidence and standards examined
- o Laboratory results
- o Related investigative variables
  - Suspect identification
  - Witness presence
- o Police clearance outcome
- o Charges filed against defendants
- o Judicial outcome
  - Dismissal
  - Guilty plea
  - Trial verdict
- o Sentence imposed

Maintenance of such information on all cases is a major task and requires coordination with other police and prosecutor functions. The current study shows that it is not only important to maintain outcome measures (clearance, convictions) but also to record related investigative information on suspects and witnesses in order to sort out the contribution of physical evidence from other factors which are associated with clearance.

These reporting systems can assist laboratories in focusing their efforts on those case investigations where laboratory results are likely

to make the greatest difference. For example, in the present study it appears that physical evidence has minimal impact on the investigation and prosecution of aggravated assaults and batteries. These cases would, accordingly, receive a lower priority, particularly in relation to robberies and burglaries where the effect of the physical evidence is much greater. The homicide category presents an interesting question for in two of the cities there is no significant association between common origin laboratory results and arrests leading to conviction. Although certainly a sensitive area and one that merits further study, laboratories should question the level of effort put forth on any crime category if some social, economic or judicial benefit cannot be measured.

Lastly, laboratories must develop innovative means for managing their drug caseloads. Several laboratories have been successful in reducing their drug caseload volume by deferring examinations of some samples, marijuana for example, until it is clear the defendant will contest the charge of possession. Continuing liaison with the police narcotics investigation unit and the prosecutor's office is essential if such a deferred analysis plan is to be implemented successfully.

Although not the subject of in-depth study in this project, the potential contributions of crime laboratories is very much a function of the qualifications of scientific staff, instruments and related scientific resources in those facilities. The reader is referred to Appendix A for a summary of the law enforcement and scientifc resources available in each of the study sites. Ratios of police, investigative, evidence technician and laboratory personnel have been computed as have the ratios of laboratory budgets to total police budgets in the different

jurisdictions. These data are helpful in placing the study findings and recommendations into the proper framework.

The nature of this project does not permit us to make specific recommendations concerning such questions as: the costs and benefits of one type of laboratory configuration over another; the optimal number and qualifications of scientific examiners needed in various sized communities; or the types of scientific equipment and instrumentation needed in an up-to-date forensic laboratory. These considerations are simply beyond the scope of this particular study and the types of data which were collected. These questions are meritorious, however, and should be addressed in followup studies.

Prosecution

While the major focus of this project has been on police investigations, the data show that the presence of physical evidence makes a significant contribution to the conviction of persons arrested. Prosecutors may play a very important role in seeing that detectives present cases to them which contain essential evidence. This study further underscores the desirability of having physical evidence collected and examined in cases being prepared for prosecution. Robberies and burglaries have significantly higher rates of conviction where physical evidence is examined compared with cases where it is not.

As more and more prosecutors develop automated management information systems, they should be mindful of the importance of including scientific evidence in their classification of case variables. The Inslaw study, What Happens After Arrest? (Forst, 1977), illustrates

very well the potential value of tracking the presence or absence or various types of information in individual prosecutions. The Cook County, Illinois State's Attorney's Office has incorporated several items on physical evidence into its new computerized management information system. Maintenance of this information on an ongoing basis will greatly ease the process of tracking down the dispositions of cases where physical evidence is present.

Prosecutors' offices should take steps to improve communications with their respective forensic installations. The high turnover of personnel in such units makes the task of keeping legal staff trained in scientific procedures all the more difficult. While nothing can take the place of having each trial attorney well-versed in forensic capabilities, in large offices this is impractical.

In large offices it is recommended that one staff position be designated as a forensic science resource person. This person, preferably an attorney with scientific training, would review all incoming cases for potential physical evidence and handle communications concerning this evidence with the crime laboratory. This liaison person would serve as the conduit for questions directed toward the crime laboratory about the meaning of various tests and analyses and screen requests for additional or more sophisticated examinations.

This individual would also coordinate pre-trial conferences between attorneys and scientists to insure that attorneys are absolutely clear as to the meaning and significance of examinations. He/she should arrange for periodic visits by staff attorneys to the laboratory and for the training of new prosecutors in the capabilities and limitations of physical evidence. This individual would also be in charge of debrief-

ing attorneys following the disposition of cases, and relaying information back to laboratories about the perceived value of test results and expert testimony. Creation of such a position could make tremendous strides in reducing the communications gap that usually exists between attorneys and scientists. This position would also help minimize the attrition of arrest cases which fail to survive the judicial screening process because of insufficient evidence.

Laboratories must, also, shoulder a portion of the burden for failing to communicate adequately with prosecutorial personnel. A recent survey of crime laboratory directors (Peterson, 1983) determined that examiners confer with prosecutors prior to trial in about 57% of the cases where they examine evidence. While many prosecutor's offices are not sufficiently large to support the forensic science liaisons position discussed above, in those that are, the failure to confer before trial could all but be eliminated by introducing such a plan.

Police Administration

The top level administration of a police agency is primarily responsible for developing, disseminating, implementing and evaluating departmental policy. It is in the collection, examination and utilization of physical evidence where enlightened and clearly defined policies are needed, but are commonly absent. A number of recommended policies have been offered in the previous sections of this chapter, but it is the responsibility of the chief executive officers of the police department to insure these policies are in place and are being followed.

This leads to a second major responsibility of the police department administration which is to insure that crime scene investigation units and crime laboratories have adequate resources to accomplish the objectives defined in these policy statements. In our opinion, two of the jurisdictions in this study, Chicago and Oakland, are without adequate resources to respond to the scientific investigation needs of their agencies. The crime laboratories in these respective jurisdictions have taken two different approaches in response to these deficiencies: Chicago attempts to keep pace with the influx of evidence, examining as many cases as possible, albeit sometimes in a cursory fashion; Oakland severely restricts the flow of cases into the laboratory, with each case receiving a more thorough examination. Even so, we see that the Oakland laboratory is able to analyze only a small fraction of the evidence collected in cases that reach the examiner's bench.

This project has shown that physical evidence can make a substantial difference in case outcome, but only if the laboratory receives the proper evidence and standards and has the time, expertise and resources to examine this evidence completely. An assembly line approach to evidence evaluation, or one in which only the most rapid and/or obvious tests are made, does not lead to laboratory results that make a measurable difference in case outcome. Department administrators must be sensitive to these resource needs within their respective organizations and take steps to correct existing deficiencies.

Future Research

It is hoped that this report stimulates practitioners and researchers to engage in additional studies in the forensic science-criminal investigations area. The types of data gathered in this study, the statistical analyses performed, and the measures of outcome used should provide a number of alternative research theories and strategies for this future work. Three major recommendations are outlined below to guide this work.

One of the principal problems encountered in this study, that has been faced by several other researchers exploring the relationship between the laboratory and criminal investigations, is the cumbersome records management systems in crime laboratories, police departments and court systems. Crime laboratories should take the initiative and introduce management reporting systems in their operations. The essential data elements in such a system were discussed previously. Only with adequate reporting systems can laboratories begin to collect, cost-effectively, the types of data which are needed to define the contribution of various types of evidence and analytical procedures in the investigation of different types of crime.

Laboratories must also take advantage of case information systems which are under development in related police investigation units and criminal justice agencies. Laboratory directors should insure that physical evidence is included in investigative data systems used in deciding to screen out cases, compare M.O.'s of suspects, or link offenders with vehicles, weapons or other tools of a crime. The prosecution management information systems, also, provide another good oppor-

tunity for inclusion of physical evidence variables which can subsequently simplify the task of determining the dispositions of cases where evidence is analyzed.

Secondly, departments and laboratories are encouraged to consider the initiation of quasi-experimental studies of evidence utilization. This would involve making improvements or modifications in the way physical evidence is processed in a particular criminal offense (rape for example). Before and after measurements (clearances, arrests, prosecutions) would be made in an effort to determine the effects of these modifications. Similarly, the laboratory might focus added crime scene or laboratory resources in one geographical section of the city to determine if these added resources affect the outcomes of these cases when compared with cases from other areas of the city where services were maintained at an existing level.

A third more rigorous, politically sensitive, but nevertheless scientifically superior design would be an experimental approach. The key element of this approach is <u>random</u> assignment of cases into experimental and control groups. The experimental cases would be processed in a more intensive fashion, for example, while the control sample would receive routine scientific processing. Because such a design calls for an <u>increase</u> in services to particular crimes, with the existing level of services maintained for all others, there should be no serious political or ethical problems encountered. Such a design would permit researchers to isolate the effects of scientific investigation in a far more controlled and statistically rigorous fashion than either the quasi-experimental approach, or the retrospective, archival method of data collection used in this study.

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