THE ROLE AND IMPACT OF FORENSIC EVIDENCE IN THE CRIMINAL JUSTICE PROCESS

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Introduction

Over the past twenty-five years, the forensic sciences have made dramatic scientific breakthroughs (DNA typing, physical evidence databases, and new scientific instrumentation) but studies are needed to assess the contribution of such advancements on the role and impact of scientific evidence in criminal case processing. Targeted studies have evaluated the value of DNA evidence in property crime investigations, but no studies have reviewed the full array of scientific evidence present at crime scenes. In 2006, the National Institute of Justice funded this project to address the following four goals:

Objective 1—Estimate the percentage of crime scenes from which one or more types of forensic evidence is collected;

Objective 2—Describe and catalog the kinds of forensic evidence collected at crime scenes;

Objective 3—Track the use and attrition of forensic evidence in the criminal justice system from crime scenes through laboratory analysis, and then through subsequent criminal justice processes; and

Objective 4—Identify which forms of forensic evidence contribute most frequently (relative to their availability at a crime scene) to successful case outcomes.

Literature Reviewing the Examination and Impact of Physical Evidence

Forensic laboratories have multiplied almost four-fold since the early 1970s as the result of the drug abuse problem, pressure on the police and courts to increase their reliance on more objective forms of evidence, scientific breakthrough in such fields as DNA testing that uniquely determine the source of biological substances, and a popular culture that has embraced forensic science through both fictional and true crime media. In spite of these advancements and growth of forensic science services, little published research exists on the uses and effects of forensic science evidence. Early studies in the 1960s and 1970s indicated physical evidence was available at most crime scenes, but little scientific evidence was collected and had minimal impact on case outcome.

The most detailed studies of the use of scientific evidence in the investigation and adjudication of cases were funded by NIJ in the 1980s. At the police investigation level, Peterson et al. (1984) found clearance rates of offenses with evidence scientifically analyzed were *about three times greater* than in cases where such evidence was not used. A second companion study found scientific evidence to have a very limited role in decisions to convict a defendant but had its major effect on sentencing; lab reports, generally led to higher rates of incarceration and was the only type of evidence to influence the length of the sentence. More recent studies of DNA evidence by Roman et al. (2008) found solution rates of property crime doubled when DNA evidence was collected, prosecutions doubled, and DNA was much more

effective than fingerprints in using evidence databases, and Briody (2004) found homicide cases with DNA evidence were much more likely to reach court and had a positive effect on juries' decisions to convict.

Scientific laboratory techniques hold the potential of developing information from the physical clues left at the crime scene that can assist in determining what transpired at the scene and who was (and was not) involved. Specifically, the types of information it can provide are:

Identification and Classification – The review of physical evidence by competent crime laboratory examiners often begins with tests to identify and classify a substance.

Common Origin – This is a refined and powerful conclusion in which the examiner concludes that an item of evidence originated from a particular person or source.

Reconstruction/Corroboration - Reconstruction aids the investigator and prosecutor in hypothesizing the order of events, the relative position of actors to one another, and how the crime in question unfolded.

Different Origin/Negative Identification - Negative identifications are conclusions that a substance is found not what the investigator hypothesized it to be. A conclusion of different origin is a laboratory result that states two or more items of evidence are not of common origin or source.

Inconclusive - A comparison between an item of evidence and a standard (paint, glass, plastic, etc.) may simply be inconclusive.

Recent censuses of crime laboratories have documented the millions of cases annually submitted to the nation's four hundred crime laboratories and the growing backlog of cases awaiting examination. Beginning with the report of a crime to police, the response by patrol and investigation personnel, the search for and collection of evidence, and its submission to laboratories, physical evidence may be submitted for one of the reasons noted above. In response to the volume of scientific evidence being submitted to laboratories, crime scene investigators, and the laboratories themselves have (of necessity) erected filters to screen out evidence before it reaches laboratory facilities.

Research Methods

The principal data collection method in this project was a prospective analysis of official record data that followed criminal cases in five jurisdictions (Los Angeles County; Indianapolis, IN; and the Indiana State Police Laboratory System (Evansville, IN; Fort Wayne, IN; and South Bend, IN)) from the time of police incident report to final court disposition. Sites were selected to represent city, county and state crime laboratory services. Data for the analyses were based on a random sample of the population of reported crime incidents for the year 2003, stratified by crime type and jurisdiction. Crime incidents for the year 2003 were used so that cases would have complete data, including final dispositions. A total of 4,205 cases were sampled including 859 aggravated assaults, 1,263 burglaries, 400 homicides, 602 rapes and 1,081 robberies.

Descriptive and impact data were collected from three sources: police incident and investigation reports, crime lab reports and prosecutor case files. Various forensic variables were used for both descriptive and outcome analyses. These included: location and type of crime scene, presence of crime scene evidence, laboratory submitted evidence, and laboratory examined evidence; (i.e. biological, latent prints, pattern evidence, firearms, natural and synthetic materials, generic objects, drugs); unique identification; and link suspect to crime scene and/or victim. Police incident and investigation reports yielded information on forensic, offense, and disposition variables; information from crime laboratory reports gave information on type of evidence submitted and examined, laboratory results and evidentiary value; prosecutor files provided charging, disposition and sentencing information. The physical evidence present and collected from scenes of crimes was determined exclusively from reports contained in police files.

All analyses for the present study are based on pooled data for each crime across the five sites. The study explored the effect of forensic evidence on five different case outcomes, including: (1) whether a reported crime incident resulted in an arrest, (2) whether a case arrest was referred to the DA (3) whether an arrested suspect(s) was formally charged, (4) whether a prosecuted defendant was convicted, and (5) sentence length for incarcerated offenders. As each of the first four outcomes is binary, these models used logistic regression analysis to model the respective case outcomes. Sentence length was modeled using ordinary least squares regression.

Role and Impact of Forensic Science Evidence

Aggravated Assaults - The majority of the randomly selected assault incidents across the five jurisdictions shared common characteristics. Most assaults took place indoors between young, minority males who knew each other previously, but a sizeable number (approximately 40% of the sample) involved male on female domestic violence. Most incidents had no witnesses and most victims received medical treatment of some kind. Physical evidence/substrates were collected in 30% of incidents, with Firearms/Weapons (e.g., guns, bullets, shell casings) the leading category of evidence gathered. In only about 12% of cases where evidence was collected was the evidence submitted to the crime laboratory, and most of it was Firearms/Weapons and Latent Print evidence. Examinations in 79 cases (9.2%) conducted across all crime laboratories yielded 34 cases with identifications of evidence, most of them (21) involving firearms-related evidence. In terms of individualizations, there were 18 cases with firearms individualities and four other individualities involving Latent Prints. There were a total of 15 searches of the NIBIN database but only one (Indianapolis) resulted in a hit.

Forty-nine percent of assault incidents had an arrest. Bivariate comparisons of cases with and without crime scene evidence showed statistically significant higher rates of arrest, prosecutor referral, charging, and conviction for cases with forensic evidence. Multivariate analyses determined that the collection of physical evidence was a statistically significant predictor of arrest. However, most evidence was not examined in advance of the actual arrest, which shows that information derived from laboratory analyses generally had no influence on arrest decisions. The physical evidence itself, although unexamined at the time of arrest, nonetheless gave support and direction to the investigation and helped to propel the case toward

arrest. Analyses showed that non-forensic variables- victim reports to the police, intimate relations between victim and suspect and being arrested within ten minutes of the incident- were significant predictors of charging. Overall, 20.5% of all reported incidents resulted in a conviction. The strongest predictor of conviction was victim medical treatment. The primary impact of the physical evidence was clearly at the point of arrest and that impact decreased as the case moved forward through the justice process. Approximately 90% of case convictions were obtained through pleas. Bivariate data showed that the presence of physical evidence in a case increased significantly the likelihood that the case would be resolved through trial. However, lab examined evidence did not differentiate plea from trial. Furthermore, forensic evidence variables were not significant predictors of plea/trial in the logistic regression analysis.

Burglary - Burglaries were largely committed by young, minority males against slightly older victims who were highly represented by females and Whites. Most were committed in houses and apartments, by strangers, with no witnesses, which, likely explains the low arrest and conviction rates, 8.2% and 3.2%, respectively. Police collected physical evidence and substrates in 19.6% of burglaries. Latent Prints made up 84% of the evidence collected. A high percentage of collected Latent Print evidence was submitted to the laboratories (75%) and crime labs examined approximately 72% of submitted prints. Laboratories produced 52 cases with individualized evidence – mostly latent prints. Latent Print evidence was entered into respective AFIS systems and, based on 63 inquiries, obtained nine hits for a success rate of about 14%.

The contrasts between cases with and without physical evidence for rates of arrest, referrals to the district attorney, charged cases, and convictions were all statistically significant. The multivariate analyses showed that arrests for burglary were more likely if the case had witness reports of the crime to the police, occurred among intimates/family members and had physical evidence collected at the crime scene. Cases in which the victim and suspect had an intimate or family relationship were significantly less likely to be referred to the DA than stranger cases and suspects arrested within 10 minutes of the crime incident were more likely to be convicted. Overall, 95% of convictions were resolved through plea bargaining. Given the high rate of plea outcomes, the presence of physical evidence had little effect on mode of case disposition.

Homicide - Suspects were principally young minority males who largely mirrored their victims demographically. Suspects knew their victims in 45% of homicide incidents. Interestingly, the overwhelming majority (76%) of homicides had at least one witness. Fifty-five percent of incidents had an arrest and 34.5% had a conviction.

A very high percentage (97%) of homicides resulted in physical evidence/substrates being collected, primarily Firearms/Weapons and Natural/Synthetic Materials (mostly clothing). The next most frequently gathered physical clues were Biological and Latent Print. A very high percentage (88.5%) of collected physical evidence was submitted to crime laboratories, and most incidents had evidence that was examined (81%).

Multivariate analysis revealed that homicides among non-strangers and cases with witness reports were significantly more likely to result in arrests. Forensic evidence was not significant but this result was most likely due to a lack of variation in cases with and without

evidence. The interaction of race/ethnicity and gender were also important predictors of arrest. Cases with White victims (both male and female) and Black suspects (both male and female) were more likely to result in arrests. Friend/acquaintance victim/suspect relationships were more likely to be charged than stranger homicides and homicide cases where the suspect was arrested within 10 minutes of the incident were also more likely to be charged. Cases with crime scene evidence were approximately 21 times more likely to be charged than those without evidence. However, two issues are important to note. First, all but 12 cases had crime scene evidence, thus, it is not surprising that cases with evidence would be charged at a higher rate. Second, although crime scene evidence was a significant predictor, lab examined evidence was not. Furthermore, the "linking" forensic variable (examined evidence connects the suspect to the crime scene and/or victim) also was not a significant predictor of charging a homicide case. The results indicate that although cases with known relationships between victim and suspect were more likely to be charged they were significantly less likely to result in convictions. In addition, suspects arrested within 10 minutes of the crime incident were less likely to be convicted. Similar to the regression model for charging, none of the lab examined forensic variables were significant predictors of conviction.

There were 90 homicide trials (92.2% conviction rate) and 55 plea dispositions across the study sites. Homicide had the highest ratio of trials to pleas. The percentage of cases that had lab-examined evidence was similar for trials (77.8%) and pleas (74.5%). However, cases resolved through trial tended to have a higher percentage of lab-examined Biological (45.6% vs. 36.6%), Latent Print (43.3% vs. 38.2%) and Firearms (65.6% vs. 52.7%) evidence than did plea negotiated cases.

Rape - The Study's database included 602 randomly selected rape incidents. All of the victims were female and all of the suspects were male. Slightly more than half (53.9%) of the victims were White but the majority of suspects were Black (45.9%) or Latino (20.3%). With regard to age, victims tended to be young with the vast majority being under 30 years old (74.1%). Similarly, the majority of suspects were under 30 years old (57.7%). The overwhelming majority of rapes were among people that knew each other, either as intimates/family (36.2%) or as friends/acquaintances (42.7%). Victims received medical treatment for their injuries in 68.3% of cases. Two-thirds of rapes occurred in houses and apartments.

Approximately 64% of incidents had physical evidence or substrates collected. Biological and Natural and Synthetic Materials were the two primary types of physical evidence collected. Sexual assault kits were often employed to gather physical evidence (51.3%). The kits held samples of suspected blood, semen, saliva and DNA. The data reveal that there was a dramatic decline (approximately 50%) from collected evidence to evidence submitted to crime labs. The biggest decline occurred in the submission of sexual assault kits (68%). While some of submitted evidence likely came from sexual assault kits, the complete kits themselves were not identified as being submitted. A high percentage of cases with submitted semen evidence were examined (86.2%). Vaginal, blood and latent print evidence also were examined in most submitted cases (87.5%, 59.0% and 74.1%, respectively. In terms of establishing the uniqueness of material, 19 cases had individualized biological materials and nine had individualized latent finger and/or palm prints.

Bivariate comparisons indicated that cases with crime scene evidence were significantly more likely to lead to arrest, to be referred to the prosecutor, to be charged, and to result in conviction than cases without evidence. Arrests were more likely to occur if the victim reported to the police and participated in the investigation. In addition, arrests were more likely if the incident occurred among intimate/family or friend/acquaintances compared to strangers. Multivariate analysis showed the collection of crime scene evidence and lab examined evidence were both significant predictors of arrest. However, of the 191 rape cases with crime scene evidence that had an arrest, physical evidence was examined in only 1.6% of the cases prior to the time the arrest was made. Laboratory examined forensic evidence increased the odds of DA case charges by over five times. The strongest predictors of case charging, however, were victims' reports and victims' receipt of medical treatment. The strongest predictors of conviction were victims' reports to the police and direct arrest techniques.

Overall, 67 of 81 (82.7%) charged cases resulted in convictions. Cases where physical evidence was collected resulted in convictions 87.3% of the time as opposed to 66.7% of the time in cases without physical evidence collected. There was physical evidence examined in 30 convictions (44.8% of all convictions and 54.5% of convictions with physical evidence). Seventy-eight percent of rape dispositions were through pleas and 22% through trials. Eighteen out of 19 trials (94.7%) resulted from cases where physical evidence was collected. The trial conviction rate for cases with evidence was 83.3%. The sole trial without physical evidence resulted in an acquittal.

Robbery - A high percentage of robbery offenders were male, from a minority racial group (either Black or Latino), and under thirty years old. A high percentage of victims were women, more likely to be White, and over the age of thirty. Typically, victims and suspects were strangers. Robberies occurred mostly on the street, followed by within residences and retail businesses. Most robbery incidents had no witnesses. Medical treatment was usually not required. A low percentage of robbery incidents had arrest and convictions, 22.6% and 12.6%, respectively.

Physical evidence and substrates were collected in only 24.8% of the robbery incidents. Latent Prints, Natural and Synthetic Materials, and Firearms/Weapons were collected most frequently. South Bend collected Latent Prints in about 24.6% of incidents, whereas Los Angeles, on the other hand, gathered prints in only about 2.1% of cases. Materials (clothing) was the next major category of evidence/substrates collected. Firearms/Weapons were collected in 2.5% to 7.7% of cases. The evidence was submitted to crime laboratories in 44% of cases where it was collected (only 10.9% of all robbery incidents). A high percentage of the evidence submitted was actually examined (90.7%) but only 9.9% of all robbery incidents had examined evidence. Latent Print examinations yielded individualizations in 44% of the 41 cases where prints were submitted to the laboratory for examination.

The contrasts between rates of arrest with and without physical evidence were substantial and statistically significant, as were rates for prosecutor referral, charging, and conviction. Multivariate analysis indicated that physical evidence collected at crime scenes had a significant impact on arrests. In particular, firearms and latent print evidence were predictors of arrest.

Similar to other crimes in the study, the likelihood of arrest also increased with witness reports and if the robbery occurred among friends/acquaintances. Witness reports and intimate/family relationships between victims and suspects increased the odds of DA charges. None of the various forensic variables predicted charging, however. Victim reports to police was the strongest predictor of robbery convictions. In addition, cases in which the victim received medical treatment and the victim and suspect had intimate/family relationships were more likely to have a conviction.

Seventy-eight of the 93 cases charged, where physical evidence was collected, resulted in conviction (83.9%). Fifty-eight of the 65 cases without physical evidence collected resulted in conviction (89.2%). In all, 35 convictions had physical evidence that was examined in crime laboratories. Unlike the other crimes included in this study, robberies were notable for having the highest percent of cases adjudicated through trial. A significantly higher percent of cases with crime scene evidence (68%) was resolved through plea compared to cases without evidence (36%).

Unique/Associative Evidence

There were a total of 87 offenses where uniquely identified evidence associated suspects/offenders with the crime scene and/or victim and criminal justice outcome data (arrests/convictions) could be determined for 85 of them. Forty-six (52.8%) of these cases involved latent prints, 26 (29.9%) of them involved biological (DNA) evidence, and 10 (11.5%) involved firearms. Homicide cases were the predominant offense type represented in these cases with individualizing/associative evidence, followed by burglaries, rapes, and robberies. Firearms, biological, and latent print evidence were almost equally represented in homicides, while biological evidence dominated rapes, and latent prints dominated burglaries and robberies. Conviction rates were determined for cases that involved single forms of such evidence and for those involving two or more forms of individualizing evidence. For all types of evidence categories, conviction rates were substantially higher for offenses with two or more types of such evidence compared to offenses with single forms. Conviction rates were highest for offenses with biological evidence and lowest for cases with latent print evidence, regardless of the number of forms of that evidence present. Cases where DNA evidence was individualized, regardless of its ability to associate the offender with the crime, were also tabulated. There were a total of 75 such offenses, and almost three-quarters (73.3%) were from homicides.

Conclusions

In spite of the increased attention paid to forensic evidence over the past decade, there is little published empirical data identifying the types of evidence routinely collected, and the extent to which this evidence is submitted to and examined in forensic crime laboratories. There is even less research that describes the role and impact of such evidence on criminal justice outcomes. While the current study shows that forensic evidence can affect case processing decisions, it is not uniform across all crimes and all evidence types; the effects of evidence vary depending upon criminal offense, variety of forensic evidence, the criminal decision level, and other characteristics of the case. The current study attempted to fill this gap in knowledge by

examining the role and impact of forensic evidence on five felony crimes across five jurisdictions.

Given the varied nature of the criminal offenses, as well as contextual differences across study sites, the project reached the following conclusions:

1. The study data revealed that the collection of forensic evidence from crime scenes (and victims) was very extensive in homicides and, to a lesser extent, rapes; it was much more limited for assault, burglary and robbery offenses.

2. With the exception of homicides (89%), few of the reported crime incidents had forensic evidence that was submitted to crime laboratories. While the rate of submission of evidence for rape was 32%, submission rates in assaults, burglaries and robberies were under 15% of reported offenses.

3. With the exception of homicides (81%), the overall percent of reported crime incidents that had physical evidence examined in crime labs was low. Less than 20% of rape cases and less than 10% of assault, burglary and robbery incidents had lab examined evidence. Of evidence submitted to labs, however, rates of examination, with the exception of rape cases (58%), exceeded 70%. Consequently, it is clear that criminal justice officials external to the laboratory screen much of the forensic evidence and have a major influence on evidence examination priorities and practices.

4. The most frequently collected, submitted and examined forms of evidence were fingerprints, firearms and biological (blood and semen). For the sites included in this study and for the time period reviewed, DNA testing was rarely performed across all offenses and was concentrated in homicides and, to a lesser extent, rapes.

5. Although rates of arrest and conviction in study sites were low, the study rates were quite similar to national arrest and conviction data (see Table 4).

6. Rates of arrest, prosecutor referral, charging and conviction for the crimes of aggravated assault, burglary, and robbery with and without physical evidence were all substantial and statistically significant. For the crime of rape, differences were significant for all decision levels except for prosecutor referral.

7. At the logistic regression level, crime scene evidence was a consistent predictor of arrest across all crimes, but a very low percentage of arrests actually had physical evidence examined before the arrest. The exact role played by forensic evidence at investigation and prosecution levels is complex and dependent upon many factors.

8. Post-arrest, the predictive power of forensic evidence varied by crime type and criminal justice outcome. Lab examined evidence was a significant predictor of case charges for aggravated assault and rape. Forensic evidence also was associated with sentence length for assault and homicide. None of the measures of forensic evidence, however, were significant

predictors of case conviction regardless of crime. In fact, few independent variables predicted trial/plea outcome due to the very high rate that charged cases resulted in conviction.

9. While collected forensic evidence was a consistent predictor of arrest across all offense types, most other predictors of criminal justice outcomes were typically non-forensic, legal and situational variables: victim and witness reports, victim/suspect relationships, victim medical treatment, and arrest methods.

10. Very few reported crime incidents had forensic evidence that linked a suspect to the crime scene and/or victim (~2% of all cases, 6% of cases with crime scene evidence, and 12% of cases with examined evidence). However, the conviction rate for the cases with linking forensic evidence was significantly higher than cases without such evidence. Furthermore, conviction rates were higher for offenses with two or more forms of individualizing evidence that associated offenders with crime scenes.

In addition, the present project has led the researchers to identify ten follow-up research initiatives that would advance the understanding of the role played by forensic evidence in judicial decision making.

1. This research should be replicated and refined in other jurisdictions around the nation. In particular, studies should expand and strengthen their qualitative components as they assess decision processes at important criminal justice decision levels.

2. The filtering of forensic evidence, from collection at the crime scene to ultimate usage by investigators and prosecutors, requires additional study. The tracking of evidence utilization in various offense categories should expose factors that shape decisions to collect evidence, submit it to laboratories, and to request examination.

3. A major finding of the study was that most evidence goes unexamined, but its presence in cases was associated with arrest and movement of cases through the justice process. Added studies are needed to review how unexamined forensic and tangible evidence teams with other conventional investigative procedures to lead to arrests.

4. Cost studies, much like that completed by Roman et al., 2008, are needed to estimate the costs of various forensic analytical procedures applied to types of physical evidence. Such cost data must be linked to studies that determine the value of forensic investigations; together, they will constitute a more comprehensive view of such evidence.

5. Improved crime laboratory information management systems (LIMS) that assess the cost and impact of forensic evidence analysis need to be developed, implemented and adopted by crime laboratories around the nation. Such systems will enable the collection of research data on a routine basis of the type described in this study.

6. The present study's finding that two or more forms of individualizing/linking forensic evidence in cases lead to higher rates of conviction should be investigated in additional studies.

7. Alternative systems for evaluating and prioritizing forensic evidence upon its submission to forensic crime laboratories need evaluation. Priority systems must be anchored in empirical data that have tracked the types of forensic evidence that provide most useful information to investigators and prosecutors in various offense categories.

8. Sexual assault kit backlogs are a serious and pressing problem in many forensic crime laboratories around the nation. Added studies are needed that investigate the reasons for such backlogs, as well as research examining the role examined forensic evidence plays in sexual assault investigations and criteria for assigning priorities to collected evidence.

9. Research studying the submission of biological evidence and forensic DNA analysis in property and personal crimes is needed. The cost and benefits of forensic DNA testing, including inquiries of CODIS database systems, need evaluation for property as well as personal offenses.

10. Additional studies of the role and impact of forensic evidence at the level of adjudication are also needed. The role of the prosecutor in shaping forensic testing policies needs investigation. In particular, the impact of forensic evidence in prosecutors' decisions to take cases to trial vs. offering pleas needs review, as well as the role played by forensic evidence in negotiating pleas and offering charge/sentence bargains.

Chapter I

Introduction

Background to the Study

The National Institute of Justice (NIJ) seeks to further its mission by sponsoring research that will provide "objective, independent, evidence-based knowledge and tools to meet the challenges of crime and justice, particularly at the State and local levels." It has been over twenty-five years since NIJ sponsored research to examine the utilization of all forms of scientific evidence in the criminal justice system. During those twenty-five years, the forensic sciences have made dramatic scientific breakthroughs (DNA typing, physical evidence databases, related scientific instrumentation) that, due to limited resources, are not utilized in most criminal investigations. There have been more targeted studies of DNA testing and its costs and effects upon the solution of cold cases and property crimes, but no studies examining the full array of physical evidence and the processing of cases though the criminal justice process.

Unlike the media's romanticized portrayal of forensic science as a profession ever ready to solve crimes at a moment's notice, the reality is much different. Routine drug and alcohol identification cases consume more than 70% of laboratory resources, and crime laboratories had more than 500,000 backlogged requests at yearend 2002 (Peterson and Hickman, 2005; Durose, 2008). Congress has appropriated monies to improve testing and reduce backlogs, but has done so without authorizing empirical research to measure outcomes (DNA Backlog Elimination Act (2000); Paul Coverdell Forensic Science Improvement Act (2003); Justice for All Act (2004); Advancing Justice Through DNA Technology Initiative (2003)). Thus, the National Institute of Justice's decision to fund this study could not be timelier.

Given the evolution of the forensic science field over the past twenty-five years, it would not be our goal to repeat what has been done before, but rather to build on prior work while being mindful of current conditions in the forensic science field. Although the real and perceived value of this field is that it rests on a hard, laboratory science foundation, forensic science remains housed within an overworked justice system, composed primarily of nonscientists who determine if and when that science will be applied. That lab resources are typically unavailable to process most crime scenes or examine most evidence shapes the uses and effects of scientific evidence and, in turn, is a fundamentally important condition that a social science researcher must confront in developing an appropriate research strategy to describe its role and impact.

For this project, the National Institute of Justice established four goals and objectives for investigating the role and impact of forensic science evidence on the criminal justice process:

Objective 1—Estimate the percentage of crime scenes from which one or more types of forensic evidence is collected;

Objective 2—Describe and catalog the kinds of forensic evidence collected at crime scenes;

Objective 3—Track the use and attrition of forensic evidence in the criminal justice system from crime scenes through laboratory analysis, and then through subsequent criminal justice processes; and

Objective 4—Identify which forms of forensic evidence contribute most frequently (relative to their availability at a crime scene) to successful case outcomes.

In addition to the CSULA research team, a Project Advisory Committee (Shari Diamond, Michael Saks, Paul Giannelli, and Kevin Lothridge) composed of noted legal/social science scholars and administrators in the forensic science fields assisted in guiding and assessing the study's implementation and progress.

Organization of the Report

The final report is divided into the following 8 chapters:

Chapter 2. Physical Evidence Impact Literature

- Impact Studies
- Criminalistics – What it tells the justice system
- Crime Laboratory Operations
- Processing and Filtering of Physical Evidence

Chapter 3. Project Methodology

- Study Sites
- Research & Sample Designs
- Variables and Measures
- Analytical Strategy

Chapter 4. Assault

- Physical Evidence Collection, Submission and Examination
- Tracking Cases Through the Justice System
- Predictors of Criminal Justice Outcomes
- "Hard to Solve Cases"
- Discussion

Chapter 5. Burglary

- Physical Evidence Collection, Submission and Examination
- Tracking Cases Through the Justice System
- Predictors of Criminal Justice Outcomes
- "Hard to Solve Cases"
- Discussion

Chapter II

Physical Evidence - What It Can Tell the Investigator, and The Flow of Evidence Through the Criminal Justice System

Forensic Evidence Impact Studies

Since the 1930s police and courts in the U.S., as well as various blue-ribbon crime panels, all have recommended the increased use of science in solving crime and achieving justice. In the 1960s the President's Crime Commission Task Force reports on *Police* and *Science and Technology* (1967) called for greater reliance on physical evidence in the investigation and adjudication of crimes. In the 40+ years since the publication of those reports, there have been remarkable advancements in the growth of forensic (crime) laboratories serving the criminal justice system and in the sophistication of scientific techniques employed to examine and interpret physical clues. Forensic laboratories have multiplied almost four-fold since the early 1970s as the result of increasing the drug abuse problem in society that mandates the chemical identification of controlled substances, pressure on the police and courts to increase their reliance on more objective forms of evidence, scientific breakthrough in such fields as DNA testing that uniquely determine the source of biological substances, and a popular culture that has embraced forensic science through both fictional and true crime media.

In spite of these advancements and growth of forensic science services, little published research exists on the uses and effects of forensic science evidence. Parker's 1963 survey of forensic laboratories was one of the first to record the infrequent (1% of criminal violations) use of scientific evidence. Parker's empirical study of scientific evidence usage in 1969, supported by NIJ's predecessor agency (the National Institute of Law Enforcement and Criminal Justice), found physical evidence to be present at almost 90% of felony crime scenes (Parker and Peterson, 1972). That study also documented that most of this evidence was not collected from the scene, and even less was analyzed in a crime laboratory.

Several studies in the 1970s and 1980s looked at the effects of physical evidence on the outcomes of police investigations and prosecutions. The Rand Corporation study (Greenwood et al, 1975) was highly critical of detective activities, finding that information supplied by victims to the first officers at the scene was most determinative in predicting if a crime would be solved. Classical investigation techniques and physical evidence in particular played little role in solving crimes. The study also found physical evidence available in most cases and latent fingerprints in over half, but that fingerprints led to the identification of the offender in only 1% of cases.

Forst et al., (1977) examined the outcome of cases after arrest. They found that more than 70% of arrests did not lead to conviction, but that three factors were critical to arrests that did: the location of two or more witnesses, the minimization of time from crime incidence to arrest, and the presence of "tangible evidence." Unfortunately, the study did not define tangible evidence, nor was it known if this evidence was actually examined in a crime laboratory. Another study showed that on average only about half of police arrests resulted in formal charging by a prosecutor. Of the cases charged, about 70-80% resulted in conviction; however, the vast majority (90%) was resolved through a plea and only 10% had actually gone to trial

(Boland *et al*., 1989). Studies of burglaries by Stanford Research Institute (Greenberg et al., 1973) and the Police Executive Research Forum (Eck, 1979) successfully identified key variables (including usable fingerprints) that predicted case outcome in 85% of cases. A British study (Ramsay, 1987) found that forensic laboratories provided "helpful information" to the police in about three-quarters of cases where suspects had been identified (suspects were absolved in about 7% of evidence submissions), but in less that 40% of cases without suspects. This line of research did not continue into the 1990s and beyond.

At the court level, Eisenstein and Jacob (1977) attempted to assess the impact of evidence on actual case outcomes and found that strength of evidence was associated with likelihood of conviction and sentence imposed. However, their measures were crude – aggregating various types of evidence – which precluded assessment of the impact of scientific or any other type of evidence. Feeney et al.'s 1983 study of robbery and burglary arrests found evidence (a witness's identification of the defendant) as the most important factor in predicting conviction.

The role of evidence in plea bargains is debatable given the inconsistent, varying character of plea discussions. Some (Heumann, 1978; Rosett and Cressey, 1976) downplayed the importance of evidence in case disposition, with attorneys finding it easier to agree on disposition than on disputed facts (evidence). Neubauer (1974) described plea-bargaining as a "mini-trial" where the attorneys analyze the evidence much as jurors would. McDonald (1979) similarly found "strength of the case" and available evidence and witnesses most critical in decisions to plea bargain or to take a case to trial. In sum, there is little agreement about the importance of evidence and little knowledge about the importance that various kinds of evidence play in decisions to charge or to seek or accept a plea.

Research into the role evidence plays at trial is somewhat better documented but not current. Kalven and Zeisel's 1966 landmark study of jury behavior found that most juries followed the evidence presented and reached verdicts identical to those of judges. They also documented the infrequent use of scientific expert witnesses at trial. A study of court files by Lassers in 1967 found a heavy reliance on confessions and witness testimony to secure convictions in contrast to the infrequent (~25%) use by prosecutors of scientific evidence in capital cases reviewed by the Illinois Supreme Court.

The most detailed studies of the use of scientific evidence in the investigation and adjudication of cases were funded by NIJ in the 1980s. The first, *Forensic Evidence and the Police* (Peterson, et al., 1984), examined close to 2,700 randomly selected cases drawn from four jurisdictions nationwide – ~1,600 cases with analyzed physical evidence and ~1,100 otherwise similar cases where no physical evidence was collected. Case files were stratified by offense type (homicide, rape, robbery, aggravated assault and burglary) and were drawn from police agency, crime laboratory, prosecutor and court files.

This study showed that physical evidence was collected and analyzed in only 20-30% of all serious crimes. Further, this rate varied greatly by crime type. For example, the police collected physical evidence in virtually 100% of murder and drug cases and 75% of rape cases, but in only 10-20% of attempted murders, 33% of burglaries, and 20% of robberies. Excluding controlled substances, which make up 70% or more of laboratory caseloads, blood, hair, firearms

and fingerprints were the principal forms of physical evidence most frequently collected and examined in the laboratory. Suspected semen was also high on the list of physical evidence collected in sexual assault cases, but its utility was dependent upon the prior relationship between the defendant and victim. More and greater varieties of physical evidence were gathered and, typically, earlier in violent crime investigations than property crimes.

After controlling for the availability of suspects, eyewitnesses to the crime, and elapsed time between discovery of the offense and its report to the police, clearance rates of offenses with evidence scientifically analyzed were *about three times greater* than in cases where such evidence was not used. In addition, the forensic evidence appeared to have its greatest effect in cases that traditionally had the lowest solution rate – cases with suspects neither in custody nor identified at the preliminary investigation stage.

A second companion study funded by NIJ explored the uses and effects of scientific evidence in the charging, plea negotiation, trial and sentencing stages of the criminal justice process (Peterson et al., 1987). The scientific evidence had minimal effect at the point of charging of most felony cases, excluding drug, stranger rape, and arson cases. Guilty pleas were the norm in more than 90% of cases tracked in the five jurisdictions. In cases where the scientific evidence strongly associated the defendant with the crime, prosecutors were *less* inclined to offer a plea bargain.

The second study found that scientific evidence had a *very limited* role in decisions to convict a defendant, particularly compared with the effects of admissions, incriminating statements, and tangible (non-scientific) evidence. The presence or absence of scientific evidence had more of an effect on case outcome in otherwise *weak* evidentiary cases. It was during the stage of sentencing, however, where the forensic evidence had its major effect on the adjudication of felony cases. While a defendant's prior record overwhelmed most other factors in the incarceration decision, lab reports generally led to higher rates of incarceration and were found to be the only type of evidence to influence the length of the sentence.

More recently, a study by Briody (2004) examined the effects that DNA evidence had on decisions in homicide cases as they progressed through the criminal courts. These effects were examined within a context of other evidentiary and extra-legal factors that may also have had a bearing on case outcomes. The study involved a sample of 750 solved and completed cases referred by police for prosecution in the State of Queensland. Half of these cases resulted in DNA evidence relating the accused to the crime, while the other half acted as a control group and did not include DNA evidence. Cases with DNA evidence were much more likely to reach court than cases without, while incriminating DNA evidence had a positive effect on juries' decisions to convict, but no effect on securing guilty pleas from defendants.

The Office of Justice Programs and the National Institute of Justice have sponsored a number of projects over the past several years supporting and evaluating the use of DNA to solve violent crime cold cases and property crimes in particular. Support has been given to various units of government at the federal, state and local level to identify and investigate cases and recognize those types of physical evidence that have the potential of yielding DNA profiles and may be solved through the use of CODS databases. Projects like the Denver Cold Case Project

fostered cooperation among police, crime laboratories and prosecutors in the analysis of hundreds of DNA samples, the development of profiles and the achievement of scores of DNA hits via CODIS, and the prosecutions of serious offenders. The National Institute of Justice released a set of guidelines to assist agencies (*Using DNA to Solve Cold Cases)* in the review of cold, or unsolved cases that may be solved through DNA technology and DNA databases. Training courses have also been offered for law enforcement officers and prosecutors in investigating cold cases, prioritizing cases, and prosecuting identified offenders.

NIJ has also been active in promoting the use of DNA testing in investigating minor offenses. One project in particular, the *DNA Field Experiment: Testing Cost Effectiveness of Collecting DNA in Property Crimes* (Roman et al., 2008), undertaken by the Urban Institute in five cities examined the effectiveness of performing DNA testing on biological evidence found at property crimes. The study found solution rates of property crime doubled when DNA evidence was collected, prosecutions doubled, and that DNA was much more effective than fingerprints in identifying suspects in using the CODIS and AFIS databases. The study also broke new ground in estimating the average costs of analyzing DNA and the added costs of suspect identification, arrest, and acceptance of the case by the prosecution.

Criminalistics/Forensic Science

The scientific and technical literature of forensic science and criminalistics focuses on those laboratory methods used to examine and interpret physical evidence collected from the scenes of crimes. After all, it is the information that can be derived from the physical evidence that drives the physical evidence collection and examination process. Scientific laboratory techniques hold the potential of developing information from the physical clues left at the crime scene that can assist in determining what transpired at the scene and who was (and was not) involved. For the last 100 years, police investigators and the courts have grown increasingly reliant on such forensic evidence and testimony, as it can supply information about the crime otherwise unavailable to investigators and fact-finders.

Forensic science and criminalistics laboratories generally provide the following types of information based on the scientific examination of physical evidence collected from scenes of crimes, victims, and suspects:

Identification and Classification – The review of physical evidence by competent crime laboratory examiners often begins with tests to identify a substance and, for example, to determine that a stain is blood or white powder is cocaine. Debris from a suspected arson scene might yield information to determine a volatile liquid was present in fire debris. Examinations also enable the examiner to place the evidence into a more restricted class or category, finding that blood is of human origin, the volatile liquid was light petroleum distillate, that a bullet was shot from a .38 caliber firearm, or that a fiber was cotton. Even latent (not readily visible) fingerprints must first be identified as a human fingerprint and that the print is identifiable and has sufficient detail to make a determination to make a subsequent determination of origin. Such classifications enable an examiner to conclude the evidence in question may have, or is consistent with originating from a particular source.

Common Origin – This is a refined and powerful conclusion in which the examiner concludes that an item of evidence originated from a particular person or source. In practice, an examiner will commonly compare an item of evidence with a reference standard of known source and declare they are identical in all respects and of a common source or origin. In so doing, the criminalist is able to associate and connect persons, instruments of the crime (e.g., tools or weapons), and physical environments. Such conclusions of common origin are often termed *individualizations* by criminalistics professionals and will typically involve a comparison process between an item of evidence (unknown origin) and a standard (known origin). However, even if examiners after performing many measurements find two paint chips, hairs or fibers to be indistinguishable, the examiner may not necessarily conclude an individuality has been attained. Many mass produced items in modern society may be similar in all measurable characteristics, but criminalists are very cautious about reaching such a conclusion.

In the present study, the items of evidence most frequently resulting in conclusions of uniqueness or common origin, are projectiles from weapons, latent fingerprints found at the scenes of crimes, and biological evidence. For almost one hundred years, American courts have admitted fingerprint evidence and the testimony of examiners that a given latent print came from one individual, at the exclusion of all other persons. Firearms and toolmark evidence has a similar history, having been first admitted to the courts at about the same time. Bullets and shell casings fired from a weapon and found at a crime scene are routinely compared against projectiles fired from weapons fired in the possession of a suspect. Unlike these items of evidence yielding statements of common origin, biological fluids examinations have undergone the most radical changes and scientific advancements in the past twenty-five years. The discovery and refinement of DNA profiling tests, and their introduction into American courts in the mid 1980s, changed the face of forensic serology. Research showing everyone's DNA is unique, and the development of techniques to determine the DNA types of the smallest amounts of trace DNA at crime scenes, have revolutionized investigations and judicial inquiries.

Although not addressed in this study, a recent report by the National Research Council, Strengthening Forensic Science in the United States: A Path Forward, has challenged the scientific foundations of many of these forensic science techniques (NRC, 2009). The report found the field to have serious problems throughout many of its disciplines that can only be addressed by overhauling the forensic sciences in this country. The report declared the field of forensic science in need of changes, systemic and scientific, to ensure the reliability of the disciplines, to establish and enforce firm scientific and evidentiary standards, and to promote best practices in the field.

Computerized databases are another development that has changed the value of forensic science to the criminal justice system. Historically, and up until the mid 1980s, investigators needed a reference standard before they could make a statement of common origin. Latent fingerprints from a crime scene could not be used to identify an offender unless a known set of fingerprints could be obtained from one or more suspects. The manual filing systems in place were helpless in matching the latent print with the prints of their owner. Likewise, serologists needed a biological sample from a suspect before the source of a blood or semen stain from a crime could be determined. Firearms examiners were largely helpless in identifying the weapon

used to shoot a bullet recovered in the body of a homicide victim, unless they found a suspect weapon to test fire comparison projectiles.

As the computer science field developed techniques to digitize and store complex patterns images like fingerprints and firearms, these innovations enabled investigators to search large databases. AFIS was the first system introduced for storing fingerprint information, both to confirm the fingerprints and identities of arrestees, and to use latent prints recovered from the scenes of crime and to identify the offender. The introduction of CODIS in 1990 (FBI's CODIS Program), enabled law enforcement to store DNA profile information from known offenders and to search such files with the DNA profiles of unknown offenders recovered from the scenes of crimes. Crime laboratories and law enforcement agencies have had considerable success in recent years identifying otherwise unknown offenders and linking crimes together committed by the same person by using CODIS.

Common origin results may or may not show an *association* between the suspect/offender and the crime in question. Much of the evidence found at a scene will associate the rightful owner or victim to the crime scene, but not the suspected offender. So, making a unique identification of the *victim's* fingerprint in their own home will have little value to the criminal investigator. Crime scenes have an abundance of physical materials and it is the task of the crime scene investigator to locate that evidence that relates to the immediate crime in question. A biological stain, latent fingerprint or some other evidence at a scene may be completely unconnected to the instant crime in question or show some other party was at that scene days or weeks before. The crime scene investigator's task is to evaluate a tremendous volume of potential evidence at a crime and hopefully choose that evidence showing that a suspected person was present, in a particular location, where he or she had no rightful access.

Reconstruction/Corroboration - Examination of 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 may corroborate or refute statements by witnesses, suspects and victims. Explaining the order in which actions took place and the location of principals of the crime (particularly crimes of violence) is particularly helpful in explaining all evidence gathered. Reconstruction aids the investigator and prosecutor in hypothesizing the order of events, the relative position of actors to one another, and how the crime in question unfolded.

Different Origin/Negative Identification - Negative identifications are conclusions that a substance is found not to be what the investigator hypothesized it to be (the powder is not cocaine, the reddish stain is paint and not blood). A conclusion of different origin is a laboratory result that states two or more items of evidence are *not* of common origin or source. Typically, comparisons are made between an item of evidence with a standard of known source, and they are found to be different. Such exclusions tend to dissociate persons, objects, and locations. Basically, such determinations state that the evidence in question could not have originated from a particular source of origin. The latent fingerprint did not come from suspect A, the bullet was not fired from weapon B, and the DNA in the biological stain did not originate from suspect C.

Inconclusive - On occasion, the crime laboratory is not able to come to a firm conclusion of any sort. The examiner may not be able to reach any firm conclusion as to the origin of an item of evidence. Searches of databases may not be able to identify the origin of the evidence in question. A comparison between an item of evidence and a standard (paint, glass, plastic, etc.) may simply be inconclusive. Inconclusive results may not necessarily amount to an exclusion – only that there is an absence of scientific information for an examiner to make a statement of common origin or exclusion and the answer is inconclusive.

Crime Laboratory Operations

Peterson and Hickman's (2005) report and analysis of survey data in the Bureau of Justice Statistics'(BJS) 2002 Census of Forensic Crime Laboratories identified 351 public crime laboratories in the United States. This census documented an almost four-fold increase in crime laboratories in the U.S. since Joseph's 1968 study. The major area of growth has been the state supported regional crime laboratories that began to be constructed in the 1970s and were created to bring forensic science services closer to medium sized and rural communities and law enforcement agencies in the United States. To be counted in the 2002 census, laboratories needed to employ at least a single examiner with a minimum of a bachelor's degree in science. This excluded the thousands of 'identification' units in police agencies around the nation performing crime scene, photography, fingerprint and occasional pattern matching work. The survey documented for the first time the numbers of scientific and management personnel, operating budgets, testing capabilities, resource needs, caseloads, and backlogged requests for laboratory services. The survey found these crime labs received almost 2.7 million new cases for analysis in 2002, but ended the year with more than 500,000 backlogged requests for forensic services. The survey also found almost half of the crime laboratories were also outsourcing forensic casework to outside private laboratories, mostly in the area of DNA testing.

BJS updated this survey in 2005 (Durose, 2008) and found that backlogs had increased 24% since yearend 2002. The survey also documented almost 12,000 full time personnel based on data from 351 of the 389 laboratories operating in the U.S. and budgets exceeding $1 billion. . Other results of note included the fact that controlled substances accounted for about half of all backlogged evidence, and backlogged evidence existed in all areas of examination, including biology screening and DNA analysis, firearms/toolmarks, and latent prints. The survey also documented laboratories' success in using computerized databases for fingerprint, firearms, and DNA information. Data showed that the case productivity of examiners varied widely across evidence areas; controlled substance examiners complete about ten times the requests that a DNA analyst would in a given year. The new survey also found that in order to achieve 30 day turnarounds of requests, crime laboratories would need an infusion of resources in many areas, including a 73% increase in DNA examiners, a 46% increase in firearms and toolmark examiners, and 43% increase in trace examiners. Outsourcing of testing is most prevalent in DNA casework and CODIS databasing samples, but is also being used to a lesser extent in the areas of toxicology and controlled substances testing.

Physical Evidence Filtering Process

Prior research (Peterson et al., 1984) has described the process in which physical evidence present at the scenes of crimes is filtered before it reaches the crime laboratory examiner's bench. This research identified six primary stages responsible for such screening:

The Criminal Offense and Its Report to Police

The level of interaction of the offender with the victim and/or crime scene environment is what produces the physical evidence in the first place. The Locard or 'exchange principle' (named after famed French criminalist Edmund Locard) posits that any time there is contact between a person and another person or physical object there is an exchange of physical evidence. The offender acquires physical evidence from the target and he/she leaves evidence behind on whomever or whatever he has had contact. Breaking and entering and violent struggles between the perpetrator and his victim produce the most physical evidence and crimes that are quick and involve little or no contact generate the least. The condition of crime scenes is an important factor, with indoor scenes and those committed in clean and orderly environments allowing investigators to distinguish the newly created evidence from the background environment. Crime committed in commercial establishments and public areas (sidewalks and roadways) pose special problems for preserving evidence and protecting its contamination.

The time elapsed from crime commission and its report to police, and the delay in police response to the scene, have long been considered factors not only in apprehending criminals but also in the preservation of scene evidence. With the passage of time, the likelihood increases that the evidence may be contaminated or destroyed by the victim, witnesses and passersby. The nature of offenses also contributes to the condition of the evidence as the seriousness of the offense and the availability of witnesses correlates with the speed with which the offense is reported. Homicides without witnesses and those committed in locations not immediately discovered may also be factors that hinder recovery. Crimes like sexual assaults that are often times not even reported to police or after lengthy periods of time lead to the destruction and contamination of evidence. Offenders may also take precautions to leave no physical evidence behind or to destroy/conceal that which they do.

Preliminary Report

The police officer taking the initial report is critical in the success that physical evidence is preserved and collected. Police training guides admonish patrol and detectives to protect crime scenes upon arrival and to prevent unauthorized persons from accessing the crime scene. The oftentimes fragile and transient nature of physical evidence allows it to be easily contaminated or destroyed through careless handling. Depending upon the crime and the jurisdiction, different practices are followed in mandating that patrol officers call for crime scene technicians and to remain at the scene until technicians arrive. The presence of victims and witnesses to crimes may assist the police in understanding what transpired and the location of key physical evidence. The decisions made by the first officers at the scene can help pinpoint available physical evidence, its protection, and its ultimate collection by trained crime scene search officers.

Follow-up Investigation

Not all crimes receive follow-up investigations. There are some offenses, like burglaries that may involve only a telephone call to police and the taking of a report over the telephone. The availability of witnesses and suspects at the outset of the investigation may be critical in the effort put forth by the police agency in investigating the crime. The collection and submission of evidence to the crime laboratory is a key indicator that police are making a concerted effort to solve the case. The police may employ various strategies in collecting information about the crime: follow-up interviews with victims and witnesses, canvassing of the neighborhood, vehicle descriptions and license plate checks, photographs and mugshots, informants, public and private records checks, and lineups and interrogations are among alternatives employed.

Crime Scene Search

As will be explained in more detail in the report, different agencies have various policies with respect to calling a crime scene specialist to the crime scene. Many policies are not explicit, however, and leave great latitude to the patrol officers and investigators. For homicides, trained crime scene investigators come to almost every scene. In rapes, it is usually the victim who transports herself to the appropriate hospital and at which a sexual assault nurse will examine the victim and administer a sexual assault rape kit. For routine burglaries, aggravated assaults and robberies, the speed and route the technician takes to the scene is dependent on many factors. The caseload of the technicians is important and not only influences the directness they take to the scene, but also the amount of time they may spend at any given scene.

Submission of Evidence to the Laboratory

Upon collection, physical evidence will be taken to the police department property storage area or to the crime laboratory directly. Evidence sometimes remains in the property room for brief or extended periods of time while the investigation is proceeding and sometimes until suspects are identified, standards are being sought, or a decision is being made whether to pursue or terminate the investigation. It is usually clear from the crime scene report submitted to the laboratory what types of scientific examinations are being sought.

Examination of Evidence and Report of Findings

As outlined at the outset of this chapter, the primary investigative reasons that evidence is submitted to the crime laboratory are the following:

Establishing an Element of the Crime – The laboratory identification of a material, such as a controlled substance in a drug possession case, semen in a sexual assault or a volatile liquid in an arson, may assist in satisfying a legal requirement for proving that a crime occurred. Autopsies at homicide scenes will determine the cause and manner of death and if the death was accidental, suicidal, or homicidal

Identification of a Suspect or Victim – Fingerprints or DNA testing are two good examples of forensic evidence that may identify an otherwise unknown offender. The presence of computerized databases greatly facilitate this process.

Associative Evidence – As discussed earlier under the heading of determining the common origin of substances, this type of scientific finding can help form an association or linkage between the offender and the crime scene or victim. Evidence may also dissociate the offender where evidence excludes the offender as the source of critical evidence.

Testing Statements and Alibis – Evidence may also test, verify or refute the statements of victims, suspects and witnesses.

Reconstruction – Noted previously, the physical evidence may help determine how a particular crime occurred or to reconstruct the movements of offenders, victims, or instruments of an offense. A powder pattern on the shirt of a victim may indicate the shooter-suspect was greater distance from the victim when the fatal shot was fired.

Corroboration – Physical evidence may also corroborate (or refute) the information that investigators gather from witnesses, suspects and victims. Many of the foregoing activities in this list may also serve to do the following.

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Chapter III

Research Methodology

NIJ established four goals in investigating the role and impact of forensic science evidence on the criminal justice process:

(1) Estimate the percentage of crime scenes from which one or more types of forensic evidence is collected;
(2) Describe and catalog the kinds of forensic evidence collected at crime scenes;
(3) Track the use and attrition of forensic evidence in the criminal justice system from crime scenes through laboratory analysis, and then through subsequent criminal justice processes; and
(**4)** Identify which forms of forensic evidence contribute most frequently (relative to their availability at a crime scene) to successful case outcomes.

To accomplish these goals, the study utilized a prospective analysis of official record data that followed criminal cases in five jurisdictions (Los Angeles County; Indianapolis, IN; Evansville, IN; Fort Wayne, IN; and South Bend, IN) from the time of police incident report to final criminal disposition. Sites were selected to represent city, county and state crime laboratory services.

Study Sites

The County of Los Angeles

The County of Los Angeles encompasses an area of 4,752 square miles, which includes 4,061 square miles of land and 691 square miles of water. The density of the County was an estimated 2,450 people per square mile in 2007. Los Angeles County is the most populous county in the United States, with an estimated 10,393,185 residents as of January 1, 2009. Approximately 29.2% of county inhabitants are White (Non-Hispanic/Non-Latino), 9.6% Black, 13.1% Asian, and 47.3% Hispanic or Latino. In 2007, 49.5% of the inhabitants were male and 50.5% were female. Additionally, the median age of county inhabitants was 34.5 years and 64.1% of the inhabitants (≥ 16 years of age) were in the labor force. In 2007, 14.6% of County inhabitants were below the poverty level, and the per capita income for the County was $25,759.

The County is governed by the Los Angeles County Board of Supervisors—a five-member board of elected officials with executive and legislative authority. The Board of Supervisors oversees the 22.5 billion dollar budget (2008) of the County, and governs the many County departments with the County's Chief Executive Officer. These departments include the District Attorney's Office, the Public Defender's Office, and the Sheriff's Department.

The Los Angeles County Sheriff's Department (LASD) is the largest Sheriff's Department in the world and the sixth largest law enforcement agency in the United States. The Sheriff of Los Angeles County is an elected 4 year position. The Department's jurisdiction covers 3,171 square miles, and over four million people directly served by the Department. LASD provides law enforcement services to 40 incorporated cities of the 88 cities in Los

Angeles County, in addition to 90 unincorporated communities and 9 community colleges. The Department also serves hundreds of thousands of daily commuters of the Metropolitan Transit Authority and the Rapid Rail Transit District. Moreover, the Department serves 58 Superior Courts and 600 bench officers, and manages the Nation's largest local jail system housing over 20,000 prisoners. LASD has an annual budget of 2.4 billion dollars. LASD has 8,400 sworn (700 reserve) and 7,600 civilian personnel. Law enforcement services are provided to the citizenry via 23 LASD patrol stations located throughout the county.

LASD is operationally organized into divisions: three patrol divisions (Field Operations Regions I, II and III), the Custody Operations Division, the Correctional Services Division, the Detective Division, the Court Services Division, the Technical Services Division, the Office of Homeland Security, the Administrative Services Division, and the Leadership and Training Division. The Divisions are further divided into Bureaus.

The LASD Scientific Services Bureau (SSB) Crime Laboratory is an ASCLD/LAB accredited county laboratory that provides forensic services to the LASD, local police departments, and other county, state, and federal agencies. The SSB is under the Technical Services Division of the Sheriff's Department. The main laboratory of the SSB is located at the Hertzberg-Davis Forensic Science Center on the campus of the California State University, Los Angeles. Five other laboratories are located throughout the county in the cities of Los Angeles, Downey, Lynwood, West Covina, and Lancaster. The SSB provides services in Controlled Substances (solid-dose and alcohol), Trace Evidence, Biology, Questioned Documents, Toxicology, Firearms/Toolmarks, Latent Prints, Polygraph, Crime Scene Investigation and Photography (crime scene and studio). The SSB is headed by an LASD Captain and staffed primarily with civilian personnel. Other sworn personnel occupy positions in management and the latent prints and firearm sections. As of March 21, 2006, the SSB had a staff of 123 testifying analysts and 92 support personnel, and an annual operating budget of approximately 16 million dollars. The SSB is recognized as one of the largest crime labs in the United States in terms of caseload and personnel. The SSB receives over 70,000 evidence submissions annually.

The City of Indianapolis

The city of Indianapolis is the largest of the four Indiana jurisdictions included in the NIJ sponsored Role and Impact of Forensic Science in the Criminal Justice Process study. A brief word is necessary in explaining the nature and jurisdictional limits of Indianapolis. Despite the fact the adoption of Unigov in the late 1960s, extended the jurisdictional limits of the city of Indianapolis to the entirety of surrounding Marion County (excluding pre-existing cities), law-enforcement agencies retained their original jurisdictions despite consolidation of most city-county agencies. In the year data were gathered for this study (2003), the Marion County Sheriff's Department patrolled sub-urban and unincorporated areas of the county and the Indianapolis Police Department (IPD) had responsibility for the territory within the old city limits. This remained the case until 2007 when these two principal law enforcement agencies were consolidated under the office of the Marion County Sheriff. Since the most recent consolidation, command of the Indianapolis Metropolitan Police Department moved under the office of the Mayor. For this study, however, data were collected for the former IPD service district, which possessed more traditional urban characteristics than the rest of the county.

In 2003, the Indianapolis Police Department budget was 106 million dollars, an increase of 7.5% from the previous year. Eighty-four million dollars were allocated to the department's 1,216 sworn officers and 379 civilian employees. The Department's territorial responsibility encompassed approximately 90 square miles and a population of 322,158 people. According to the 2000 census, 57% of that population was White, 38% Black, and 4% reporting Hispanic/Latino heritage. There was approximately one sworn officer for every 265 people living within the service district.

For the five categories of crime studied in this project, four had distinct central commands within the Indianapolis Police Department's structure. With minor exceptions, detectives within those commands were responsible for the investigations. Burglary was handled differently from district to district and without a centralized command. In 2003, crime in the vast majority of the studied categories reached a nadir from the time between 1998 and 2008. Each specific command responsible for the investigation of a particular crime followed a similar pattern in their investigations.

The organization involved in the investigation of criminal incidents in Indianapolis is the Indianapolis/Marion County Forensic Services Agency (IMCFSA). The IMCFSA shared responsibility with the Indianapolis Police Department for collecting crime scene evidence. Evidence technicians from the IMCFSA are typically dispatched to more severe crimes, and undergo far more extensive training than their counterparts under the police department's command. IMCFSA conducted all scientific analysis of collected physical evidence with two notable exceptions. Most of the fingerprint analysis was conducted within the Indianapolis Police Department's fingerprint unit. In addition, several cases of DNA analysis were outsourced to Orchid Cellmark Laboratories due to a growing backlog. In 2003, the agency had a budget of approximately $3 million with 52 full time employees. A specific discipline breakdown of forensic examiners for 2003 was unavailable. Since the time frame of the study, the IMCFSA has experienced significant growth in both staff and budget.

State/Regional Jurisdiction: Indiana

Indiana, this study's state/regional jurisdiction, provided us with the opportunity to track cases from three geographically-separated regions of Indiana into the Indiana State Police ("ISP") Crime Laboratory Division. The ISP Crime Laboratory Division consists of four regional laboratories, located in Evansville, Fort Wayne, Indianapolis, and Lowell, which together serve the entire State of Indiana. The Indianapolis lab was established in 1936 and the other labs were implemented beginning in 1977. The ISP Crime Laboratory Division labs became ASCLD accredited in 1991, the same year a DNA unit was established at the Indianapolis ISP lab. In 2003, the ISP Crime Laboratory Division had a staff of 145, of which over eighty-five percent were directly involved in collecting, maintaining, and analyzing evidence. Today, these labs employ over 176 employees, comprised of approximately 41 sworn officers and 135 civilians. ISP laboratory services are available to all law enforcement agencies statewide free of charge to the individual department.

In 2003, the ISP Crime Laboratory Division was organized into nine units, excluding evidence clerks, crime scene technicians, and administrative/management personnel. The units were: Crime Scene QA Unit, Polygraph Unit, Photography Unit, Drug Unit, Trace Unit, DNA Unit, Document Unit, Firearms Unit, and Fingerprint Unit. Today, the ISP Crime Laboratory Division is organized into five sections: Biology, Chemistry, Comparative Science, Crime Scene and Field Support, and Management and Administration. The Biology Section consists of Serology, DNA, and Combined DNA Index System (or "CODIS"). The Chemistry Section consists of the Drug Unit and Microanalysis Unit. The Comparative Science Section consists of the Firearms Unit (including Integrated Ballistics Identification System or "IBIS"), Latent Fingerprint Unit (including Automated Fingerprint Identification System or "AFIS"), Photography Unit, and Questioned Document Unit. The Crime Scene and Field Support Section consist of the Polygraph Unit and Crime Scene Investigators. The Management and Administration Section consists of administrative and support personnel.

With new facilities completed in 2007, the Indianapolis laboratory, at 75,000 square feet on three floors, is by far the largest, serving as the administrative headquarters, and providing the most comprehensive services. The laboratories in Evansville, Fort Wayne, and Lowell employ personnel who report directly to their unit leaders in Indianapolis. For example, a DNA analyst in Evansville reports to the head of the DNA Unit in Indianapolis; a firearms examiner in Lowell reports to the head of the Firearms Unit in Indianapolis. Not all of the units in the ISP Crime Laboratory Division have personnel working in the smaller laboratories, requiring the latter to send less commonly-submitted evidence, such as questioned documents, trace evidence, and arson- or explosive-related evidence, to Indianapolis for analysis. The smaller labs also look to the central lab for backlog/outsourcing coordination and support, as well as training.

Evansville

The ISP Evansville Regional Crime Laboratory serves approximately 21 local jurisdictions, the largest of which is the City of Evansville, the county seat of Vanderburgh County. With a population of 121,582 and a greater metropolitan population of 342,815, Evansville is the third largest city in Indiana and the largest city in southern Indiana. Evansville's southern border runs along the Ohio River, across from which is Henderson, Kentucky. The racial makeup of Evansville is 86.24% White, 10.92% African American, 0.21% Native American, 0.72% Asian, 0.05% Pacific Islander, 0.49% from other races, and 1.37% from two or more races. Evansville's population is 1.1% Hispanic of any race and 85.59% of its population is non-Hispanic white.

The ISP Evansville Regional Laboratory was established in March 1980. The laboratory provides services in ballistic imaging, forensic biology, drug analysis, firearms examination and latent print comparison. A DNA unit was created at the lab in January 1999, and the lab began casework in DNA the following year. Currently, the lab is staffed with 11 analysts consisting of 3 DNA analysts, 3 firearms analysts, 2 latent print analysts, and 3 drug chemists along with 1 manager, 1 secretary and 2 evidence clerks.

In 2003, the Evansville lab received 2,314 case submissions, including 222 ballistic imaging, 188 DNA, 1,578 drug, 89 firearms, 164 latent print, 68 trace, and 5 documents (trace

and document evidence were sent to Indianapolis). That year the Evansville lab completed 1,864 cases, including 223 ballistic imaging, 107 DNA, 1,236 drug, 75 firearms, and 223 latent print cases. The Evansville lab had a backlog of 1,767 cases, including 143 ballistic imaging, 132 DNA, 1,368 drug, 71 firearms, and 53 latent print cases.

By comparison, in 2006, the Evansville lab received 1,956 case submissions, including 184 ballistic imaging, 164 DNA, 1,191 drug, 96 firearms, and 321 latent print cases. The lab completed 2,102 cases, including 186 ballistic imaging, 161 DNA, 1,361 drug, 69 firearms, and 325 latent print cases. In 2006 the overall backlog dropped to 350 cases, including 75 ballistic imaging, 87 DNA, 12 drug, 106 firearms (an increase), and 70 latent print cases (an increase).

Fort Wayne

The ISP Fort Wayne Regional Crime Laboratory serves over 20 local jurisdictions in the northeastern sector of Indiana, the largest of which is the City of Fort Wayne which is the seat of Allen County. With an estimated population of 251,247 and a greater metropolitan population of 570,779, Fort Wayne is Indiana's second largest city after Indianapolis. The city is located in northeast Indiana, where the Maumee, St. Joseph and St. Mary rivers come together. The racial makeup of Fort Wayne is 75.45% White, 17.38% African American, 0.39% Native American, 1.56% Asian, 0.04% Pacific Islander, 2.91% from other races, and 2.26% from two or more races. Fort Wayne's population is 5.78% Hispanic or Latino.

The Fort Wayne lab provides services in ballistic imaging, forensic biology, drug analysis, firearms examination and latent print comparison. Prior to 1999, the lab did no DNA casework. In May 1999, the lab began doing extractions and quantitations on DNA cases before sending the cases to Indianapolis or Lowell for analysis. The lab began doing DNA casework in 2004 and in March 2005 began full DNA analysis on casework. Currently, the lab is staffed with eight analysts (2 DNA, 1 serologist (almost ready for DNA), 2 firearms/tool marks, 2 latent print and 1 drug chemist), 1 manager, 1 part-time secretary and 2 evidence clerks.

During the 2003-04 timeframe from which this study's case sample was taken, a significant amount of the Fort Wayne Police Department's evidence was not analyzed at the Fort Wayne lab, with the exception of drug evidence. As mentioned above, the Fort Wayne lab did no DNA casework until late 2004. It also had only one firearms examiner, who then left the lab in 2004, leaving the lab temporarily without that capability. Also, because FWPD had its own latent print examiners in-house, it did not use the Fort Wayne lab's latent print examination services.

In 2003, the Fort Wayne lab had 5,103 case submissions, including 737 ballistic imaging, 219 DNA, 3,886 drug, 87 firearms, 110 latent print, 50 trace, and 14 documents (trace and document evidence were sent to Indianapolis). That year the lab completed 3,628 cases, including 408 ballistic imaging, 216 DNA (serology only), 2,878 drug, 107 firearms, and 19 latent print cases. The Fort Wayne lab had a backlog of 1,884 cases, including 378 ballistic imaging, 23 DNA, 1,285 drug, 57 firearms, and 137 latent print cases.

By comparison, in 2006, the Fort Wayne lab had 4,000 case submissions, including 1,089 ballistic imaging, 97 DNA, 2,638 drug, 41 firearms, and 135 latent print cases. The lab

completed 4,632 cases, including 902 ballistic imaging, 106 DNA, 3,484 drug, 17 firearms, and 123 latent print cases. In 2006 the overall backlog dropped to 447 cases, including 239 ballistic imaging, 53 DNA (an increase), 21 drug, 44 firearms, and 90 latent print cases.

Lowell/South Bend

The ISP Lowell Regional Crime Laboratory serves over 16 local jurisdictions, including the City of South Bend, the seat of St. Joseph County. With a population of about 107,789 and a greater metropolitan population of 316,663, South Bend is the fourth largest city in Indiana. The city is in northern Indiana and sits on the southern most turn of the St. Joseph River, from which it derives its name. Once an industrial-based economy, South Bend now relies on education, health care and small business. Nearby University of Notre Dame is the largest employer in St. Joseph County. The racial makeup of South Bend is 56.05% White, 34.60% African American, 0.41% Native American, 1.20% Asian, 0.06% Pacific Islander, 4.87% from other races, and 2.80% from two or more races. Hispanic or Latino of any race makes up 8.45% of the population.

The ISP Lowell Regional Laboratory began operations in 1979. After Indianapolis, Lowell is the most established of the regional laboratories. The lab provides services in ballistic imaging, forensic biology, drug analysis, firearms examination and latent print comparison. In 1995, the ISP expanded its DNA unit to Lowell. The lab began doing DNA casework in July 1997.

In 2003, the Lowell lab received 4,737 case submissions, including 828 ballistic imaging, 530 DNA, 3,005 drug, 93 firearms, 221 latent print, 50 trace, and 10 documents (trace and document evidence were sent to Indianapolis). That year the lab completed 3,488 cases, including 746 ballistic imaging, 386 DNA, 2,063 drug, 124 firearms, and 169 latent print cases. The Lowell lab had a backlog of 3,331 cases, including 209 ballistic imaging, 250 DNA, 2,668 drug, 49 firearms, and 155 latent print cases.

By comparison, in 2006, the Lowell lab received 2,431 case submissions, including 351 ballistic imaging, 239 DNA, 1,522 drug, 72 firearms, and 247 latent print cases. The lab completed 3,184 cases, including 344 ballistic imaging, 296 DNA, 2,276 drug, 50 firearms, and 218 latent print cases. In 2006, the overall backlog dropped to 410 cases, including 54 ballistic imaging, 90 DNA, 91 drug, 80 firearms (an increase), and 95 latent print cases.

Sample Design

Data for the study analyses were based on a random sample of the population (see Table 1) of reported crime incidents for the year 2003, stratified by crime type and jurisdiction. Crime incidents for the year 2003 were used so that cases would have complete data, including final dispositions. Due to the relatively low numbers of homicides and rapes committed annually as well as the greater likelihood of forensic evidence for these two crimes, reported incidents for homicide and rape were over-sampled for Los Angeles and Indianapolis. All homicides and 50% of rape cases were selected for analysis.

Similarly, due to the lower number of crime incidents in the three smaller Indiana sites (Evansville, Fort Wayne and South Bend) as well as changes in data management systems in Evansville, additionally years were included in the sample selection process for these sites. Specifically, in Evansville, because of a change in data management systems, effective mid-September 2003, and due to the relatively low numbers of homicides and rapes committed annually, all homicides occurring from mid-September 2003 through December 2006 and all rapes occurring from mid-September 2003 through December 2005 were reviewed to achieve the desired sample size. Likewise, due to the change in data management systems, aggravated assault, burglary and robbery cases in Evansville were sampled from incidents occurring after September 2003 and during all of 2004. In Fort Wayne and South Bend, due to the relatively low numbers of homicides committed annually, all homicides occurring during 2003 and 2004 were reviewed to achieve the desired sample size.

Table 1. Reported Crime Incidents

	LA	Indianapolis	Evansville	Fort Wayne	South Bend
Assault	12,855	3,454	1,450	281	350
Burglary	15,106	5,030	2,224	2,188	1,716
Homicide	342	76	20	41	26
Rape	631	262	139	214	78
Robbery	5,544	1,951	317	354	324

Los Angeles & Indianapolis, 2003
Evansville: Assault, Burglary & Robbery 2003-2004; Homicide 2003-2006; Rape 2003–2005
Fort Wayne & South Bend: Assault, Burglary, Rape, & Robbery 2003; Homicide 2003-2004

Juvenile cases as well as cases with incomplete data were eliminated for analysis in all sites. The number of randomly selected cases by crime type and site is highlighted below (Table 2).

Table 2. Sample Size by Crime and Site

	Assault	Burglary	Homicide	Rape	Robbery	Total
Los Angeles	230	489	245	231	528	1723
Indianapolis	323	350	71	150	335	1229
Evansville	108	142	14	75	80	419
Fort Wayne	95	144	38	70	73	420
South Bend	103	138	32	76	65	414
Totals	859	1263	400	602	1081	4205

Study Variables & Measures

Descriptive and outcome data were collected from three sources: police incident and investigator reports, crime lab reports and prosecutor case files. A unique case identifier linked police incident and crime lab reports and for most crime incidents, connected the case with the prosecutors' database. For cases that could not be linked through the unique identifier number, suspect's name, race/ethnicity and birth date were used to connect the case with prosecutor data.

Various forensic variables were used for both descriptive and outcome analyses. These included: presence of crime scene evidence, laboratory submitted evidence and laboratory examined evidence; laboratory submitted and laboratory examined evidence (i.e. biological, latent prints, pattern evidence, firearms, natural and synthetic materials, generic objects, drugs); unique identification; and link suspect to crime scene and/or victim. It is important to note the types and quantities of physical evidence at crime scenes was determined by reviewing police reports describing evidence recognized and collected by various police personnel visiting the scene. There was no attempt to assess independently physical evidence at crime scenes that was present, but not collected.

The specific variables collected from each source are specified in Table 3.

Table 3. Key Study Variables

Variables	***Measures***
Forensic	
crime scene location(s)	specific locations (e.g., bar, car, park, house)
types of evidence & substrates collected at crime scene	each type coded 1= yes 0=no
types of evidence submitted to lab	each type coded 1= yes 0=no
types of evidence examined by lab	each type coded 1= yes 0=no
identification of evidence	positive, negative, inconclusive
individualization of evidence	unique, class/group, inconclusive
database entry	CODIS, NIBIN, AFIS
database hit	1=yes 0=no
link suspect to crime (i.e., places suspect at crime scene, indicates suspect on victim or on weapon)	1=yes 0=no
tangible evidence (i.e.,A physical item of evidence that, without scientific analysis, is of evidentiary value to the case) (e.g., stolen property, driver's license)	1=yes 0=no
Criminal Offense	
date of crime	date
date incident reported to police	date
date of arrest	date
time from incident to report	total # days
time from incident to arrest	total # days
victim sex	1= male 0-female
victim age	1= <20 2= 20-29 3= 30+
victim race/ethnicity	1=White 2=Black 3=Latino 4=Asian 5=other
suspect/offender sex	1= male 0-female
suspect/offender age	1= <20 2= 20-29 3= 30+
suspect/offender race/ethnicity	1=White 2=Black 3=Latino 4=Asian 5=other
number of eyewitness(es)	1=0 2=1 3=2+
victim report to police	1=yes 0=no
witness report to police	1=yes 0=no
victim/suspect relationship	dummy coded (1,0) intimate/family, friend/acquaintance, stranger
victim receipt of medical treatment	1=yes 0=no

Table 3 Continued. Key Study Variables

Variables	***Measures***
Crime Dispositions	
suspect arrest	1=yes 0=no
DA referral	1=yes 0=no
Case charged	1=yes 0=no
Case conviction	1=yes 0=no
Sentence type	1=incarceration 0=probation
Sentence length	total # of months
attorney type	1=public defender 0=private counsel
plea	1=plea 0=trial
suspect apprehended within 10 minutes of the crime	1=yes 0=no
type of arrest technique	1= direct (i.e., suspect surrender, suspect apprehended, suspect arrested in another case, police observation, suspect named, traffic stop, recovered property) 0= descriptive (i.e., vehicle description, citizen observation, photo ID, suspect description, line-up)
suspect crime history:	
# prior arrests	total number
# prior convictions	total number

Analytical Strategy

The metaphor of the funnel is popular in criminological discourse. It captures the perception that few suspected criminals are ultimately convicted, while the majority are diverted from the criminal justice system by discretionary decisions of victims, police officers, prosecutors, juries, and judges. The loss of subjects at each stage of criminal case processing can result in the inability to detect true statistical differences; that is, the loss of power (i.e., the ability to find a statistically significant difference when the null hypothesis is in fact false, in other words power is the ability to find a difference when a real difference exists). Consequently, all analyses for the present study are based on pooled data for each crime across the five sites. It is important to note that case outcomes exist within varying site-specific organizational structures. That is, important factors such as sentencing guidelines, police culture, prosecutorial attitudes toward various crimes, and other factors vary across sites but not within a site. Therefore, any pooled analysis where data from all five sites are evaluated in a single model would have to account for this clustering. Unfortunately, sufficient data on the jurisdictional contexts that might condition variation in dispositional outcomes were limited. Consequently, the analyses were only able to include three dummy coded variables for the sites (i.e., Los Angeles, Indianapolis and the combined outcomes for the three smaller Indiana sites- Evansville, Fort Wayne and South Bend).

Due to the nature of non-linearity, sample size calculation for logistic regression is complicated. However, Hsieh, Bloch, and Larsen (1998) developed a formula for the approximate size of the sample required for simple logistic regression by using formula for calculating sample size for comparing two means or for comparing two proportions. They then adjusted the sample size requirement for a multiple logistic regression by a variance inflation factor.[1] The current study used a R program written by Strecker (2009) that calculates the sample size required for data that will be analyzed by logistic regression. The program implements formulas by Hsieh, Bloch, and Larsen (1998). The power analysis results indicate that an average sample size of 122 would be necessary to achieve power of .8 at the 95% confidence interval. With the exception of the charge and conviction models for burglary, the sample size was sufficient for the regression analyses.

The study explored the effect of forensic evidence on five different case outcomes, including: (1) whether a reported crime incident resulted in an arrest, (2) whether a case arrest was referred to the DA (3) whether an arrested suspect(s) was formally charged, (4) whether a prosecuted defendant was convicted, and (5) sentence length for incarcerated offenders. As each of the first four outcomes is binary, these models used logistic regression analysis to model case the respective case outcomes. Sentence length was modeled using ordinary least squares regression.

With regard to the logistic regression models, the key outcome statistic is the odds ratio. The odds ratio is equal to $exp(B)$. If the odds ratio is 2.00, for example, this means that the probability that Y equals 1 is twice as likely as the value of X is increased one unit. An odds ratio of .5 indicates that Y=1 is half as likely with an increase of X by one unit (so there is a negative relationship between X and Y). An odds ratio of 1.0 indicates there is no relationship between X and Y. This odds ratio terminology makes most sense when dealing with a special case in which both X and Y are dichotomous. When they are both dichotomous, the odds ratio is the probability that Y is 1 when X is 1 *compared* to the probability that Y is 1 when X is 0. In the present study the overwhelming majority of predictors were measured as dichotomous variables (see Table 3).

The Correction of Selection Bias: The Heckman Estimator

Criminal justice case processing can be thought of as a multi-stage process, involving, first, a decision to arrest a suspect; second, if arrest is selected, a decision to refer the case to the prosecutor; next the decision to charge the case, and if charged, the conviction; and, finally, sentencing decisions. However, there are three problems with simply treating these decision

[1] The squared multiple correlation coefficient $p^2_{1.23...p}$, also known as R^2, is equal to the proportion of the variance of X_1 explained by the regression relationship with $X_{2...,}Xp$. The term $1/(1\text{-}p^2\ 1..23\ldots p)$ is referred to as a variance inflation factor (VIF). The required sample size for the multivariate case can also be approximated from the univariate case by inflating it with the same factor $1/(1\text{-}p^2\ 1..23\ldots p)$. Following the relationship of the variances, we have $n_p = n_1/(1\text{-}p^2\ 1..23\ldots p)$ where n_p and n_1 are the sample sizes required for a logistic regression model with p and 1 covariates, respectively. Hsieh, Bloch, and Larsen (1998) have demonstrated that the same VIF works well for binary covariates.

points as separate occurrences: (1) the phases of the case process are left disconnected, while in practice they are not; (2) the separate results make it difficult to reach summary judgments about the overall influence of explanatory variables; and (3) the parameter estimates for the separate analysis of each decision point will be biased (Heckman, 1979).

For example, the decision to refer a case to the DA results in a selected pool of offenders who have exceeded a threshold on the criteria that determine the choice of case referral. When such selection occurs, the decision to charge a case will be a function not only of the linear combination of regressors ordinarily considered, but also of what Heckman (1979) terms the "hazard rate," or risk of not being selected into the referral population, i.e., the risk of exceeding or not exceeding the threshold. Estimation procedures that fail to take into account the "hazard rate" will yield biased and inconsistent estimates of the structural coefficients (Berk, 1983).

To avoid these problems a procedure is required that provides information about the two decisions, referral and charging, but that also allows us to combine this information in a meaningful way. One type of correction for selection bias involves calculating the likelihood of reaching a particular stage of case processing (using a probit model), and then entering this likelihood as a control variable in the model predicting an outcome at the next possible stage of case processing (Heckman, 1979). In the present study, this two-stage procedure was followed by first estimating probit models predicting DA case referral (for all arrested suspects), formally filed charges (for all case referrals), prosecution (for defendants with formal charges), convictions (for fully prosecuted defendants), and sentence length (for convicted defendants), and then entering the likelihoods (i.e., inverse Mills ratio) calculated from these equations into the appropriate models.

The inverse Mills ratio represents the hazard rate, or the probability of exclusion for each observation conditional on being at risk and is a function not only of observed or measured variables that are included in the selection equation, but also of unobserved or unmeasured variables. These are captured through the error term or residual in the selection equation, and included through the non-linear function used to estimate the inverse Mills ratio. As a result, adding the inverse Mills ratio into the outcome equation introduces a term that attempts to capture both observed and unobserved variables that affect selection.

A common error in the Heckman approach, however, is a failure to properly correct for misestimated standard errors (Bushway, Johnson and Slocum, 2007). Because the data are censored, the variance estimates obtained tend to be smaller than the true population variance. This, in turn, produces underestimated standard errors in the second stage of the Heckman two-step model. Underestimated standard errors can lead to overstated statistical significance. As a result, researchers need to correct these standard errors using a consistent errors estimator, referred to as robust standard errors. In the current study, robust standard errors were used in all stage-two (i.e., outcome model) estimates.

Additionally, when the same predictors are used to model the selection process and substantive outcome, there will often be substantial correlation between the correction term and the included variables. The presence of serious multicollinearity is a common theme in papers that use the Heckman method, but one that is seldom addressed effectively. In the case under

study here, the concern is with the collinearity between one particular regressor (the inverse Mills ratio) and the other predictor variables. As explained by Belsley, Kuh & Welsch (1980), a sufficient condition for the presence of collinearity for any particular regressor is a high value of its variance inflation factor (VIF). The VIF provides an index that measures how much the variance of an estimated regression coefficient (the square of the estimate's standard deviation) is increased because of collinearity. There is no formal VIF value for determining presence of multicollinearity. Kutner (2004) suggests that VIF's that exceed 10 should be regarded as indicating multicollinearity but in weaker models, which is often the case in logistic regression, values above 2.5 may be a cause for concern (see Allison, 1999). The present study calculated the VIF's for each model across each of the five crimes. In each case, the VIF value between the correction factor and the respective predictor variables did not exceed 2.5.

Finally, since the dependent variables in the second stages are binary, a standard Heckman model would be inconsistent and biased. Therefore the study used a modified Heckman selection model. As in the original approach, it consists of two stages. While the original Heckman selection model employs a probit estimator in the selection equation and an ordinary least squares estimator in the second stage, the present study ran a probit estimator in stage one and logistic regression in stage two incorporating Lee's (1983) transformation technique.

Analytical Models

As discussed above, the Heckman two-stage correction estimate was used to analyze criminal justice outcomes. The first step used probit analyses to estimate selection into the respective processing stage (i.e., the selection models). Likelihood estimates (inverse Mills ratio) were subsequently used in the stage two logistic regression models (the substantive or outcome models) to correct for selection bias. The predictors used in each stage are outlined below.

Predictors for the Selection Models:

Arrest	Referral	Charged	Conviction
Witness reports	Witness reports	Witness reports	Witness reports
Victim reports	Victim reports	Victim reports	Victim reports
Intimate/family	Intimate/family	Intimate/family	Intimate/family
Friend/acquaintance	Friend/acquaintance	Friend/acquaintance	Friend/acquaintance
Crime scene evidence	Crime scene evidence	Crime scene evidence	Crime scene evidence
Time incident to report	Time incident to arrest	Time incident to arrest	Time incident to arrest
Victim male	Victim male	Victim male	Victim male
Suspect male	Suspect male	Suspect male	Suspect male
Victim teen	Victim teen	Victim teen	Victim teen
Victim young adult	Victim young adult	Victim young adult	Victim young adult
Victim black	Victim black	Victim young adult	Victim young adult
Victim Latino	Victim Latino	Victim Latino	Victim Latino
Suspect Black	Suspect Black	Suspect Black	Suspect Black
Suspect Latino	Suspect Latino	Suspect Latino	Suspect Latino

Predictors of Outcome Models:

Referral	Charged	Conviction	Sentence
Witness reports	Witness reports	Witness reports	Witness reports
Victim reports	Victim reports	Victim reports	Victim reports
Intimate/family	Intimate/family	Intimate/family	Intimate/family
Friend/acquaintance	Friend/acquaintance	Friend/acquaintance	Friend/acquaintance
Crime scene evidence	Crime scene evidence	Crime scene evidence	Crime scene evidence
Lab examined evidence	Lab examined evidence	Lab examined evidence	Lab examined evidence
Victim treatment	Victim treatment	Victim treatment	Victim treatment
Arrest within 10 min.	Arrest within 10 min	Arrest within 10 min	Arrest within 10 min
Direct arrest	Direct arrest	Direct arrest	Direct arrest
LA	LA	LA	LA
Indy	Indy	Indy	Indy
Correction factor (arrest)	Correction factor (referral)	Correction factor (charged)	gender*race/ethnicity interaction correction factor (conviction)

Comparison of National & NIJ Study Outcomes

To better anchor the case process outcomes found in the present study, national data on arrests and convictions, for the time period corresponding to the study, are provided in Table 4. It should be noted that percentages of arrests and convictions by crime vary over time. To this point, the percentage of homicide cases that have an arrest has dropped from 76.5% in 2004 to 63.6 in 2008. Furthermore, the lower percent of arrests for homicides found in the present study as compared to the national data can be attributed to the significantly lower rate of arrests in Los Angeles County (46% in 2003). In 2007, the Los Angeles percent of arrest for homicides declined to 41%.

Table 4. Criminal Justice Outcomes: Data for Arrests & Convictions

	% Arrests			% Convictions	
	U.S., 2004*	U.S., 2008*	NIJ Study	U.S. 2004	NIJ Study
Assault	44.0	54.9	49.4	11.1	20.5
Burglary	9.9	12.5	8.2	4.4	3.2
Homicide	76.5	63.5	55.5	52.0	34.5
Rape	23.0	40.4	45.0	12.9	11.1
Robbery	20.9	26.8	22.6	9.7	12.6

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Chapter IV

Aggravated Assault

The 859 aggravated assault incidents in the project database came from a random sampling within the five jurisdictions in this study (Table 5). The victims across all sites were typically male (69%) as were the offenders/suspects (86%). Victims and suspects were predominantly Black or Latino (62% and 69%, respectively). In terms of age, the majority of victims and suspects were less than 30 years old (58% and 73%, respectively). The majority (62%) of cases involved persons who knew one another before the offense took place with more than half (57%) of the assaults taking place in houses or apartments. Thus, it is logical to conclude that the majority of assaults in the sample were domestic in nature. Approximately half (52%) the assault victims received medical treatment for their injuries. Sixty-four percent of assaults had at least one witness but only one-third of the witnesses provided reports to the police. On the other hand, victims gave eyewitness descriptions to the police in a high percentage of cases (80%). Incidents were reported to police in an average of 1-2 days and the average time from incident to arrest was approximately 22 days.

Physical Evidence Collected, Submitted & Examined

With respect to the physical evidence, project staff used the data collection instrument (see Appendix 1) to record the types of physical evidence/substrates that were collected by police patrol officers, detectives and crime scene investigators. Table 6 identifies the array of evidence collected at crime scenes, submitted to and examined by crime labs. The data show that only 30% of assault incidents had physical evidence collected at the crime scenes. Firearms/Weapons evidence was the leading category of evidence collected with the evidence fairly equally distributed among guns, bullets and shell casings. It is important to note, that Firearms evidence may not only be material to the investigation and prosecution of the case, but is also an indicator of the *seriousness* of the offense. Other Weapons (mostly knives) were gathered in approximately 9% of the assault cases. Overall, Natural/Synthetic Materials and Generic Objects were the next two primary categories of evidence collected, in about 6% of incidents. Clothing was the principal Material collected and vehicles and home furnishings/materials (doors, flooring) were the principal Generic Object collected. Biological evidence (primarily blood) was collected in only 4% of assaults.

Physical evidence is not automatically submitted to forensic laboratories and may be held in a police property facility until the investigator wants the evidence examined. The percentage of cases with submitted evidence of some type drops from 30% (collected) to 12% (submitted). Again, Firearms/Weapons were the primary forms of evidence submitted to the labs. Table 6 also indicates the percentage of cases with evidence examined in the laboratory. Overall, only 9% of cases had evidence that was examined in labs but high proportions of submitted Firearms/Weapons (74%) and Drug (94%) evidence were examined.

Commonly the first step in a criminalistics examination of evidence is to identify and classify the evidence; that is, to determine what the substance is. Throughout this report the term *identification* means a determination of what the object is and possibly the class or subclass in

which it belongs. For example, the identification of a firearm may note that it is operational and capable of firing a projectile, or that it is a particular make, model and caliber. Latent print ridge patterns will be noted as *identifiable* (having sufficient features capable of being compared with a reference print of known source). A biological substance may be identified as blood, or semen, or of a particular genetic type. Suspected drug evidence may be identified as a particular class or type (cocaine, marijuana, etc.).

These identifications do not, however, connect that evidence to a particular source or origin. Identifications merely tell the investigator that the evidence and known are similar and might have shared a common source. A conclusion of common source is an *individualization,* or unique identification, where evidence is associated with its particular location of origin or source, at the exclusion of all other possibilities. A latent print is found to have originated from a particular person; a bullet or shell casing was fired from a particular weapon; a jimmy mark on a door jam was made by one specific tool, and a biological stain was found to have come from a particular person at the exclusion of all others. DNA testing has greatly enhanced the ability of crime laboratories to individualize Biological evidence. An *exclusion*, on the other hand, means that a particular item of evidence did *not* come from a specific source (bullet A was not fired from weapon B). Given the mass of unrelated physical materials in a crime scene location, attempts to determine the common origin of an item of evidence are often times unsuccessful, and the laboratory examination is *inconclusive*.

Examinations yielded 34 cases with identifications of evidence, most of them (21) involving firearms-related evidence. In terms of individualizations, there were 18 cases with firearms individualities and four other individualities involving Latent Prints. There was a total of 15 searches of the NIBIN database but only one (Indianapolis) resulted in a hit.

Tracking Cases through the Justice System

Figure 1 tracks the movement of assault cases through the justice process, controlling for the presence/absence of collected physical evidence. In the boxes are the percentages of incidents, with and without physical evidence, that reach a given stage of the justice process. The contrasts between rates of arrest with and without physical evidence are substantial and statistically significant (t=4.91, p=.000). The data also show significant differences for the movement of cases to higher decision levels. About 42% of cases with physical evidence were referred to the DA as compared to 33% of cases without physical evidence (t=2.75, p=.000)**.** Thirty-nine percent of cases with physical evidence were charged as compared to 27% without physical evidence (t=3.52, p=.000). Bivariate results also were significant at the conviction stage. Approximately 27% of cases with physical evidence resulted in a conviction compared to 18% for cases without physical evidence (t=2.91, p=.004). It is important to recognize, however, that only 48% of convictions with crime scene evidence actually had evidence that was examined in crime labs.

Table 5. Descriptive Characteristics of Assault Incidents (N=859)

Victim:	
% male	69.0
% < 20	25.0
% 20-29	33.3
% 30+	41.7
White	36.7
Black	50.3
Latino	12.3
Asian	1.5
Other	.1
Suspect:	
% male	86.4
% < 20	43.9
% 20-29	29.1
% 30+	26.0
White	29.9
Black	55.7
Latino	13.5
Asian	.8
Other	.1
Victim/Suspect Relationship:	
% intimate/family	37.1
% friend/acquaintance	24.9
% stranger	38.0
% victim received medical treatment	52.4
Crime Location:	
% car	3.4
% bar	5.5
% park	1.3
% school	.9
% retail store	2.8

Table 5 Continued. Descriptive Characteristics of Assault Incidents (N=859)

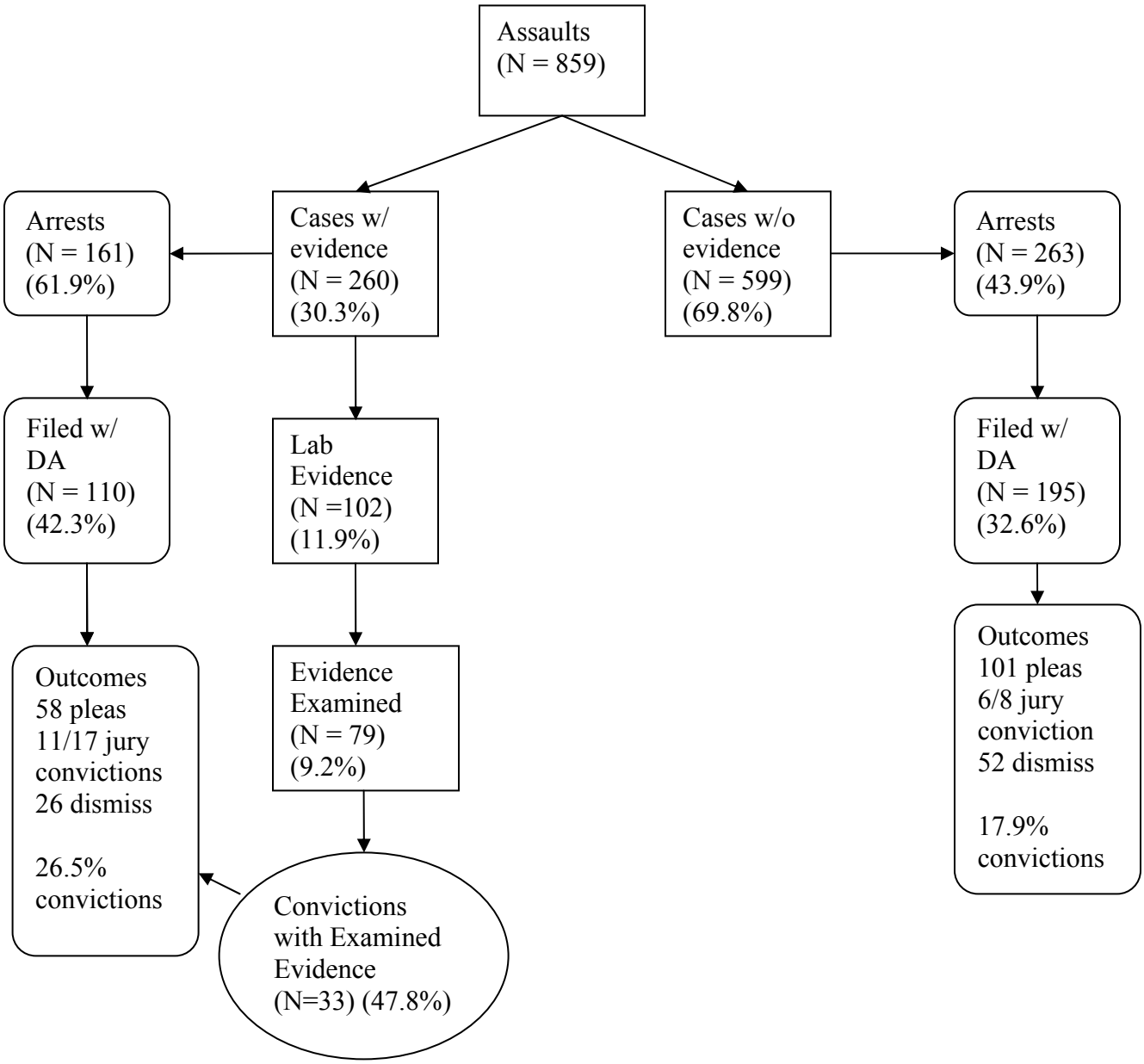
% house/apt.	56.8
% street	26.5
% other (e.g., hotel/motel, restaurant, hospital)	2.8
# of Witnesses:	
% 0	33.0
% 1	43.5
% 2+	23.5
% witness report to police	33.3
% victim report to police	79.7
% arrests	49.4
% DA referral	35.5
% charged	30.5
% convictions	20.5
% arrested within 10 minutes of incident	29.9
time from incident to police report (mean days)	1.37
time from incident to arrest (mean days)	21.57

Table 6. Crime Scene Evidence for Assault Cases

Evidence Type	N=	Collected		Submitted		Examined	
		n	%	n	%	n	%
Total	859	260	30.3%	102	11.9%	79	9.2%
Biological		34	4.0%	4	0.5%	4	0.5%
blood		30	3.5%	3	0.3%	2	0.2%
bite mark		1	0.12%	0	0.0%	0	0.0%
condom		1	0.1%	0	0.0%	0	0.0%
urine		0	0.0%	1	0.1%	1	0.1%
biological, other		1	0.1%	0	0.0%	0	0.0%
Latent Prints		10	1.2%	25	2.9%	22	2.6%
fingerprints		10	1.2%	25	2.9%	22	2.6%
Pattern Evidence		10	1.2%	0	0.0%	0	0.0%
blood pattern		3	0.3%	0	0.0%	0	0.0%
footprint		2	0.2%	0	0.0%	0	0.0%
footwear		2	0.2%	0	0.0%	0	0.0%
tools/marks		3	0.3%	0	0.0%	0	0.0%
Firearms/Weapons		192	22.4%	78	9.1%	58	6.8%
gun		52	6.1%	30	3.5%	23	2.7%
bullet		43	5.0%	24	2.8%	23	2.7%
casing		65	7.6%	43	5.0%	38	4.4%
cartridge		31	3.6%	14	1.6%	8	0.9%
GSR		1	0.1%	3	0.3%	1	0.1%
other weapons		75	8.7%	10	1.2%	3	0.3%
Natural/Synthetic Materials		49	5.7%	3	0.3%	2	0.2%
clothing		46	5.4%	0	0.0%	0	0.0%
bed/bath		1	0.1%	0	0.0%	0	0.0%
carpet		1	0.1%	0	0.0%	0	0.0%
pavement		3	0.3%	0	0.0%	0	0.0%
Generic Objects		49	5.7%	0	0.0%	0	0.0%
vehicle		23	2.7%	0	0.0%	0	0.0%
collision		4	0.5%	0	0.0%	0	0.0%

container	3	0.3%	0	0.0%	0	0.0%
floor	15	1.7%	0	0.0%	0	0.0%
door	7	0.8%	0	0.0%	0	0.0%
furniture	1	0.1%	0	0.0%	0	0.0%
Electronic/Printed Data	9	1.0%	1	0.1%	1	0.1%
documents	8	0.9%	1	0.1%	1	0.1%
electronics	1	0.1%	0	0.0%	0	0.0%
Trace	10	1.2%	2	0.2%	1	0.1%
explosives	1	0.1%	0	0.0%	0	0.0%
fire debris	1	0.1%	0	0.0%	0	0.0%
soil/dirt	1	0.1%	0	0.0%	0	0.0%
metal fragments	7	0.8%	2	0.2%	1	0.1%
glass	2	0.2%	0	0.0%	0	0.0%
plastic	2	0.2%	1	0.1%	1	0.1%
hair	1	0.1%	0	0.0%	0	0.0%
Drugs	18	2.1%	17	2.0%	16	1.9%
Other	6	0.7%	0	0.0%	0	0.0%

Figure 1. Flowchart of Forensic Evidence and Criminal Justice Outcomes for Assault Incidents



Predictors of Criminal Justice Outcomes

Arrest

The data in Table 7 reveal that availability of a victim's eyewitness account of the crime was an important predictor of arrest. Having this information available increased the odds of arrest by three-fold. In addition, intimates were twice as likely to be arrested compared to strangers. There were also significant differences across the study sites. Arrests were close to 9 times more likely in Los Angeles than in the smaller Indiana sites. Crime scene and lab examined evidence were both significant predictors of arrest, each increasing the odds of arrest by more than three times. More specifically, firearms evidence (both collected and examined) was the key type of evidence related to arrest outcomes. As mentioned earlier, the presence of firearms in assault cases adds to the seriousness of the offense and may merit more attention by the police and the justice process.

A number of extralegal factors also were related significantly to arrest. Arrests were more likely if the victims were White males or females, the victims were older (30+), and the suspects were Black or Latina females or male Latinos.

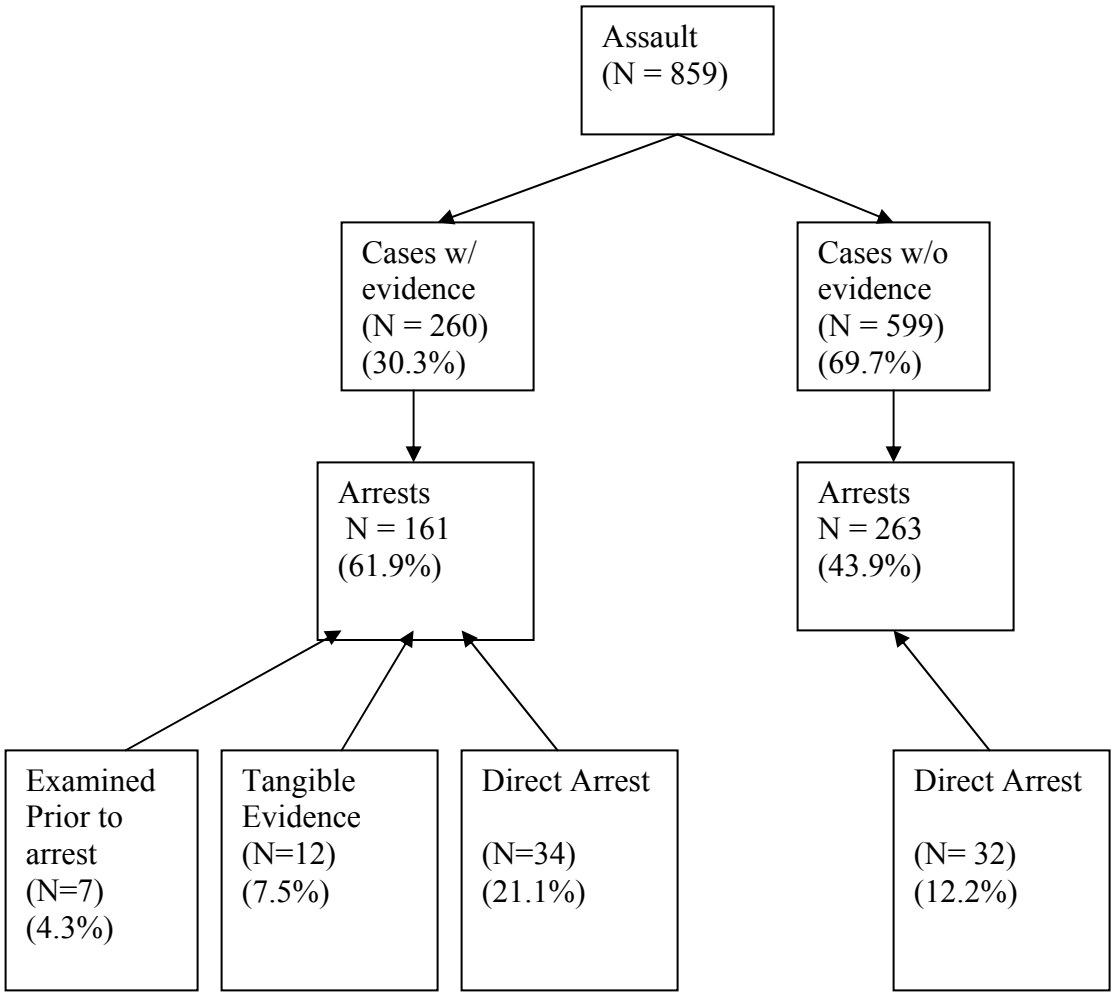
Why does the collection of physical evidence contribute to higher rates of arrest? The data compelled our researchers to explore this question across the crime categories, starting here with aggravated assaults. Establishing a predictive relationship between physical evidence at a crime scene and an arrest requires, first, that the police send the collected evidence to the lab for analysis and second, that the resulting analysis successfully links the suspect with the crime scene or victim. The study examined this time order relationship and found that evidence was actually examined *prior to arrest* in only 4.3% of cases (Figure 2). Consequently, why then is the presence of forensic evidence associated with higher arrest rates even if that evidence is not tested before an arrest is made? It may be that the collection of evidence is not exogenous and the likelihood of arrest may predict the presence of collectable evidence through some other mechanism. The study explored this possibility by differentiating scientific from tangible evidence, as well as assessing the circumstances of arrests. Tangible evidence is a physical item of evidence that, without scientific analysis, is of evidentiary value to the case (e.g., stolen property, driver's license). A "direct arrest" was operationalized as a suspect admission, suspect surrender, suspect arrested in another case, police observation of the crime, suspect named, traffic stop leading to an arrest, or recovery of property related to the crime incident. The data in Figure 2 indicate that an additional 7.5% of cases had tangible evidence that lead to an arrest. More importantly, 21% of arrests for cases with physical evidence were based on direct arrest techniques compared to 12% for cases without physical evidence. Thus, the combination of lab examined evidence, tangible evidence and direct arrest techniques could explain why the crime scene evidence variable was significant. In addition, other unobserved attributes of the offense or the offender (such as their criminal skill) also may be predictive of arrest but are distributed unequally between cases with and without evidence.

Table 7. Likelihood of Criminal Justice Outcomes for Assault

	ARREST		REFERRAL		CHARGES		CONVICTION	
	Estimate	Odds Ratio	Estimate	Odds Ratio	Estimate	Odds Ratio	Estimate	Odds Ratio
Witness Reports to Police	.224	1.25	.681	1.98**	-.086	.917	-.721	.486*
	(.165)		(.257)		(.378)		(.351)	
Victim Reports to Police	1.06	2.87***	.892	2.44**	1.08	2.93*	-1.41	.244
	(.218)		(.346)		(.517)		(.896)	
Intimate/Family	.642	1.90**	-.564	.569*	1.65	5.19*	-.754	.471
	(.199)		(.274)		(.519)		(.400)	
Friend/Acquaintance	.272	1.31	-.678	.508*	.568	1.77	-.505	.603
	(.215)		(.327)		(.573)		(.489)	
Crime Scene Evidence	1.24	3.45***	.100	1.11	.655	1.93	-.120	.887
	(.178)		(.273)		(.434)		(.380)	
Lab Examined Evidence	1.27	3.57***	.660	1.94	2.34	10.41*	.699	2.01
	(.281)		(.402)		(1.05)		(.531)	
Victim Medical Treatment			-1.64	.195**	-.123	.884	3.25	25.68***
			(.274)		(.554)		(1.07)	
Arrest within 10 Minutes of Crime Incident			-.094	.910	1.00	2.73**	-.012	.988
			(.241)		(.364)		(.353)	
Direct Arrest			-1.18	.306**	.	.	.701	2.02
			(.376)				(.638)	
Los Angeles	2.14	8.51***	.771	2.16	.	.	-.588	.555
	(.271)		(2.04)				(.959)	
Indianapolis	.625	1.87**	1.13	3.10	37.95	3.02***	-2.51	.082**
	(.186)		(.771)		(1.19)		(.834)	
Correction Factor			.347	1.42	.278	1.32	-.404	.667
			(.428)		(.584)		(.524)	
Naglekerke's R-square	.271		.205		.209		.287	

Correction (selection) variables control for the time from the incident to arrest, victim and suspect age, race/ethnicity and sex. All evidence categories were entered individually into each model. Robust Standard Errors are in parentheses. Stranger is the reference category for victim/suspect relationship. Pooled small Indiana sites (Evansville, Fort Wayne, South Bend) is the reference site category. (.) = constant or lack of correlation. * $p < .05$ ** $p < .01$ *** $p = .000$

Figure 2. Flowchart of Forensic Evidence and Arrest Outcomes for Assault Incidents



Direct Arrest = suspect admission, suspect surrender, suspect apprehended, suspect arrested in another case, police observation, suspect named, traffic stop, recovered property

Descriptive Arrest = vehicle description, citizen observation, photo ID, suspect description, line-up

Tangible Evidence = A physical item of evidence that, without scientific analysis, is of evidentiary value to the case (e.g., stolen property, driver's license)

Referral to DA

Cases with arrests were more likely to be referred to the DA if witnesses and victims provided descriptions of the offender and the suspects were not strangers (Table 7). Significant inverse relationships were found for victim medical treatment and direct arrest variables. Although these associations seem counterintuitive, a closer look at the data revealed that a statistically significant number of victims who received medical treatment and/or were arrested through direct techniques and whose cases were not referred to the DA had intimate relationships with the suspects. This highlights prosecutors' reluctance to proceed with assault cases where the victim and suspect have prior relationships.

Two extralegal factors also were significant. Cases involving White female suspects and White male victims were more likely to be referred to the DA.

Charging

The previously referenced Figure 1 highlights the funneling of cases through the justice system. The funneling begins with 49% of reported assault incidents resulting in arrest and continues to narrow after arrest. Although the majority of cases with an arrest were referred to the DA (71.9%), an additional 119 cases were filtered out post-arrest. Overall, only 35.5% of all assault incidents were referred to prosecutors. A very high percentage (85.9%) of cases that were referred to the prosecutor led to charges being filed. To a large extent this was due to the close supervision of cases by prosecutors in the Indiana sites. In these sites, the case selection process began with the criminal investigation and gathering of case information. Most cases were declined before referral to the DA and thus the remaining cases resulted in charges by the DA. In contrast, only 58.6% of cases referred to the Los Angeles DA resulted in charges. This lower rate is due to the fact that cases were screened within the DA's office post-referral rather than pre-referral as was the case in the Indiana sites. Overall, 42% of assault cases referred to the DA in Los Angeles were declined for prosecution. The final filtering process is conviction of a suspect. Across sites, 57.7% of assault cases referred to the DA resulted in a conviction. However, only 20.5% of all reported incidents resulted in a conviction.

The logistic regression results in Table 7 show that non-forensic variables- victim reports to the police, intimate relations between victim and suspect and being arrested within ten minutes of the incident- were significant predictors of charging. In addition, cases were more likely to be charged in Indianapolis than the smaller Indiana sites. With regard to forensic variables, cases with laboratory examined evidence were 10 times more likely to be charged. Unfortunately, records data were not available for the date/time that a case was charged. Thus, the time order between lab examination and charging could not be determined. Often evidence is not examined until the prosecutor charges the case. In this circumstance, charging is actually predictive of the examination of evidence. On the other hand, there certainly are cases where examined evidence leads to prosecutorial charging. Nonetheless, study data revealed that in only one assault case physical evidence actually linked the suspect to the victim, crime scene or weapon.

In addition, charges were more likely if the victims were White males or females and the suspect was a White male.

Conviction

Overall, 20.5% of all reported incidents resulted in a conviction. The data in Table 7 indicate that three variables were significant predictors of conviction. Interestingly, cases with witness reports were less likely to result in convictions as were cases from Indianapolis. The one positive predictor of conviction was victim medical treatment. This variable can be viewed as an indicator of the seriousness of the crime as well as providing credibility to victims' reports of the incidents. Overall, 33 of the 176 case convictions (18.8%) had forensic evidence examined in crime labs. One-third of the lab examined convictions has biological evidence, 27.3% had latent prints and 42.4% had firearms evidence.

None of the extralegal variables were significant predictors of conviction.

Plea/Trial

Few criminal cases were adjudicated through trial. In fact, approximately 90% of case convictions were obtained through pleas. Although television has popularized the idea that plea bargains are made in exchange for information, in reality, the large majority of plea bargains are done to save resources. Miceli (2007) and Fisher (2000) pointed out that because of severe budgetary pressure on prosecutors, this method of resolving cases is viewed as an essential tool for managing large caseloads. Plea bargaining saves money by reducing the time spent in court by both prosecutors and judges. Court time is often seen as the most significant constraint to a smoothly functioning legal system. Empirical evidence, dating as early as Alschuler (1968), revealed that plea bargaining became more prevalent as these types of constraints became more binding.

In line with the above comments, a high percentage of dispositions of assault cases with collected physical evidence were through pleas (58/75 or 77.3%). An even higher percentage of prosecutions without physical evidence were resolved through pleas (101/109 or 92.7%). Bivariate data show that the presence of physical evidence in a case increased significantly the likelihood that the case would be resolved through trial ($t=2.83$, $p=.005$). However, lab examined evidence did not differentiate plea from trial dispositions. Furthermore, forensic evidence variables were not significant predictors of plea/trial in a logistic regression analysis (not shown).

Sentencing

Perhaps the most relevant question is: does having forensic evidence contribute to sentence length? This question was examined through multiple linear regression analysis (Table 8). The model not only included variables used in the prior outcome models but also included measures of attorney type, plea vs. trial and interactions between gender and race/ethnicity. In addition, the results are based only on sentences of incarceration. The results indicate that cases with laboratory examined evidence significantly increased sentence length. In addition, cases with witness reports increased sentence length. Male Latinos were also more likely to receive longer sentences compared to male White offenders.

Hard To Solve Cases (stranger and no witnesses)

Across all five sites there were 198 "hard to solve" cases with no known relationship between assailant and victim and no witness to the crime. There was physical evidence collected in 28.3% of these cases, 12.6% had evidence submitted to the labs and 9.6% had evidence actually examined in the labs. Of the 198 cases, 33.3% had arrests and 22.7% were referred to the DA. In total, 15.7% of the hard to solve cases resulted in convictions. Of the 31 convictions, 6 (19.4%) cases had lab examined evidence. Not surprisingly, significantly fewer hard to solve cases resulted in arrests and convictions compared to all other cases. The arrest and conviction rates for non-hard to solve cases were 54.2% and 21.9%, respectively. However, the percent of convictions with lab examined evidence (18.6%) was not significantly different from the hard to solve cases (19.4%).

Discussion

A number of the findings merit comment. The results of the multivariate analyses tend to be consistent with previous research. With regard to arrest, previous studies of arrest decisions indicate that the seriousness of the crime, a victim injury, the presence of witnesses, or victim and suspect demographic characteristics improve the likelihood of case clearance. For instance, D'Alessio and Stolzenberg (2003) and Stolzenberg, D'Alessio & Eitle (2004) found that violent incidents between intimate partners and seriously injured victims significantly increased the likelihood of crime clearance. In addition, similar to the present results, the above studies found that the effects of victim's gender and race/ethnicity on odds of clearance were not statistically significant. The tracking of assault cases through the justice process, controlling for the presence/absence of collected physical evidence, revealed statistically significant differences at the arrest, prosecutor referral, charging, and conviction levels. Employing logistic regression analysis, collected and examined crime scene evidence were also significant predictors of arrest, particularly when collected in combination with tangible evidence and where arrests were 'direct' (see discussion and table on pages 58 and 60.)

The study results concerning the decisions to refer and charge a case also are consistent with previous research demonstrating that prosecutors attempt to avoid uncertainty by accepting and filing charges in cases where the likelihood of conviction is good, and by rejecting cases where conviction seems unlikely. The fact that 91% of prosecuted cases resulted in a conviction supports this observation. It also is confirmed by the findings regarding the predictors of referral and charging decisions. In a substantial number of cases, the decision to reject charges could be traced to the victim's refusal to cooperate in the prosecution of the case. In other words, the odds of conviction were low (or nonexistent), not because the prosecutor had insufficient evidence of the crime, but because an uncommitted or unavailable victim might not be willing to testify, making it impossible to proceed with the case. On the other hand, the likelihood of referring and charging a case increased with the participation of the victims. Prosecutors are also constrained by limited manpower and resources, which encourages them to screen cases carefully. They decline a large percentage of cases and do so for many reasons. In the current environment, however, there is clearly no upside to taking cases where the outcome appeared to be uncertain.

Overall, these findings support the notion that the prosecutor does "control the doors to the courthouse" (Neubauer 1988:200).

Table 8. Predictors of Sentence Length for Assault Convictions

	B	*S.E.*	*Sig.*
Witness reports	**21.22**	**9.90**	**.036**
Victim reports	14.39	17.54	.415
Intimate	6.89	11.77	.560
Acquaintance	14.98	12.26	.226
Suspect arrested within 10 minutes of incident	-8.17	9.85	.410
Victim medical treatment	19.12	12.77	.139
Public defender	4.11	7.40	.581
Plea bargain	-4.69	15.09	.757
# prior arrests	.291	.555	.602
# prior convictions	-.280	1.10	.800
Lab examined evidence	**51.99**	**11.38**	**.000**
Indianapolis	7.06	12.70	.580
Victim teen	-9.21	12.70	.471
Victim young adult	15.11	9.95	.134
Victim black male	-2.63	14.58	.857
Victim black female	9.98	13.70	.469
Suspect black male	-1.07	11.14	.924
Suspect Latino	**230.33**	**44.00**	**.000**
Suspect black female	17.16	18.51	.357
R^2	.573		
Mean sentence (months)	29.67		
Median sentence (months)	12.00		

The majority of research on sentencing finds that legally-relevant factors play a dominant role in explaining these decisions. For example, sentences are likely to be more severe when offense seriousness increases (Kramer & Steffensmeier, 1993; Steffensmeier, Ulmer, & Kramer, 1998), when the offender has a prior record (Kramer & Steffensmeier, 1993; Spohn & Welch, 1987; Steffensmeier et al., 1998), or if the offense involves a firearm or is between strangers (Crawford, Chiricos, & Kleck, 1998; Kramer & Steffensmeier, 1993; Steffensmeier et al., 1998). Even so, extralegal variables continue to exert direct and indirect influences on sentencing after legally-relevant case characteristics have been properly controlled (Spohn, 2000).

Regarding the victim's demographic characteristics, the findings did show support for the claims made by conflict theorists (Quinney, 1977; Turk, 1969) and Black (1976) that police are less likely to put investigative effort into cases whose victims are in weaker social positions. Thus, crime incidents with younger, female, and ethnic minority victims should be less likely to clear. In the present study, cases with White females and older victims increased the odds of arrest. Differences in clearance by victim characteristics could indicate differences in victim cooperation with investigators, not just police willingness and investigative effort. Perhaps White victims are more willing to cooperate with police than any other racial group. Cases with White victims also were more likely to be charged but, contrary to the conflict theory argument, White suspects were more likely to be charged than minority suspects.

Research shows inconsistent effects of race on sentencing. Early studies found that race had little substantive impact on sentencing (Hagan, 1974; Kleck, 1981); more recent investigations (Chiricos & Crawford, 1995; Spohn, 2000; Spohn & Holleran, 2000; Zatz, 2000) have concluded that race and ethnicity do influence sentencing outcomes. Current research examining the effects of race/ethnicity on sentencing finds that combining race/ethnicity with other extralegal factors (e.g., gender) results in greater sanction disparity than when only race/ethnicity are considered. These extralegal factors interact with race/ethnicity so that Black and Latino offenders are sanctioned more severely (Spohn & Holleran, 2000).

The findings of the current study show mixed support for previous results on sentencing. Study results do support the perspective that legally relevant variables play a key role in explaining sentencing decisions. Witness reports and lab examined forensic evidence were the primary predictors of sentence length. In this regard, the current study support prior research by Peterson et al. that found forensic evidence predictive of sentence length. In addition, the current data support the findings of previous literature that sentence disparities are greater for male minority defendants. In the present case, male Latinos received longer sentences than male White defendants.

Finally, however, the study results on sentencing for assaults were contrary to previous studies that have shown that prior record, type of attorney, convictions by trial, and victim’s and suspect’s age are significant predictors of sentence length.

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Chapter V

Burglary

With a total of 1,263 randomly selected incident files, burglary comprises the largest section of the database. The data in Table 9 show that approximately 52% of the victims and 85% of the suspects were male, respectively. The majority of victims (54%) were White but only 41% of suspects were White. Two-thirds of victims were 30 or older. Suspects, on the other hand, were much younger, 63.5% were less than 30 years of age. Burglars seldom knew their victims; in 81% of burglary incidents, the victims and suspects were strangers.

Victims of burglary almost never required medical treatment, and the overwhelming majority (99%) of incidents were committed in houses or apartments. Burglary is a crime of stealth where 95% of cases had no witnesses and where a witness description report to police occurred in only 5% of incidents. Victims supplied eyewitness reports to police in about the same low percent (7%) of cases. These characteristics explain, in large part, the low rates of case solution and arrest for burglaries. Only 8% of incidents had an arrest. When arrests were made, apprehensions occurred within 10 minutes of the crime's report to police in 30% of cases. The average time from incident to arrest was 35.6 days. The conviction rate for burglary incidents was extremely low (3%).

Physical Evidence Collected, Submitted and Examined

Burglary represents that crime category where the least amounts of physical evidence and substrates were collected. Physical evidence was gathered in 20% of crime scenes (Table 10). Latent finger and palm prints, or various Materials and Generic Objects upon which Latent Prints might be developed were, by far, the types of physical evidence collected most frequently. Biological evidence at burglary scenes was collected only in 1% of cases.

Latent Prints, again, was the dominant form of evidence submitted to crime labs (12.4%). In fact, a large percentage of cases with latent prints submitted these prints to crime labs (75.5%). The data in Table 10 show that there was substantial filtering of other forms physical evidence. There was a large reduction in the submission of Generic Objects and Materials collected from the scenes of burglaries, the bulk of Biological evidence and Pattern evidence was not submitted for analysis, and all Electronic/Printed Data and Trace evidence was filtered out. In sum, the form of physical evidence submitted for scientific evaluation in burglaries was overwhelmingly Latent Prints.

As discussed in the prior chapter on aggravated assaults, the work of the forensic laboratory has the primary objective of identifying and individualizing organic and inorganic substances and materials. In the process, the laboratory seeks to reconstruct crimes and to associate (and dissociate) offenders with crime scenes and victims. Table 10 shows that

Table 9 . Descriptive Characteristics of Burglary Incidents (N=1263)

Victim:	
% male	51.7
% < 20	7.4
% 20-29	26.0
% 30+	66.6
White	54.0
Black	26.9
Latino	13.8
Asian	4.3
Other	1.0
Suspect:	
% male	85.0
% < 20	24.2
% 20-29	39.3
% 30+	36.5
White	41.4
Black	43.9
Latino	13.3
Asian	1.4
Victim/Suspect Relationship:	
% intimate/family	7.5
% friend/acquaintance	11.2
% stranger	81.3
% victim received medical treatment	.6
Crime Location:	
% car	.2
% bar	.2

Table 9 Continued. Descriptive Characteristics of Burglary Incidents (N=1263)

% school	.2
% retail store	.2
% house/apt.	98.9
% street	26.5
% other (e.g., hotel/motel, restaurant, hospital)	.3
# of Witnesses:	
% 0	95.3
% 1	3.5
% 2+	1.2
% witness report to police	4.7
% victim report to police	7.5
% arrests	8.2
% DA referral	4.7
% charged	3.7
% convictions	3.2
% arrested within 10 minutes of incident	29.9
time from incident to police report (mean days)	3.65
time from incident to arrest (mean days)	35.62

Table 10. Crime Scene Evidence for Burglary Cases

Evidence Type	N=	Collected		Submitted		Examined	
Total	1263	247	19.6%	164	13.0%	118	9.2%
Biological		13	1.0%	4	0.3%	4	0.3%
blood		8	0.6%	3	0.2%	3	0.2%
saliva		3	0.24%	1	0.1%	1	0.1%
biological, other		2	0.2%	0	0.0%	0	0.0%
Latent Prints		208	16.5%	157	12.4%	113	8.9%
fingerprints		204	16.2%	154	12.2%	110	8.7%
palm prints		7	0.6%	4	0.3%	4	0.3%
Pattern Evidence		14	1.1%	1	0.1%	0	0.0%
footprint		5	0.4%	0	0.0%	0	0.0%
footwear		2	0.2%	0	0.0%	0	0.0%
tire prints		1	0.1%	1	0.1%	0	0.0%
tools/marks		8	0.6%	0	0.0%	0	0.0%
Firearms/Weapons		5	0.4%	1	0.1%	1	0.1%
gun		1	0.1%	1	0.1%	1	0.1%
bullet		1	0.1%	0	0.0%	0	0.0%
casing		1	0.1%	0	0.0%	0	0.0%
other weapons		3	0.2%	0	0.0%	0	0.0%
Natural/Synthetic Materials		7	0.6%	1	0.1%	1	0.1%
clothing		5	0.4%	1	0.1%	1	0.1%
carpet		4	0.3%	0	0.0%	0	0.0%
fabric		1	0.1%	0	0.0%	0	0.0%
Generic Objects		78	6.2%	2	0.2%	1	0.1%
vehicle		5	0.4%	1	0.1%	0	0.0%
container		6	0.5%	1	0.1%	1	0.1%
floor		3	0.2%	0	0.0%	0	0.0%
door		18	1.4%	0	0.0%	0	0.0%
furniture		5	0.4%	0	0.0%	0	0.0%
window		39	3.1%	0	0.0%	0	0.0%
appliances		6	0.5%	0	0.0%	0	0.0%
sink		1	0.1%	0	0.0%	0	0.0%

Electronic/Printed Data	15	1.2%	0	0.0%	0	0.0%
documents	8	0.6%	0	0.0%	0	0.0%
computer	2	0.2%	0	0.0%	0	0.0%
electronics	6	0.5%	0	0.0%	0	0.0%
Trace	22	1.7%	2	0.2 %	2	0.2%
wood	1	0.1%	0	0.0%	0	0.0%
soil/dirt	1	0.1%	0	0.0%	0	0.0%
metal fragments	2	0.2%	0	0.0%	0	0.0%
glass	5	0.4%	0	0.0%	0	0.0%
plastic	5	0.4%	0	0.0%	0	0.0%
cigarette butt	2	0.2%	0	0.0%	0	0.0%
paper	5	0.4%	2	0.2%	2	0.2%
fibers	1	0.1%	0	0.0%	0	0.0%
Drugs	5	0.4%	2	0.2%	2	0.2%
Other	15	1.2%	0	0.0%	0	0.0%

9.2% of burglaries had evidence examined in labs. However, 72% of cases with lab submitted evidence were examined in crime labs. Most of this evidence was latent fingerprints.

Examinations in the various crime laboratories yielded 66 cases with one or more identifiable Latent Prints, two cases with confirmed controlled substances, and one with identified blood. Subsequent examinations yielded 52 cases with individualized latent finger or palm prints, six with excluded Latent Prints, one case with an individualized bloodstain, and one with individualized clothing. Latent Print evidence also was entered into respective AFIS systems and, based on 63 inquiries, obtained nine hits for a success rate of about 14%. There also was one NIBIN inquiry (firearms evidence) but it did not produce a hit.

Tracking Cases through the Justice System

To determine if and how the presence or absence of physical evidence could be associated with the movement of cases through important decision points, data collectors tracked cases starting with the incident report. For the vast majority of burglaries, however, a minimal incident report was the only document in the case file. Figure 3 shows the movement of burglary offenses through the justice process. In total, the sample included 1,263 burglary incidents, of which 19.6% had evidence collected at crime scenes. The contrast between rates of arrest, referral to DA, charged cases, and convictions for cases with and without physical evidence were all statistically significant (p=.000). Similar to the aggravated assault data, approximately half (47.4%) of the convictions for cases with physical evidence actually had the evidence examined in labs.

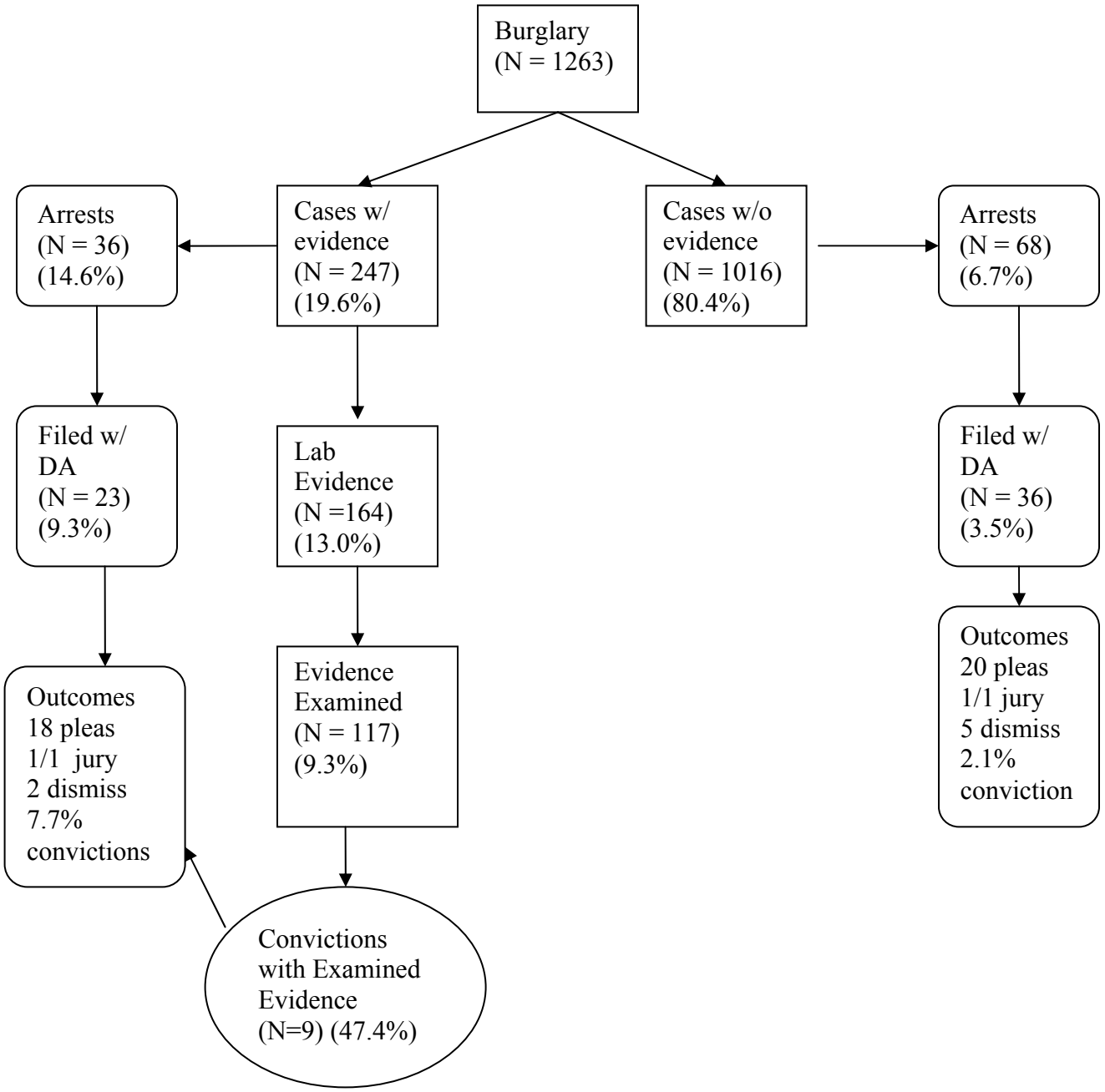
Predictors of Criminal Justice Outcomes

Arrest

Arrests for burglary were more likely if the case had witness reports of the crime to the police, occurred among intimates/family members and had physical evidence collected at the crime scene. Although witness reports were the strongest predictor of arrest (odds ratio = 5.16), few cases (5%) actually had witnesses. Even though most burglaries were committed by strangers, in the few cases where the burglar was an intimate/family member the odds of arrest increased significantly. The presence of collected crime scene evidence increased the odds for arrest more than three-fold (3.41). In addition, arrest for burglary was more likely to occur in Los Angeles compared to the smaller Indiana sites. Finally, female Black suspects were more likely to be arrested than their White counterparts.

As with the prior chapter on Aggravated Assault, researchers were very interested in explaining why the collection of physical evidence was associated with higher rates of arrests even after controlling for other variables. Unlike the results for assault cases, approximately 28% of arrests with physical evidence were examined prior to arrest (Figure 4). An additional 14% of arrests with physical evidence were the result of tangible evidence. There was no difference in the arrest techniques employed between cases with and without evidence. Thus, 42% of arrests for cases with evidence can be attributed to examination of, or leads provided by, the evidence.

Figure 3. Flowchart of Forensic Evidence and Criminal Justice Outcomes for Burglary Incidents



Referrals to DA

The primary significant variable predicting referral was intimate/family relationships. Cases in which the victim and suspect had an intimate or family relationship were significantly less likely to be referred to the DA than stranger cases (odds ratio = .198). Also, cases with Black male suspects were more likely to be referred to the DA (not shown).

Charging

There were no significant predictors of case charging. This may be to due to the small number of cases charged (N= 47), thus resulting in poor power to detect significant differences.

Conviction

The only significant predictor of conviction was the arrest of the suspect within 10 minutes of the crime incident. Overall there were 40 convictions, 3.2% of all cases. However, of the cases charged, the conviction rate was 85.1%. The rate of conviction was 3 ½ times greater for cases with physical evidence (7.7%) than those without evidence (2.1%). Only 9 cases had evidence examined in crime labs. Physical evidence (all latent prints) *linked* the suspect/offender to the crime scene in a total of 18 cases. Arrests were made in five (27.8%) of those cases, compared with an arrest rate of 5.6% for cases without physical evidence collected. The linking evidence had no value at the level of adjudication, however, as none of the cases resulted in convictions.

Plea/Trial

Overall, 95% of convictions were resolved through a plea. Given the high rate of plea outcomes, it was not surprising that physical evidence had little effect in explaining variance in the mode of case disposition.

Sentencing

Table 12 displays the multiple linear regression results for sentences (incarceration only) for the burglary. Cases resolved through plea bargains received significantly shorter sentences. As highlighted in the previous section, however, only two convictions were through jury trials. Offenders who had public defenders received shorter sentences than cases with private counsel. In addition, young adults (ages 20-29) received longer sentences compared to older adults (30+). Overall, the average sentence length was 56.6 months, and the median was 34.0 months.

Hard To Solve Cases (stranger and no witnesses)

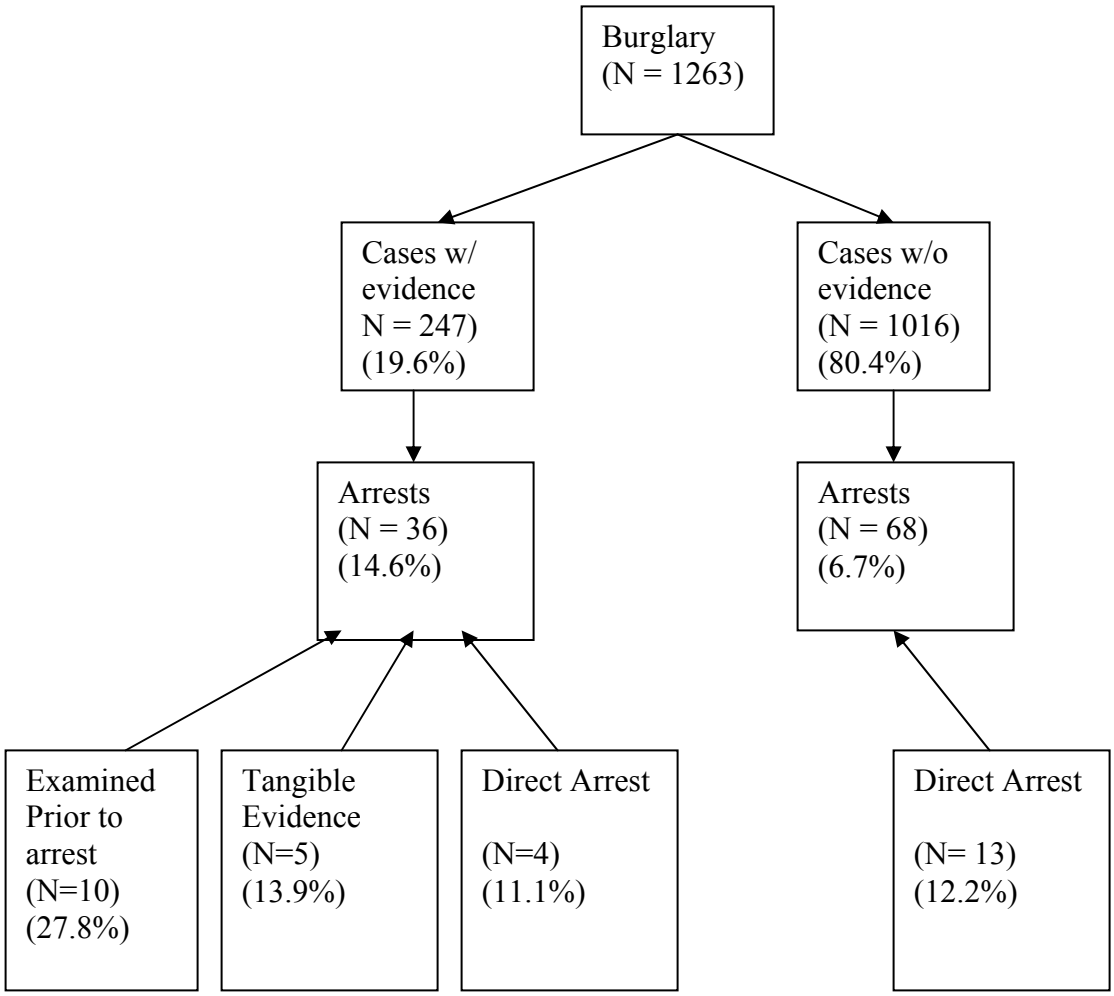
The overwhelming majority (84.6%) of burglary incidents had no witnesses and the suspects were strangers. Not surprisingly, there were significantly fewer arrests (3.8%) for hard cases" compared to other cases (32.5%). Similarly, the conviction rate for "hard cases" (4.0%) was significantly lower than other cases (18.8%). There was no statistical difference between case types with regard to lab examined evidence (9.4% of "hard cases" and 8.2% of other cases).

Table 11. Likelihood of Criminal Justice Outcomes for Burglary

	ARREST		REFERRAL		CHARGES		CONVICTION	
	Estimate	Odds Ratio	Estimate	Odds Ratio	Estimate	Odds Ratio	Estimate	Odds Ratio
Witness Reports to Police	1.64	5.16***	-.290	.748	.740	2.10	-.346	.708
	(.329)		(.784)		(1.17)		(1.23)	
Victim Reports to Police	.265	1.30	.069	1.07	-.410	.664	.	.
	(.326)		(.611)		(.988)			
Intimate/Family	1.23	3.42**	-1.66	.189*	-1.08	.340	-1.11	.330
	(.390)		(.778)		(.952)		(1.42)	
Friend/Acquaintance	.575	1.78	-.662	.516	-.312	.732	-.969	.379
	(.348)		(.679)		(1.04)		(1.01)	
Crime Scene Evidence	1.23	3.41***	.351	1.42	.089	1.09	1.06	2.87
	(.333)		(.558)		(.970)		(1.46)	
Lab Examined Evidence	.602	1.83	.543	1.72	-.206	.814	.139	1.15
	(.465)		(.673)		(.998)		(1.15)	
Arrest within 10 Minutes of Crime Incident			.593	1.81	1.61	5.00	2.29	9.83*
			(.534)		(1.01)		(1.19)	
Los Angeles	1.06	2.88*	.863	2.37	-.313	.119	.	.
	(.450)		(.597)		(3.02)			
Indianapolis	-.515	.598	.583	1.79	40.23	2.96	.	.
	(.411)		(.801)		(6.22)			
Correction Factor			-.512	.599	.663	1.94	.553	1.74
			(.740)		(1.06)		(1.08)	
Naglekerke's R-square	.275		.122		.206		.399	

Correction (selection) variables control for the time from the incident to arrest, victim and suspect age, race/ethnicity and sex. All evidence categories were entered individually into each model. Robust Standard Errors are in parentheses. Stranger is the reference category for victim/suspect relationship. Pooled small Indiana sites (Evansville, Fort Wayne, South Bend) is the reference site category. (.) = constant or lack of correlation. * $p < .05$ ** $p < .01$ *** $p = .000$

Figure 4. Flowchart of Forensic Evidence and Arrest Outcomes for Burglary Incidents



Direct Arrest = suspect admission, suspect surrender, suspect apprehended, suspect arrested in another case, police observation, suspect named, traffic stop, recovered property

Descriptive Arrest = vehicle description, citizen observation, photo ID, suspect description, line-up

Tangible Evidence = A physical item of evidence that, without scientific analysis, is of evidentiary value to the case (e.g., stolen property, driver's license)

Table 12 . Predictors of Sentence Length for Burglary Convictions

	B	*S.E.*	*Sig.*
Witness reports	-47.15	25.42	.161
Victim reports	-17.96	38.45	.672
Intimate	-14.64	34.43	.699
Acquaintance	42.66	25.98	.199
Suspect arrested within 10 minutes of incident	46.06	31.26	.237
Public defender	**-54.87**	**17.33**	**.051**
Plea bargain	**-672.94**	**38.34**	**.000**
# prior arrests	-1.89	4.22	.685
# prior convictions	19.18	7.70	.088
Lab examined evidence	-68.67	28.69	.096
Los Angeles	82.42	31.68	.080
Victim teen	8.88	39.66	.837
Victim young adult	**76.12**	**21.86**	**.040**
Victim black male	-51.91	25.67	.136
Victim black female	-20.22	22.50	.435
Suspect black male	-60.53	31.48	.150
R^2	.995		
Mean sentence (months)	56.56		
Median sentence (months)	34.00		

Discussion

Burglaries were largely committed by young, minority males against slightly older victims, in houses and apartments, by strangers, with no witnesses, which likely explain the low arrest and conviction rates. The tracking of burglaries through the justice process, controlling for the presence/absence of collected physical evidence, revealed statistically significant differences at the arrest, prosecutor referral, charging, and conviction levels. And, while this study also found that, when controlling for other factors, collected crime scene evidence was a significant predictor of arrest, an obstacle in investigation and prosecution of burglaries was that, in the great majority of cases, there was limited physical evidence collected. Only 19.6% of the sampled cases had evidence. Furthermore, only 5% of incidents had eyewitnesses. Since the majority of burglaries provided no evidence to reveal the offender's identity, less than 10% of cases resulted in an arrest. These results are similar to those found in a study of residential burglary by Coupe & Griffiths (1996). Their study revealed that only 6% of burglary incidents resulted in an arrest. Almost half of the arrests were due to catching offenders in the act, while witness evidence was responsible for most of the others. Some success resulted from further criminal investigations, and little from forensic evidence. It should be noted that their study was implemented in England prior to the establishment of the national DNA database.

With regard to DNA, in the present study, only 13 cases had Biological evidence and only one of these cases resulted in an arrest that was not referred to the DA. Although interpretation of this finding should be made with caution due to the low number of cases with Biological evidence, this finding is important to note because the outcome is quite different than that of the National Institute of Justice DNA Field Experiment (Roman et al., 2008). (It should be noted that all study jurisdictions are gathering more DNA evidence in burglary cases in present day investigations).

The DNA Field Experiment evaluated the expansion of DNA evidence collection and testing in the investigation of property crimes including residential burglary, commercial burglary, and theft from automobiles in five communities (Orange County and Los Angeles, California; Topeka, Kansas; Denver, Colorado; and Phoenix, Arizona). Biological evidence was collected at up to 500 crime scenes in each site, and cases were randomly assigned to the treatment and control groups. In the treatment group, DNA processing as well as traditional practices were used to investigate the case. In the control group, biological evidence was not initially tested, and case outcomes were due only to traditional investigation. The study findings indicate that 16% of property crime cases where DNA evidence was processed had an arrest, compared to the control group, for which 8% of cases yielded an arrest. The data for the Los Angeles site was even more impressive. Twenty-nine percent of the cases in the treatment group had a suspect arrested and 22% of the cases accepted for prosecution, while the control group had 14% of the suspects arrested and 10% of the cases accepted for prosecution.

Although the findings of the demonstration project are impressive, the outcomes also should be interpreted cautiously. Unlike the current study, the Demonstration Experiment did not control for key variables found to be predictive of arrest and prosecution. For example, the relationship between DNA processing and arrest may be spurious if the treatment and control groups differed significantly with regard to witness and victim reports and their participation in

the investigative process. (The Urban Institute is currently gathering follow-up disposition data on these cases.) Nonetheless, the findings of the Demonstration project perhaps highlight the future direction for investigation of burglary and the collection and analysis of forensic evidence.

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Roman, J., Reid, S., Reid, J., Chalfin, A., Adams, A., Knight, C. (2008). *The DNA field experiment: Cost-Effectiveness analysis of the use of DNA in the investigation of high-volume crimes.* Urban Institute Justice Policy Center, Washington, D.C.

Chapter VI

Homicide

Homicide

The study database included 400 homicides, with most of them (245 or 61.3%) committed in Los Angeles in 2003 (Table 13). The victims across all sites were typically male (69%) as were the offenders/suspects (86%). Victims and suspects were predominantly male, Black or Latino, and less than 30 years old. The majority (55%) of cases involved strangers, however, this figure was inflated largely by the high percentage of stranger cases in Los Angeles (63%) as compared to all of the other sites (50%). Stranger-based homicides have become more predominant as a consequence of gang and drug contexts. The 400 homicide incidents took place primarily on the street an in house or apartments. Interestingly, 63% of homicide victims received medical treatment for their injuries. Seventy-six percent of homicides had at least one witness and most (67%) of the witnesses provided reports to the police. As expected, few (15.8%) victims gave eyewitness descriptions to the police. Incidents were reported to police in an average of .5 days and the average time from incident to arrest was approximately 36 days.

Physical Evidence Collected, Submitted & Examined

An extremely high percentage of homicides (97%) had physical evidence collected from the crime scenes (Table 14). No other crime in this study compares with homicide in the quantity and diversity of physical evidence collected. Table 14 shows that Firearms/Weapons and Natural/Synthetic Materials were the categories of evidence collected most frequently. Police gathered a wide array of guns, bullets, shell casings and cartridges. Materials Evidence primarily factored in as a Substrate upon which other evidence might be found. Clothing was the predominant type of Materials Evidence collected. Biological (38%), Latent Print (28.5%) and Trace (27.5%) evidence were collected fairly frequently. Suspected blood evidence was the primary form of Biological evidence collected. DNA evidence was collected at 4.5% of crime scenes.

Police agencies submitted evidence from homicide scenes for lab analysis in a very high percentage (88.5% of cases. Not all forms of collected physical evidence were submitted at that same high rate, however. The reader will notice that *submission* rates for some types of evidence were actually higher than that noted as *collected* at the crime scene. Case files showed Biological evidence (e.g., tissue, semen, scents) as being submitted much more frequently than it was collected. In Los Angeles files showed Latent Prints submitted to the lab in 111 cases but collected in only one. Firearms evidence was the most consistently submitted category; a collected gun, bullet or shell casing was almost always submitted as evidence. A high percentage of cases noted vehicles "collected;" perhaps the better term would be towed and parked in police custody, but none of them noted the vehicle was submitted for examination (probably because the car was the substrate for prints).

Table 13 . Descriptive Characteristics of Homicide Incidents (N=400)

Victim:	
% male	85.5
% < 20	25.1
% 20-29	36.8
% 30+	38.1
White	14.1
Black	49.9
Latino	32.1
Asian	2.9
Other	1.0
Suspect:	
% male	94.8
% < 20	20.8
% 20-29	47.7
% 30+	31.5
White	15.4
Black	54.2
Latino	28.8
Asian	1.6
Victim/Suspect Relationship:	
% intimate/family	19.4
% friend/acquaintance	25.4
% stranger	55.2
% victim received medical treatment	62.8
Crime Location:	
% car	7.5
% bar	1.3
% park	.5

Table 13 Continued. Descriptive Characteristics of Homicide Incidents (N=400)

% retail store	1.3
% house/apt.	29.5
% street	45.5
% indoors (other than house/ apt.)	7.5
% other (e.g., hotel/motel, restaurant, hospital)	6.9
# of Witnesses:	
% 0	24.0
% 1	62.2
% 2+	13.8
% witness report to police	67.0
% victim report to police	15.8
% arrests	55.5
% DA referral	42.5
% charged	40.0
% convictions	34.5
% arrested within 10 minutes of incident	14.8
time from incident to police report (mean days)	.47
time from incident to arrest (mean days)	35.56

Table 14. Crime Scene Evidence for Homicide Cases

Evidence Type	N=	Collected		Submitted		Examined	
		n	%	n	%	n	%
Total	400	388	97.0%	354	88.5%	324	81.0%
Biological		153	38.3%	129	32.3%	102	25.5%
blood		137	34.3%	84	21.0%	60	15.0%
DNA		18	4.5%	14	3.5%	14	3.5%
saliva		13	3.3%	36	9.0%	27	6.8%
vaginal		0	0.0%	6	1.5%	4	1.0%
semen		0	0.0%	8	2.0%	8	2.0%
condom		0	0.0%	1	0.3%	1	0.3%
bone		1	0.3%	0	0.0%	0	0.0%
tissue		2	0.5%	3	0.75%	2	0.5%
sexual assault kit		16	4.00%	6	1.5%	4	1.0%
scents		0	0.0%	24	6.0%	11	2.8%
urine		0	0.0%	3	0.8%	3	0.8%
biological, other		32	8.0%	17	4.3%	12	3.0%
Latent Prints		114	28.5%	177	44.3%	167	41.8%
fingerprints		112	28.0%	177	44.3%	167	41.8%
palm prints		5	1.3%	2	0.5%	1	0.3%
Pattern Evidence		98	24.5%	44	11.0%	29	7.3%
blood stain		0	0.0%	2	0.5%	0	0.0%
blood pattern		36	9.0%	1	0.3%	1	0.3%
footprint		6	1.5%	1	0.3%	1	0.3%
shoe print		9	2.3%	7	1.8%	5	1.3%
tools/marks		4	1.0%	0	0.0%	0	0.0%
footwear		62	15.5%	33	8.3%	20	5.0%
tire prints		4	1.0%	2	0.5%	2	0.5%
Firearms/Weapons		332	83.0%	300	75.0%	272	68.0%
gun		122	30.5%	103	25.8%	96	24.0%
bullet		269	67.3%	242	60.5%	199	49.8%
casing		223	55.8%	207	51.8%	175	43.8%
cartridge		97	24.3%	74	18.5%	60	15.0%
GSR		40	10.0%	29	7.3%	11	2.8%
other weapons		36	9.0%	14	3.5%	10	2.5%

Natural/Synthetic Materials	252	63.0%	132	33.0%	101	25.3%
binding	13	3.3%	5	1.3%	3	0.8%
clothing	224	56.0%	114	28.5%	47	11.8%
bed/bath	30	7.5%	17	4.3%	11	2.8%
carpet	3	0.8%	2	0.5%	2	0.5%
pavement	5	1.3%	0	0.0%	0	0.0%
Generic Objects	137	34.3%	54	13.5%	52	13.0%
vehicle	67	16.8%	0	0.0%	0	0.0%
collision	1	0.3%	0	0.0%	0	0.0%
container	75	18.8%	52	13.0%	50	12.5%
floor	3	0.8%	0	0.0%	0	0.0%
door	0	0.0%	2	0.5%	2	0.5%
window	3	0.8%	0	0.0%	0	0.0%
furniture	2	0.5%	0	0.0%	0	0.0%
walls	3	0.8%	0	0.0%	0	0.0%
Electronic/Printed Data	44	11.0%	18	4.5%	15	3.8%
documents	26	6.5%	9	2.3%	7	1.8%
electronics	17	4.3%	8	2.0%	7	1.8%
computer	1	0.3%	1	0.3%	1	0.3%
Trace	130	32.5%	75	18.8%	51	12.8%
fire igniter	8	2.0%	5	1.3%	4	1.0%
fire debris	2	0.5%	1	0.3%	1	0.3%
fire accelerant	1	0.3%	1	0.3%	1	0.3%
rubber	3	0.8%	3	0.8%	2	0.5%
soil/dirt	2	0.5%	0	0.0%	0	0.0%
metal fragments	18	4.5%	15	3.8%	15	3.8%
glass	18	4.5%	12	3.0%	10	2.5%
plastic	23	5.8%	19	4.8%	18	4.5%
paint	5	1.3%	4	1.0%	4	1.0%
paper	23	5.8%	17	4.3%	16	4.0%
cigarette butt	22	5.5%	17	4.3%	9	2.3%
hair	50	12.5%	13	3.3%	8	2.0%
pubic hair	5	1.3%	1	0.3%	1	0.3%
trace	19	4.8%	3	0.8%	0	0.0%
fibers	8	2.0%	1	0.3%	1	0.3%

Drugs	43	10.8%	27	6.8%	19	4.8%
Other	19	4.8%	0	0.0%	0	0.0%

A high percentage (81%) of cases had evidence that was examined in crime labs. At 81%, homicide had the highest rate of evidence examined among the crime types. Firearms, Latent Prints and Biological evidence were the most frequently examined forms of evidence. It should noted, that the volume of physical evidence going into, and examined by, the Los Angeles County Crime Laboratory was far greater than that at the other labs – broken down by the type of evidence submitted and examined, the number of cases in Los Angeles often exceeded the number of cases in *all* the other sites combined. For Latent Prints, Pattern evidence, Firearms/Weapons, and Materials evidence, Los Angeles cases exceeded those in the other jurisdictions combined by a factor of three or more.

The 324 cases with examined evidence yielded 209 identifications, 165 individualizations, and 26 exclusions. Given the caseload distributions in the various laboratories, it was not surprising that Los Angeles was responsible for almost two-thirds (64%) of the positive identifications, and half (53%) of the individualizations. Most of the positive identifications involved Firearms/Weapons (73), Natural/Synthetic Materials (43), Trace (31), Generic Objects (29), Drugs (17), Latent Prints (6) and Biological (5).

Without question, Firearms/Weapons evidence generated most of the informative laboratory findings for homicides, followed by Biological evidence, and then Latent Prints. The laboratories also routinely submitted fingerprints, firearms-related evidence, and DNA profiles to different computerized databases in hopes of identifying otherwise unknown offenders or linking suspects to the victim, crime scene and/or weapon. The hits to profiles searched ratios for Latent Prints were 18.8% (9/48), for NIBIN/IBIS 8.55% (7/82), and CODIS was 0% (0 of 3).

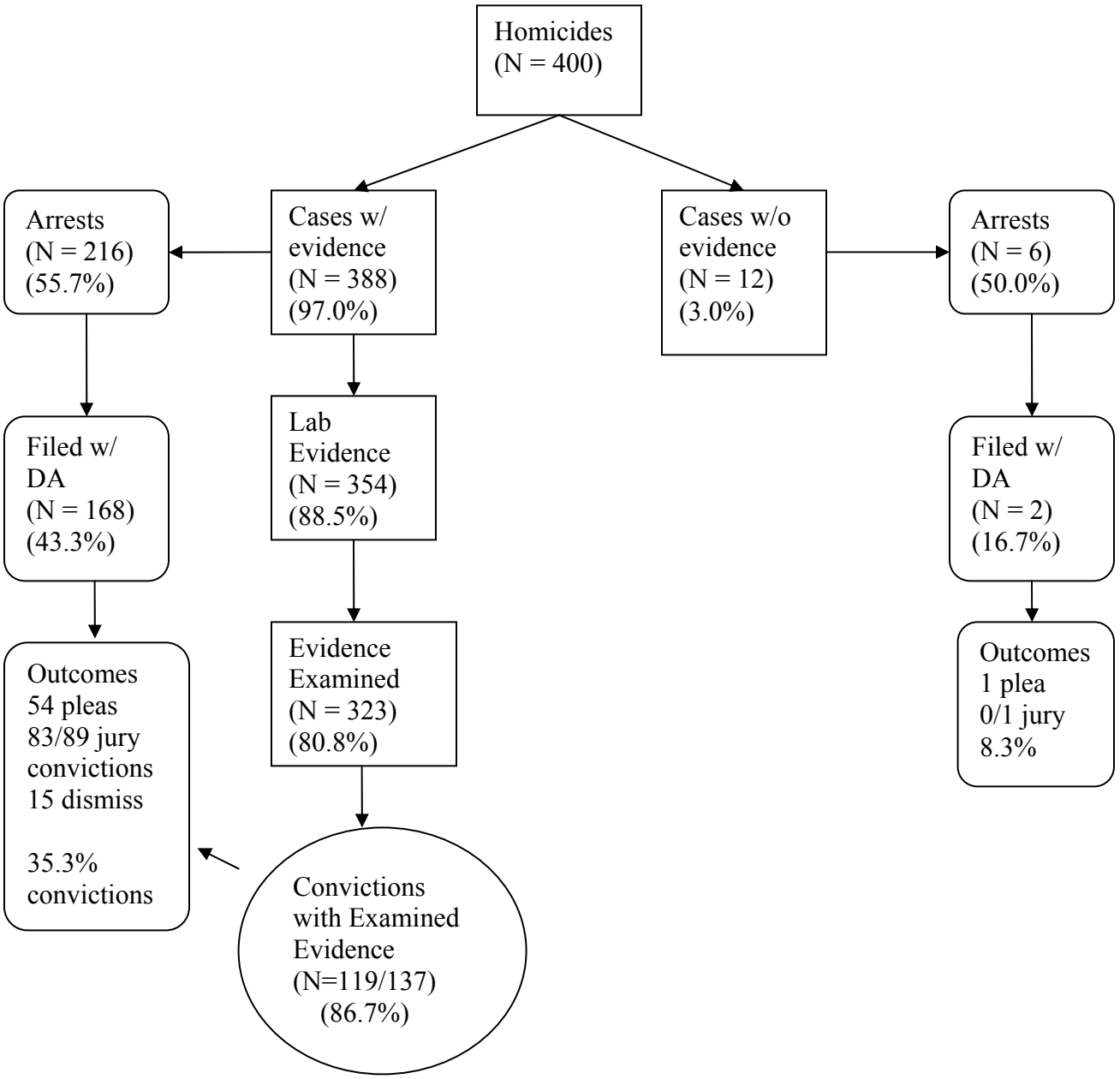
Tracking Cases Through the Justice Process

Figure 5 tracks the movement of the 400 homicides through the justice process. The data in the flowchart reveals a major difference with respect to presence of collected physical evidence compared to offenses without evidence: only 12 of 400 (3%) cases had no physical evidence collected. Consequently, the ability to compare the disposition of cases with and without physical evidence was quite limited.

A moderately high percentage of homicide offenses with forensic evidence resulted in an arrest (55.7%). Half of the cases without physical evidence resulted in an arrest. Overall, 55.5% of all homicide cases had an arrest. Although this figure appears high relative to the rates of the other crimes in this study, it is actually well below the national average of 76.5% reported in the Uniform Crime Report for 2004 or the more current rate of 63.6% for 2008. (FBI, 2004 and 2008). The percentage of homicide offenses with physical evidence, that lead to convictions (35.3%), was about four times higher than those cases without physical evidence (8.3%). The overall conviction rate across the five sites was 34.5%. Overall, the funnel effect in homicide cases was far less dramatic than it was the other crimes. The largest filtering out of cases occurred between arrest and referral to the DA (23% of arrest were not referred). Virtually all referred cases (94%) were charged by the DA.

As stated above, only 12 of the 400 (3%) homicide cases had no physical evidence collected at the crime scene. Ten cases were in Los Angeles and two in Indianapolis. A review

Figure 5. Flowchart of Forensic Evidence and Criminal Justice Outcomes for Homicide Incidents



of the 10 Los Angeles cases revealed that 8 were gang-related, stranger cases. Although evidence was not collected at the scene, 6 of the 10 homicide victims were examined in the Coroner's Office. Overall, these 10 homicides resulted in four arrests and one referral to the DA which ended in a plea conviction. Although the one conviction was a gang-related, stranger homicide, it had eyewitness reports.

Predictors of Criminal Justice Outcomes

Arrest

The data in Table 15 indicate that homicides among non-strangers and cases with witness reports were significantly more likely to result in arrests. Forensic evidence was not significant but this result was most likely due to a lack of variation in cases with and without evidence. The interaction of race/ethnicity and gender were also important predictors of arrest. Cases with White victims (both male and female) and Black suspects (both male and female) were more likely to result in arrests.

Although the crime scene evidence variable was not a significant predictor of arrest, the data in Figure 6 highlight the relationship of physical evidence with rates of arrests. Of the 216 arrests for cases with physical evidence, only 12% had evidence examined prior to arrest. An additional 6.5% of arrests had tangible evidence. Forty-five percent of physical evidence cases had arrests based on direct techniques.

Referrals to DA

The data in Table 15 show that the odds of case referral increased significantly for cases that had witness reports (odds ratio = 2.15) and cases in which the victim and suspect had a friendship or acquaintance relationship (odds ratio = 9.44). In addition, arrests were less likely to be referred to the DA in Los Angeles compared to the smaller Indiana sites.

Charging

A number of variables were significant predictors of charging and the 'nonforensic' variables will be discussed first. Friend/acquaintance victim/suspect relationships were more likely to be charged than stranger homicides (odds = 12.00). Homicide cases where the suspect was arrested within 10 minutes of the incident were also more likely to be charged (odds ratio = 6.31). Los Angeles and Indianapolis homicides were less likely to be charged compared to the smaller Indiana sites. In addition, cases in which the victim was a White male were more likely to be charged. Cases with crime scene evidence, however, were approximately 21 times more likely to be charged than those without evidence. Two issues are important to note. First, all but 12 cases had crime scene evidence; thus, it is not surprising that cases with evidence would be charged at a higher rate. Second, although crime scene evidence was a significant predictor, lab examined evidence was not. Furthermore, the "link" forensic variable (examined evidence connects the suspect to the crime scene and/or victim) also was not a significant predictor of charging a homicide case. So, although the forensic evidence variable was a significant predictor of charging, the study could not attribute the contribution of this evidence to the results of

laboratory testing. At this stage, the project was unable to determine if the evidence had been examined at the time of charging.

Conviction

The logistic regression results indicate that although cases with known relationships between victim and suspect were more likely to be charged they were significantly less likely to result in convictions. In addition, suspects arrested within 10 minutes of the crime incident were less likely to be convicted. On the other hand, cases with older victims were more likely to result in convictions. Similar to the regression model for charging, none of the laboratory examined forensic variables were significant predictors of conviction. Overall, there were 138 convictions (34.5%) of which 119 (86.2%) had evidence examined in crime labs. Of the 138 convictions, 45.6% had biological examined evidence, 47.1% latent prints and 50.7% firearms evidence examined in labs.

In light of the quantity and diversity of evidence collected in homicides across the five sites, it is surprising that only a limited amount of physical evidence linked/associated the suspect to the crime scene and/or victim. There were 54 cases with linking evidence, representing 13.5% of the 400 homicides reviewed. Overall, 46.3% of these cases resulted in a conviction, a slightly higher conviction rate as compared to all other cases in the sample (32.7%).

Plea/Trial

There were 90 homicide trials (92.2% conviction rate) and 55 plea dispositions across the study sites. Homicide had the highest ratio of trials to pleas. The percentage of cases that had lab-examined evidence was similar for trials (77.8%) and pleas (74.5%). However, cases resolved through trial tended to have a higher percentage of lab-examined Biological (45.6% vs. 36.6%), Latent Print (43.3% vs. 38.2%) and Firearms (65.6% vs. 52.7%) evidence than did plea negotiated cases.

Sentencing

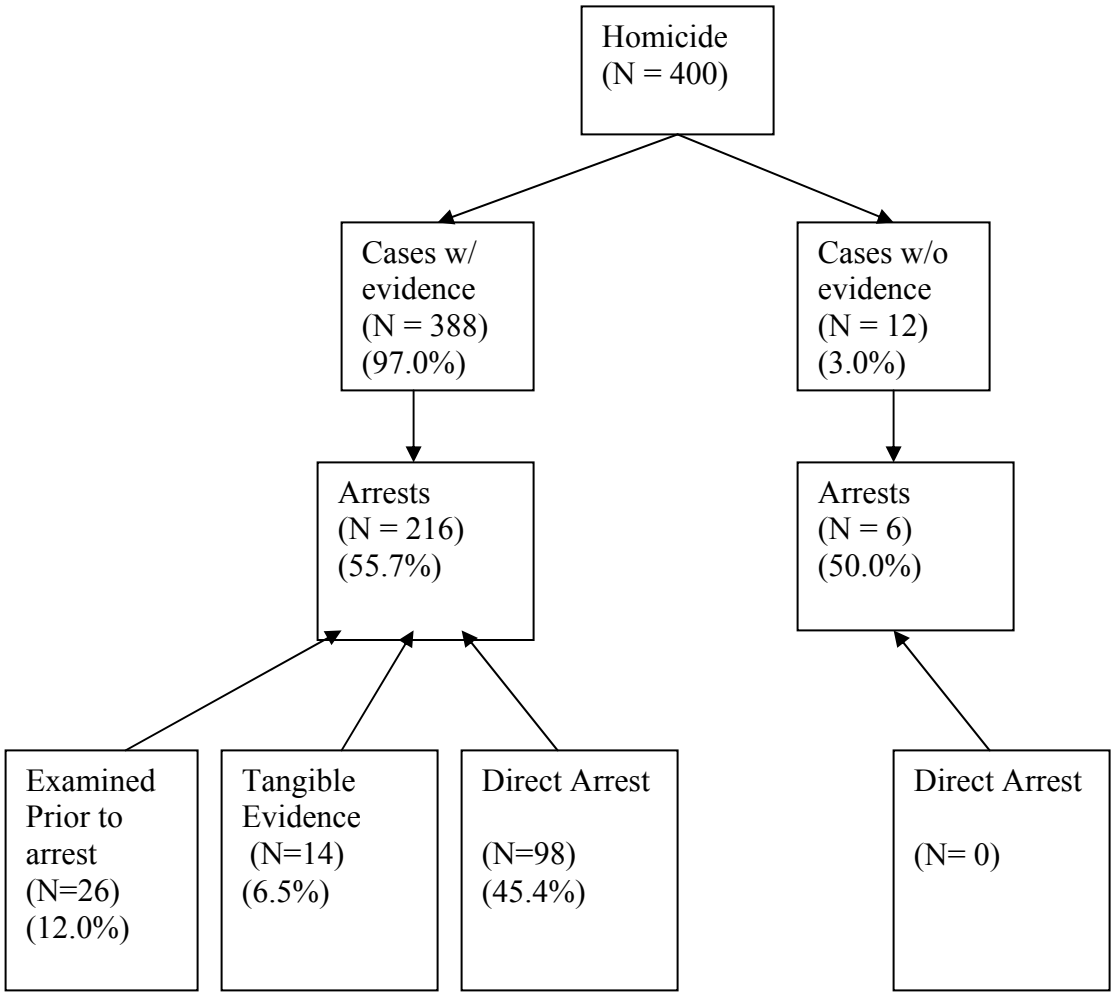
Data in Table 16 reveal that convicted homicide offenders received longer sentences if the crime was among intimates, forensic evidence linked the suspect to the crime and the offender was a young adult. On the other hand, shorter sentences were given for cases resolved through plea bargain and for cases in Los Angeles and Indianapolis. The average sentence for plea convictions was 247.5 months compared to 541.0 months for trial convictions. Overall, the average sentence length was 423.6 months, the median was 300.0 months. In addition, 10 defendants (9 in Los Angeles) received death sentences.

Table 15. Likelihood of Criminal Justice Outcomes for Homicide

	ARREST		REFERRAL		CHARGES		CONVICTION	
	Estimate	Odds Ratio	Estimate	Odds Ratio	Estimate	Odds Ratio	Estimate	Odds Ratio
Witness Reports to Police	.622	1.86*	.764	2.15*	.942	2.57	-1.45	.235
	(.292)		(.357)		(.894)		(1.07)	
Victim Reports to Police	-.222	.801	-.182	.834	-1.07	.343	.558	1.80
	(.315)		(.460)		(.774)		(1.05)	
Intimate/Family	1.054	2.87**	.608	1.84	1.46	4.31	-2.14	.118*
	(.404)		(.513)		(.934)		(1.11)	
Friend/Acquaintance	1.83	6.25***	2.24	9.44***	2.49	12.00**	-2.17	.115*
	(.425)		(.475)		(.949)		(1.02)	
Crime Scene Evidence	.377	1.46	1.89	6.59	3.04	20.88**	.644	1.90
	(.693)		(1.25)		(.950)		(1.56)	
Lab Examined Evidence	.553	1.74	.209	1.23	.784	2.19	.172	1.19
	(.314)		(.450)		(.992)		(.753)	
Victim Medical Treatment			.044	1.05	1.63	5.11	-.301	.740
			(.329)		(.863)		(.559)	
Arrest within 10 Minutes of Crime Incident			.398	1.49	1.84	6.31*	-2.05	.128*
			(.478)		(.883)		(.915)	
Direct Arrest			.145	1.16	-.223	.800	.741	2.10
			(.387)		(.726)		(.613)	
Los Angeles	-.564	.569	-1.30	.025**	- 8.69	.000***	1.65	5.22
	(.348)		(.502)		(1.91)		(.889)	
Indianapolis	-.052	.949	-.225	.725	-4.23	.015**	-.581	.560
	(.420)		(.534)		(1.53)		(.634)	
Correction Factor			2.88	17.88***	6.04	421.61***	-4.01	.018*
			(.310)		(.991)		(1.78)	
Naglekerke's R-square	.277		.661		.839		.182	

Correction (selection) variables control for the time from the incident to arrest, victim and suspect age, race/ethnicity and sex. All evidence categories were entered individually into each model. Robust Standard Errors are in parentheses. Stranger is the reference category for victim/suspect relationship. Pooled small Indiana sites (Evansville, Fort Wayne, South Bend) is the reference site category. (.) = constant or lack of correlation. * $p < .05$ ** $p < .01$ *** $p = .000$

Figure 6. Flowchart of Forensic Evidence and Arrest Outcomes for Homicide Incidents



Direct Arrest = suspect admission, suspect surrender, suspect apprehended, suspect arrested in another case, police observation, suspect named, traffic stop, recovered property

Descriptive Arrest = vehicle description, citizen observation, photo ID, suspect description, line-up

Tangible Evidence = A physical item of evidence that, without scientific analysis, is of evidentiary value to the case (e.g., stolen property, driver's license)

Hard to Solve Cases (stranger and/or no witnesses)

There were a total of 35 "hard to solve" cases committed between strangers and with no witnesses. These particularly challenging investigations had crime scene evidence collected in 100% of the cases, of which 82.9% had laboratory-examined evidence. Surprisingly, the arrest rate (54.3%) was virtually the same as the mean arrest rate for all other homicides (55.6%). Convictions were secured in 34.3% of incidents as compared to a conviction rate of 34.5% for all other homicide cases. Hard to solve conviction cases were more likely to have biological evidence (75%) compared to other homicide convictions (42%). However, there was no difference between the two groups in terms of evidence that linked the suspect to the crime (16.7% vs. 18.3%).

Discussion

Homicide cases, like all other cases, begin with different levels of "solvability" and differ in regard to the probability of an arrest. Surprisingly, there is a paucity of research literature on factors related to arrest and other criminal justice outcomes. One of the few studies of homicide clearance rates examined 215 factors in homicide cases to determine the relationship of each factor to whether the case was cleared by arrest (Welford & Cronin, 2000). Of the 215 factors analyzed, 15 key factors were identified and included both police practices and case characteristics. In terms of police practices, the probability of clearance increased significantly when the first officer on the scene quickly notified the homicide unit, the medical examiners, and the crime lab and attempted to locate witnesses. The length of time it took detectives to arrive at the scene also was a key factor. Cases in which the detective arrived within 30 minutes were more likely to be cleared. Faster response times are considered critical because they reduce the potential for the loss or contamination of evidentiary material, and there is a greater likelihood that individuals involved in the homicide may still be present at the crime scene. The findings also indicated that the number of detectives assigned to a case is particularly important: assigning a minimum of three to four detectives appeared to increase the likelihood of clearing it. The findings also suggested the growing importance of computer checks of various types, particularly checks on guns, suspects, and victims. Cases in which computer checks— using the local Criminal Justice Information System—were conducted on the victim, suspect, witnesses, and guns were more likely to be cleared.

Although the current study did not have the data to assess the influence of the number of detectives assigned to the case, it did examine the relationship between response time and arrest. Average response times varied from a low of 22.4 minutes in Indianapolis to a high of 105.2 minutes in Evansville. The mean response time for Los Angeles was 47.42 minutes. Regardless of site, the relationship between response time and the likelihood of arrest was not significant. In fact, the response time was quicker for cases without an arrest in Los Angeles and Indianapolis. The Homicide Clearance study cited above did not explore the impact of specific types of forensic evidence except for the influence of computer databases on arrest. As reported above, the success of database searches (e.g., AFIS, CODIS, NIBIN) in the present study was quite limited. In addition, few forensic variables were significant predictors of criminal justice outcomes. Evidence collected at crime scenes was a significant predictor only for DA charges.

Table 16. Predictors of Sentence Length for Homicide Convictions

	B	*S.E.*	*Sig.*
Witness reports	-105.10	100.04	.296
Victim reports	28.07	129.47	.829
Intimate	**261.90**	**136.28**	**.058**
Acquaintance	68.86	88.87	.440
Suspect arrested within 10 minutes of incident	-100.56	96.60	.300
Victim medical treatment	-84.87	82.50	.306
Public defender	-30.88	79.97	.700
Plea bargain	**-326.89**	**78.07**	**.000**
# prior arrests	-1.36	7.37	.853
# prior convictions	9.49	11.42	.408
Lab examined evidence	207.87	117.63	.080
Link suspect to crime	**225.35**	**94.66**	**.019**
Los Angeles	**-435.88**	**118.17**	**.000**
Indianapolis	**-262.78**	**109.62**	**.018**
Victim teen	51.09	98.51	.605
Victim young adult	**204.55**	**92.36**	**.029**
Victim black male	-91.89	125.97	.467
Victim Latino	241.66	126.98	.060
Victim black female	149.53	164.21	.365
Victim Latina	-148.83	246.73	.548
Suspect black male	150.74	119.25	.209
Suspect Latino	-86.60	128.98	.503
Suspect black female	-106.17	252.51	.675
Suspect Latina	-146.55	230.05	.526
R^2	.428		
Mean sentence (months)	423.59		
Median sentence (months)	300.00		

On the other hand, evidence linking the suspect to the crime was a significant predictor of sentence length.

With regard to case characteristics, the Homicide Clearance study found that a case was more likely to be closed when witnesses were at the crime scene and provided valuable information, including the circumstances of death, the motivation for the homicide, identification of the suspect, identification of the victim, and location of the suspect. The crime was more likely to be closed when a neighborhood canvass provided valuable information, when friends and neighbors of the victim were interviewed, and when confidential informants provided valuable information or came forward on their own. When police used surveillance in a case, the case was more likely to be solved.

In the past, homicide was understood primarily to be a crime of passion involving family members or close acquaintances. These existing social relationships made identifying the alleged offender relatively easy. This, in turn, led to higher rates of clearance. In recent years, however, homicides are more often stranger-to-stranger crimes. Identification of alleged offenders in stranger-to-stranger crimes, particularly gang and drug market-related homicides, is much less likely. Furthermore, the type of homicide determines the availability and cooperativeness of potential witnesses and informants. Witnesses to stranger-to-stranger homicides often fear retribution and feel that law enforcement is uninterested in their participation or indifferent to the case altogether. This is especially true for individuals viewed as "non-persons" by the larger society because they participate in drug or gang culture.

The findings in the present study support the above perspective. Suspects who knew their victims were more likely to be arrested and referred to the DA than in stranger-to-stranger crimes. Results from this analysis also support the previous findings of Lee (2005), Marché (1994), and Roberts (2007) who found that homicide incidents between strangers were less likely to be cleared. Also, similar to Wellford & Cronin (2000), Addington (2006), Litwin (2004), and Roberts (2007) found that homicides committed with firearms were less likely to be cleared. While such crimes present the possibility of firearms evidence (bullets, cartridge cases, and the weapons themselves) being present, gang related and drive by shootings will typically lack other types of physical evidence that result from close physical contact between victim and offender. Such cases are also likely committed between strangers.

Overall, the data in the current study suggest that case characteristics, including forensic evidence, can influence successful criminal justice outcomes. With an overall conviction rate of 34.5%, however, the data also indicate that there is a tremendous need for enhancing case investigation methods and perhaps allocating greater resources that will hopefully produce improved criminal justice outcomes.

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Chapter VII

Rape

The study's database includes 602 randomly selected rape incident reports (Table 17). All of the victims were female and all of the suspects were male. Slightly more than half (53.9%) of the victims were White but the majority of suspects were Black (45.9%) or Latino (20.3%). With regard to age, victims tended to be young with the vast majority being under 30 years old (74.1%). Similarly, the majority of suspects were under 30 years old (57.7%). The overwhelming majority of rapes were among people that knew each other, either as intimates/family (36.2%) or as friends/acquaintances (42.7%). Victims received medical treatment for their injuries in 68.3% of cases. Two-thirds of rapes occurred in houses and apartments. Another 9.6% of rapes occurred in automobiles and 8% took place on a street or in a park. There were very few witness reports to police (11.8%) but 66.3% of rape cases had victim reports.

Less than half (45.0%) of rape incidents resulted in an arrest and only 11.1% of cases had a conviction. Of those arrests, only 10% occurred within 10 minutes of the incident. The average time of reporting the incident to the police was 7.56 days. The mean time from incident to arrest was 53.08 days.

Physical Evidence Collected, Submitted & Examined

Physical evidence and substrates were gathered in 63.8% of rape incidents (Table 18). Biological evidence was the primary type of evidence collected (535%) and Natural and Synthetic Materials the principal type of substrate gathered (42.2%). Sexual assault kits were collected from rape victims in 51.3% of incidents. Victims would typically travel to a designated hospital in their home community to be physically examined, usually by a sexual assault nurse, and to have evidence collected using the guidelines associated with the kit. Sexual assault kits may also be used to collect physical evidence from suspects in an effort to locate evidence and standards that can be compared with evidence recovered from the victim. Whereas the sexual assault kit was the principal vehicle used in gathering physical evidence, jurisdictions would occasionally note specific evidence types. For example, DNA was noted in 4.7% of incidents, and semen was noted in 6.0% of cases. DNA and semen, however, were typically the types of biological evidence found within the rape kit itself. In many cases, there was also the possibility that evidence was retrieved from substrates collected at the crime scene. For example, blood or semen may have been found on a towel, a condom or a bedroom carpet.

Table 17. Descriptive Characteristics of Rape Incidents (N=602)

Victim:	
% male	100
% < 20	48.1
% 20-29	26.0
% 30+	25.9
White	53.9
Black	28.6
Latino	16.3
Asian	1.2
Suspect:	
% male	100
% < 20	16.7
% 20-29	41.0
% 30+	42.3
White	32.9
Black	45.9
Latino	20.3
Asian	.9
Victim/Suspect Relationship:	
% intimate/family	36.2
% friend/acquaintance	42.7
% stranger	21.1
% victim received medical treatment	68.3
Crime Location:	
% car	9.6
% bar	1.0
% park	3.0

Table 17 Continued.Descriptive Characteristics of Rape Incidents (N=602)

% school	2.0
% retail store	.5
% house/apt.	66.3
% street	8.0
% other (e.g., hotel/motel, restaurant, hospital)	9.6

# of Witnesses:

% 0	78.3
% 1	11.5
% 2+	10.2

% witness report to police	11.3
% victim report to police	66.3
% arrests	45.0
% DA referral	25.7
% charged	13.5
% convictions	11.1
% arrested within 10 minutes of incident	10.6
time from incident to police report (mean days)	7.56
time from incident to arrest (mean days)	53.08

After Biological evidence, police collected Natural and Synthetic Materials most frequently (42.2%). The leading item, clothing (38.7%), may have been retrieved from the scene or from the victim when she was undergoing the sexual assault kit collection process at the hospital. As noted previously, clothing was the substrate upon which examiners would attempt to find stains and other biological materials. Latent prints, Trace evidence, Generic Objects and Firearms/Weapons were collected in less than 5% of cases. The low recovery of these forms of evidence is an indication that rape crime scenes themselves were not usually investigated. Most of the physical evidence was collected from the victim.

The data in Table 18 reveal that there was a dramatic decline (approximately 50%) from collected evidence to evidence submitted to crime labs. The biggest decline occurred in the submission of sexual assault kits (68%). While some of submitted evidence likely came from sexual assault kits, the complete kits themselves were not identified as being submitted.

Table 18 shows that the majority (57.7%) of submitted evidence was actually examined in labs. Sexual assault kits had the largest drop from submitted to examined evidence (68%). The examination of the sexual assault kits, as a whole, is complex since a kit may have many individual items that were examined while the entire kit may not have been. A high percentage of cases with submitted semen evidence were examined (86.2%). Vaginal, blood and latent print evidence also were examined in most submitted cases (87.5%, 59.0% and 74.1%, respectively).

Across the sites, labs positively identified biological materials (semen, blood, or saliva) in 42 instances, or 7% of sampled cases. Typically, biological substances are identified before attempts are made to individualize them, and in the case of rape investigations, the identification of semen may assist to establish an element of the crime (proof of penetration). Biological substances were uniquely individualized (using DNA/STR techniques) in fifteen cases and associated a suspect/defendant to the victim in ten, representing 2.5% and 1.7% of the sample respectively. Nine cases had DNA profiles that were uploaded to CODIS that led to 'hits' (an identification of a suspect) in four (0.7%) of the 602 cases sampled.

Examinations of one or more types of other evidence in 30 of the cases yielded additional positive identifications: Latent Prints (25), Trace evidence (4), and other materials (2). There were several attempts, primarily in the Los Angeles laboratory, to identify alcohol, suspected date rape drugs, and other controlled substances in the urine of suspects and/or victims, and these examinations resulted in the identification of marijuana, cocaine, and other drugs and/or alcohol in six cases. In nine (1.5%) cases, individualized latent finger and/or palm prints that were linked to their origin/person leaving them and associated offenders with their crime scenes in three (0.5%) cases. None of the latent print inquiries led to a 'hit' through to the AFIS

Tracking Cases through the Justice System

Figure 7 tracks the movement of rape arrests through the justice process, controlling for the presence/absence of collected physical evidence. Cases with crime scene evidence were significantly more likely to result in arrest than cases without evidence ($t=3.11$, $p=.002$). There were also significant differences between the two groups in charged cases ($t=2.83$, $p=.005$) and

convictions (t=3.33, p=.001). The percent of cases referred to the DA was not significantly different for incidents with or without evidence.

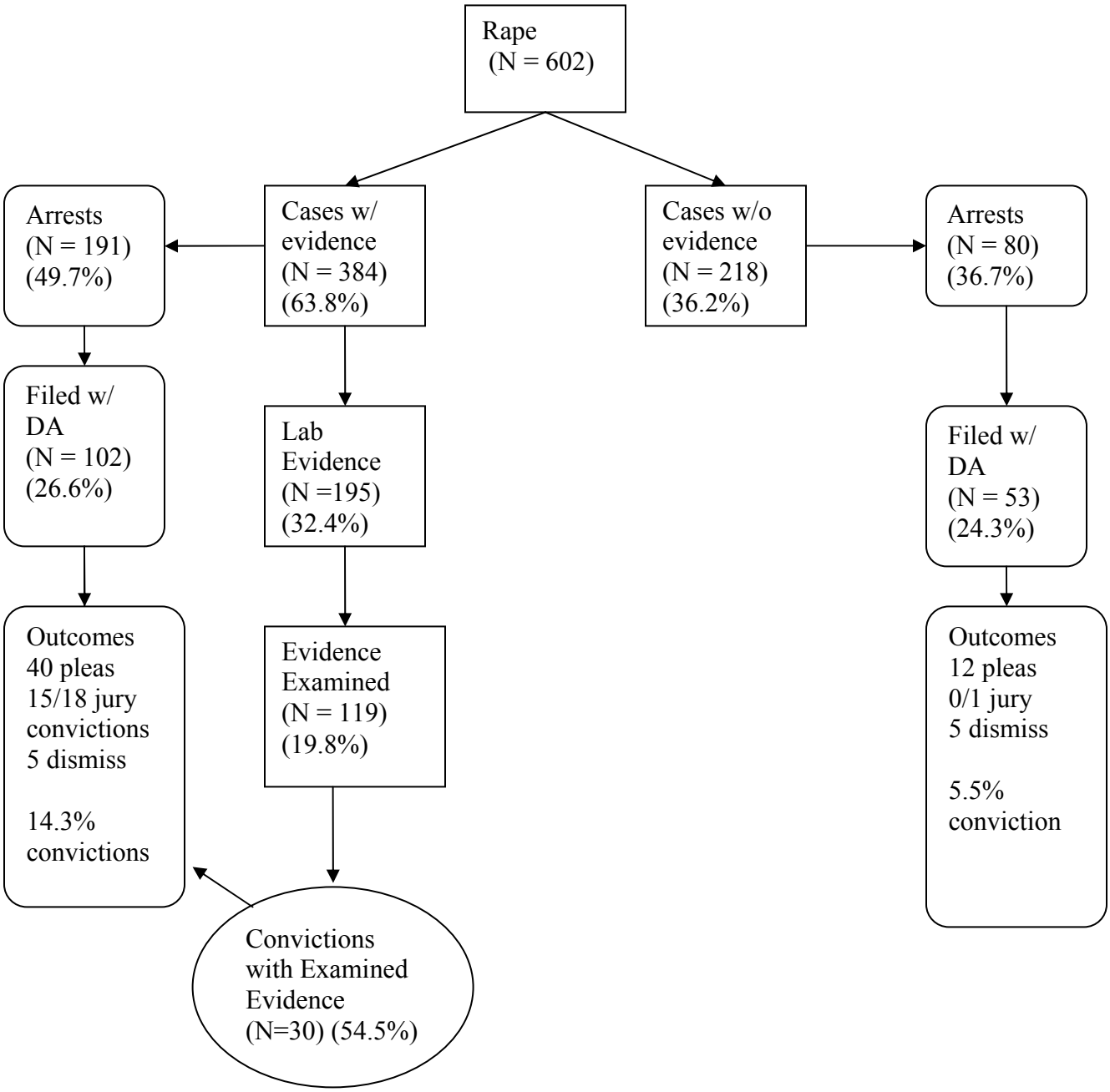
The data in Figure 7 also highlight clearly the funnel effect of case processing. With regard to cases with physical evidence, there was a 47% decline in the number of arrests referred to the DA. For cases without evidence the decline was 34%. Cases were further siphoned off from referral to charging. The reduction in the number of cases with evidence between these two decision points was 38%. For cases without evidence the decline was 66%.

Table 18. Crime Scene Evidence for Rape Cases

Evidence Types	N=	Collected		Submitted		Examined	
		N	%	N	%	N	%
Total	602	384	63.8%	194	32.2%	112	18.6%
Biological		322	53.5%	136	22.6%	89	14.8%
blood		40	6.6%	39	6.5%	23	3.8%
saliva		2	0.3%	26	4.3%	17	2.8%
DNA		28	4.7%	16	2.7%	2	0.3%
condom		10	1.7%	4	0.7%	2	0.3%
semen		36	6.0%	58	9.6%	50	8.3%
sexual assault kit		309	51.3%	100	16.6%	32	5.3%
scents		1	0.2%	0	0.0%	0	0.0%
vaginal		0	0.0%	16	2.7%	14	2.3%
urine		0	0.0%	11	1.8%	4	0.7%
bite mark		0	0.0%	1	0.2%	1	0.2%
feces		1	0.2%	3	0.5%	3	0.5%
biological, other		1	0.2%	1	0.2%	1	0.2%
Latent Prints		26	4.3%	27	4.5%	20	3.3%
fingerprints		26	4.3%	25	4.2%	18	3.0%
palm prints		0	0.0%	2	0.3%	2	0.3%
Pattern Evidence		4	0.7%	0	0.0%	0	0.0%
footprint		1	0.2%	0	0.0%	0	0.0%
footwear		1	0.2%	0	0.0%	0	0.0%
Firearms/Weapons		11	1.8%	1	0.2%	1	0.2%
gun		2	0.3%	0	0.0%	0	0.0%
other weapons		9	1.5%	1	0.2%	1	0.2%
Natural/Synthetic Materials		254	42.2%	73	12.1%	20	3.3%
bindings		2	0.3%	0	0.0%	0	0.0%
clothing		233	38.7%	70	11.6%	18	3.0%
bed/bath		56	9.3%	13	2.2%	2	0.3%
carpet		12	2.0%	1	0.2%	1	0.2%
Generic Objects		15	2.5%	0	0.0%	0	0.0%

vehicle	2	0.3%	0	0.0%	0	0.0%
container	10	1.7%	0	0.0%	0	0.0%
door	1	0.2%	0	0.0%	0	0.0%
furniture	1	0.2%	0	0.0%	0	0.0%
sink	1	0.2%	0	0.0%	0	0.0%
Electronic/Printed Data	9	1.5%	0	0.0%	0	0.0%
documents	6	1.0%	0	0.0%	0	0.0%
computer	5	0.8%	0	0.0%	0	0.0%
electronics	1	0.2%	0	0.0%	0	0.0%
Trace	25	4.2%	18	3.0%	6	1.0%
fire accelerant	1	0.2%	0	0.0%	0	0.0%
plastic	1	0.2%	0	0.0%	0	0.0%
glass	2	0.3%	0	0.0%	0	0.0%
paper	5	0.8%	0	0.0%	0	0.0%
hair	11	1.8%	12	2.0%	12	2.0%
pubic hair	0	0.0%	6	1.0%	0	0.0%
metal	1	0.2%	0	0.0%	0	0.0%
cigarette butt	5	0.8%	0	0.0%	0	0.0%
soil/dirt	1	0.2%	0	0.0%	0	0.0%
trace	6	1.0%	6	1.0%	2	0.3%
Drugs	3	0.5%	12	2.0%	9	1.5%
Other	24	4.0%	27	4.5%	19	3.2%

Figure 7. Flowchart of Forensic Evidence and Criminal Justice Outcomes for Rape Incidents



Predictors of Criminal Justice Outcomes

Arrest

A number of variables were significant predictors of arrest (Table 19). The predictors of arrest were victim reports to the police, victim/suspect relationship, forensic evidence, and site. Arrests were more likely to occur if the victim reported the offense to the police and participated in the investigation (odds ratio = 14.80). In addition, arrests were more likely if the incident occurred among intimate/family (odds ratio = 6.70) or friend/acquaintances (odds ratio = 3.26) compared to strangers. The collection of crime scene evidence (odds ratio = 2.51) and lab examined evidence (odds ratio = 1.63) were both significant predictors of arrest. Arrests were more likely in Los Angeles (odds ratio = 31.69) and Indianapolis (odds ratio = 22.12) compared to the smaller Indiana sites. Finally, rape incidents with older victims and female Black and Latina victims were more likely to have arrests.

Explaining the Association Between Crime Scene Evidence and Arrest

The preceding discussion has shown that there was an association between the collection of physical evidence and arrest. As in assault and burglary incidents, where crime scene evidence was a significant predictor of arrest, it was found that collected evidence in rape cases was examined rarely prior to arrest. Of the 191 rape cases with crime scene evidence that had an arrest, physical evidence was examined in only 1.6% of the cases prior to the time the arrest was made (Figure 8). The data in Figure 8 indicate that in addition to the examination of physical evidence, the type of arrest and *tangible* evidence may account for the significant difference in arrests for cases with crime scene evidence compared to cases without it. Although the percentage of direct arrests was actually higher for cases without evidence (61.3%), the combination of examined evidence, direct arrests and tangible evidence (66.5%) was slightly higher and may have contributed to the significant finding.

Referrals to DA

The only significant predictor of DA referral was site. Cases with arrests in Los Angeles were approximately five times more likely to be referred than those in the smaller Indiana sites.

Charging

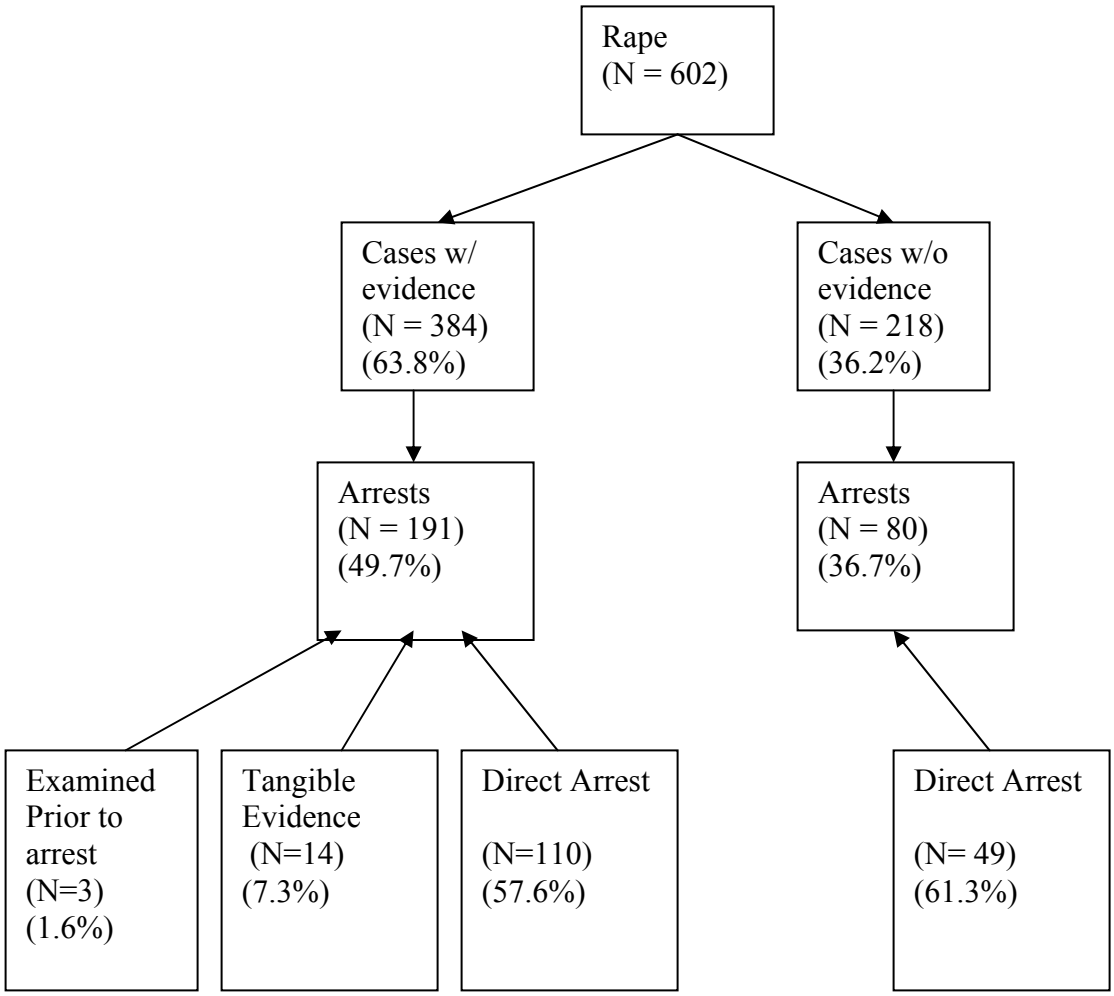
Laboratory examined forensic evidence increased the odds of DA charges by over five times (odds ratio = 5.52). The strongest predictors of case charging, however, were victim reports (odds ratio = 17. 10) and victim medical treatment (odds ratio = 21.62). Victims' medical treatment may be viewed as a proxy measure for the severity of victims' injuries that in previous research has been shown to be related to prosecutorial decisions. Injuries to the victim also may increase the credibility of the victim's statements as well as the culpability of the suspect. In addition, cases with female White victims were more likely to be charged.

Table 19. Likelihood of Criminal Justice Outcomes for Rape

	ARREST		REFERRAL		CHARGES		CONVICTION	
	Estimate	Odds Ratio	Estimate	Odds Ratio	Estimate	Odds Ratio	Estimate	Odds Ratio
Witness Reports to Police	-.991	.371*	-.682	.506	-1.08	.340	.204	1.23
	(.495)		(.587)		(.997)		(1.05)	
Victim Reports to Police	2.70	14.80***	-.284	.753	2.84	17.10**	3.02	20.41*
	(.441)		(.649)		(1.06)		(1.29)	
Intimate/Family	1.91	6.70***	.803	2.23	2.28	9.72	-1.69	.184
	(.337)		(.790)		(1.65)		(.940)	
Friend/Acquaintance	1.18	3.26***	.064	1.07	.707	2.03	-4.39	.012*
	(.309)		(.566)		(1.52)		(2.09)	
Crime Scene Evidence	.920	2.51***	.502	1.65	.593	1.81	1.91	6.75
	(.227)		(.440)		(.586)		(1.17)	
Lab Examined Evidence	.491	1.63*	1.09	2.97	1.71	5.52**	.955	2.60
	(.256)		(.574)		(.652)		(1.01)	
Victim Medical Treatment			.253	1.29	3.07	21.62**	1.73	5.64*
			(.348)		(.959)		.809)	
Arrest within 10 Minutes of Crime Incident			-.297	.743	1.06	2.88	.128	1.14
			(.405)		(1.21)		(1.37)	
Direct Arrest			.591	1.81	.901	2.46	3.23	25.31**
			(.619)		(.771)		(1.20)	
Los Angeles	3.46	31.69***	1.60	4.96*	-6.79	.001*	-.311	.733
	(.483)		(.605)		(3.00)		(.948)	
Indianapolis	3.10	22.12***	-.726	.484	37.32	1.61***	-.221	.801
	(.317)		(.382)		(1.10)		(1.23)	
Correction Factor			1.02	2.76	3.70	40.50	3.56	35.22***
			(1.06)		(1.63)		(.993)	
Naglekerke's R-square	.433		.316		.556		.844	

Correction (selection) variables control for the time from the incident to arrest, victim and suspect age and race/ethnicity. All evidence categories were entered individually into each model. Robust Standard Errors are in parentheses. Stranger is the reference category for victim/suspect relationship. Pooled small Indiana sites (Evansville, Fort Wayne, South Bend) is the reference site category. (.) = constant or lack of correlation
* $p < .05$ ** $p < .01$ *** $p = .000$

Figure 8. Flowchart of Forensic Evidence and Arrest Outcomes for Rape Incidents



Direct Arrest = suspect admission, suspect surrender, suspect apprehended, suspect arrested in another case, police observation, suspect named, traffic stop, recovered property

Descriptive Arrest = vehicle description, citizen observation, photo ID, suspect description, line-up

Tangible Evidence = A physical item of evidence that, without scientific analysis, is of evidentiary value to the case (e.g., stolen property, driver's license)

Conviction

The data in Table 19 indicate that the strongest predictors of conviction were victim reports to the police (odds ratio = 20.41) and direct arrest techniques (odds ratio = 25.31). Victims' receipt of medical treatment (odds ratio = 5.64) also was a key predictor of conviction. Forensic evidence variables were not related significantly to conviction.

Overall, 67 of 81 (82.7%) charged cases resulted in convictions. Cases where physical evidence was collected resulted in convictions 87.3% of the time as opposed to 66.7% of the time in cases without physical evidence collected. There was physical evidence examined in 30 convictions (44.8% of all convictions and 54.5% of convictions with physical evidence).

There were a total of seven rape cases with linking evidence across the five sites. All seven had Biological evidence that provided an association between victim and suspect. These seven cases resulted in four arrests that led to two charges and two convictions (one plea and one jury conviction). In the four cases with an arrest as well as the two cases with convictions, the victim and suspect had an intimate or family relationship. The three cases without an arrest were stranger rapes.

Plea/trial

Seventy-eight percent of rape dispositions were through pleas and 22% through trials. Eighteen out of 19 trials (94.7%) resulted from cases where physical evidence was collected. The trial conviction rate for cases with evidence was 83.3%. The sole trial without physical evidence resulted in an acquittal.

Sentencing

Table 20 shows that cases resolved through plea bargains and cases with public defenders and received shorter sentences. In addition, cases in which the victim was a Latina received shorter sentences compared to cases in which the victim was a White female. As stated above, the majority (77.6%) of rape convictions were disposed of through pleas. There was a substantial difference in sentences meted out at trial versus those negotiated by plea. The average sentence for convictions by trial was 405.33 months and for pleas, 101.51 months. Overall, the mean sentence length was 160.4 months and the median length was 60.0 months.

Hard to Solve Cases

There were a total of 108 (17.9%) "hard to solve" cases (strangers and no witnesses). Of these cases, there were 30 arrests (27.8%). The arrest rate for hard to solve cases differed significantly from the other rape incidents which had a 48.8% arrest rate ($t=4.02$, $p= .000$). The conviction rates for the two groups, however, were quite similar (hard to solve- 9.3% vs. 11.7%). Both groups also had very similar percentages of cases with lab examined evidence (hard to solve -18.5% vs. 20.0%). Although not statistically significant, 30% of hard to solve case convictions had lab examined evidence compared to 50% for the other cases.

Table 20. Predictors of Sentence Length for Rape Convictions

	B	*S.E.*	*Sig.*
Witness reports	104.73	90.92	.264
Victim reports	21.93	74.89	.773
Intimate	-185.5	115.4	.125
Acquaintance	-119.3	116.85	.321
Victim medical treatment	-28.96	79.62	.720
Suspect arrested within 10 minutes of incident	8.15	63.53	.899
Public defender	**-163.1**	**80.18**	**.057**
Plea bargain	**-378.0**	**118.0**	**.005**
# prior arrests	-10.12	6.25	.123
# prior convictions	8.20	9.63	.406
Lab examined evidence	59.67	52.17	.268
Los Angeles	10.45	113.17	.927
Victim teen	-131.9	76.55	.102
Victim young adult	85.55	82.37	.313
Victim black female	65.17	93.77	.496
Victim Latina	**-270.3**	**114.3**	**.029**
Suspect black male	-115.2	103.3	.279
Suspect Latino	44.32	91.59	.634
R^2	.801		
Mean sentence (months)	160.40		
Median sentence (months)	60.00		

Discussion

Similar to previous studies (Frazier and Haney 1996; Spears and Spohn 1997), the results of the present project indicate that prosecutors exercise a great deal of discretion and reject a significant percentage of rape cases at screening. This research also indicates that case rejections are motivated primarily by prosecutors' attempts to "avoid uncertainty" (Albonetti 1987) by filing charges in cases where the odds of conviction are good and rejecting charges in cases where conviction is unlikely. The results of previous studies suggest that sexual assault case outcomes are affected by the relationship between the victim and the suspect. Estrich (1987:28), for example, suggests that criminal justice officials differentiate between the "aggravated, jump-from-the-bushes stranger rapes and the simple cases of unarmed rape by friends, neighbors, and acquaintances." The findings of the current study indicate that case processing decisions, including the decision to charge or not, support the foregoing assertion. A prior relationship affects both the decision to dismiss the charges rather than prosecute fully and the likelihood that the defendant will be convicted. The findings of this study also revealed that criminal justice outcomes for rape were more likely to be successful when certain factors were present such as victim willingness to testify and severity of the assault. These results support the previous findings of Frazier and Haney (1996) and Spohn, Beichner, and Davis-Frenzel (2001) who found that sexual assault charging decisions reflect the seriousness of the offense, the degree of harm to the victim, and the culpability of the suspect. Prosecutors are more likely to file charges when the offense is serious, when it is clear that the victim has suffered real harm, and when the evidence against the suspect is strong. Indicators of a strong case in the current study were the victim's willingness to participate fully in the prosecution of the case, the availability and participation of witnesses, direct apprehension (e.g., arrest) of the suspect, and the presence of forensic evidence, primarily Biological evidence.

In addition, similar to the results of Spohn and Holleran (2001), the present study found that the relationship between the victim and suspect did not affect the likelihood of charging. Prosecutors were no less likely to file charges if the victim and suspect were acquaintances, relatives or intimate partners than if they were complete strangers. Spohn and Holleran also found that injury to the victim had a positive effect on charging. This outcome was replicated in the current study. These results suggest that prosecutors believe that an injury may counteract jurors' skepticism about a woman's allegation of rape by an intimate. In such cases, which are inherently ambiguous, the victim's credibility may be particularly important. The victim may be deemed more believable if she has injuries that can corroborate her assertion that the intercourse was nonconsensual.

Prosecutor offices varied in their timing relative to when they would screen rape cases. In Los Angeles, cases were screened post-arrest and DA referral. In the smaller Indiana sites, they were screened primarily prior to arrest. In Indianapolis, on the other hand, screening could occur both pre- and post-arrest. All prosecutors, regardless of jurisdiction, shared a primary concern about case convictability. Of the 602 rape incidents in the sample, prosecutors screened out (*i.e.*, rejected) 205 cases (34.1%). The percentage of case rejections was actually much higher when considering that not all cases were even referred to the prosecutors. In Los Angeles, for example, of the 99 DA referrals 71.17% (N=71) of the cases were rejected. This funneling or siphoning off of cases has an important affect on the interpretation of the study findings for rape.

Bivariate contrasts between rates of arrest with and without physical evidence indicated that cases with crime scene evidence were more likely to result in arrest than cases without evidence ($t=3.11$, $p=.002$). The differences were also significant at the charging and conviction levels. Logistic regression analysis also demonstrated that crime scene evidence was a significant predictor at the arrest and DA charging levels. Even though the data support the association between forensic evidence and DA charges, it must be remembered the findings are a reflection of careful screening and case selection by prosecutors. Less than one-third of cases had physical evidence submitted to labs and few cases (19.8%) actually had evidence examined by labs.

Finally, the study results have implications for the well-publicized Los Angeles rape kit backlog issue. The rape kit backlog comprises two distinct but related elements. The first exists in police evidence storage facilities, where rape kits are booked into evidence, but DNA analysis is not requested by a detective. The second backlog exists in police crime lab facilities where rape kits are submitted for testing, but are awaiting DNA analysis and have not been tested in a timely manner. As of February 2009, the estimated 12,669 untested rape kits in Los Angeles County's 88 cities comprised at least 5,193 in the Los Angeles Police Department's storage facility, 4,727 in the Los Angeles Sheriff's Department's storage facility, and at least 2,749 in storage facilities in the 47 cities in Los Angeles County that have their own police departments but rely on the Sheriff's crime lab for rape kit testing (Human Rights Watch, 2009).

County and City crime laboratories do not have the capacity to analyze quickly rape kits submitted for testing by detectives, nor do they have the capacity and personnel to test every booked rape kit. Consequently, recommendations to eliminate the rape kit backlog and delays in testing new kits have focused primarily on enhancing the Police and Sheriff's Departments' crime lab capacity (*e.g.*, adding personnel, enhancing infrastructure support, outsourcing kits for testing to private labs). The findings of the present study suggest that an additional measure should be considered to help rationalize the backlog testing process. The results indicate that a screening procedure based on victim/suspect relationship should be used to prioritize cases. As was stated throughout this chapter, the vast majority of sexual assaults were committed by someone known to the victim. In these cases, identification is not the key issue because the defense will probably claim that the sexual activity was consensual. The immediate value of DNA evidence in these cases is minimal and, ultimately, the value of the evidence collected will be realized through its addition to the CODIS database (see below).

Thus, based on the study data, two types of cases should receive top priority for testing: stranger-to-stranger rapes should be tested first, and second, incidents in which the victim and suspect have a friendship/acquaintance relationship but the suspect claims that he did not have sexual contact with the victim. Sexual assault cases among known participants in which the suspect claims that sex was consensual should receive the lowest priority (except if a child or young adolescent is the victim). Clearly, there will be exceptions to the recommended prioritization process. Any case that has other forms of evidence (*e.g.*, witnesses, police observation, an arrest in another case) and needs biological confirmation for prosecution, should receive priority. Ultimately, testing all rape kits may best serve the current and future public interest but fiscal and organizational realities dictate that priorities need to be established based on empirical evidence that helps to rationalize the testing process.

Officials must also consider submission of DNA profiles to CODIS databases and the value of linking the suspect's DNA to other offenses (rapes or other crimes) committed by the accused. This may only be possible through a search of the CODIS database. While officials and the general public frequently view the serial stranger rapist in this regard, officials should also consider the possibility that the suspect has committed a series of 'acquaintance' sexual assaults. Linking such multiple offenses together may persuade prosecutors to file charges against an accused who has committed multiple crimes and whose involvement in a single acquaintance rape may not be sufficiently convincing to the prosecutor to proceed. In such cases, it is critical that investigators work with DNA CODIS administrators to be sure legal requirements are met so that the profile can be uploaded and entered into the database. Lastly, entering an individual's DNA into CODIS also holds the possibility of linking an offender to future, unrelated crimes he may commit where he leaves his DNA.

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Chapter VIII

Robbery

There were 1,081 robberies in the sample database. Two-thirds of the victims were male and 93% of the suspects were male (Table 21). The majority (77%) of suspects were less than 30 years old but less than half (43%) of the victims were less than 30 years old. The majority (58%) of the victims Black or White and the overwhelming majority (87%) of suspects were Black or Latino. Los Angeles had a slightly higher percentage of Latino than Black suspects. Approximately three-quarters of suspects were strangers to their victims. A small percentage of victims received medical treatment (10%). Robberies took place primarily on the street (36.4%), in retail stores (21.1%), houses/apartments (17.9%), or in other locations (15.8%) such as hotels and restaurants. Close to half (48.1%) of robberies had witnesses. A low percentage of robbery incidents were cleared by arrest (22.6%). The average time from incident to report of the crime was 2.38 days and the mean time from incident to arrest was 56.16 days.

Physical Evidence Collected, Submitted & Examined

Physical evidence and substrates were collected in 24.8% of robberies (Table 22). Latent prints (9.3%) and Natural/Synthetic Materials (7.8%) were the evidence types collected most frequently. Within the Natural/Synthetic Materials classification, clothing was the primary type of material collected. Both Materials and Objects were the source of a variety of other evidence such as Latent Prints and Biological and Trace evidence. Lastly, Firearms/Weapons were gathered in 5.5% of cases.

Over half (56%) of the collected evidence was not submitted to crime labs. Only 10.9% of incidents had evidence submitted to labs. The primary form of evidence submitted was Latent Prints (8.6%). Natural and Synthetic Materials saw a large decrease, as less than 10% of collected evidence in this category was submitted for examination. Similarly, submitted Firearms/Weapons evidence declined dramatically (70% decrease).

A very high percentage of physical evidence submitted to laboratories was examined (84%). Latent Prints was the overwhelming form of physical evidence examined. Eighty-seven cases with latent prints were examined among all jurisdictions, with the most from Los Angeles and Indianapolis. After Latent Prints, Firearms/Weapons was the next most frequently examined type of evidence (14 cases). In sum, it was only the occasional Latent Print, Firearms/Weapons, and Materials case that was not examined. All of the suspected Drug Evidence (11 cases) was examined.

Examinations led to the identification of particular evidence in 67 cases – mostly Latent Prints (43), Drugs (7), Firearms (4), and various Materials and Trace Evidence. As noted in previous chapters, the identification of this evidence was merely the first step in determining whether the evidence could associate the suspect with the victim or crime scene, or otherwise explain or reconstruct what might have happened at the crime scene. Although the crime being investigated was robbery, the identification of a controlled substance did show the person possessing it was also in violation of the relevant criminal statute. There were a total of 43 cases

Table 21. Descriptive Characteristics of Robbery Incidents (N=1081)

Victim:	
% male	66.6
% < 20	16.4
% 20-29	26.5
% 30+	57.1
White	37.4
Black	20.9
Latino	32.3
Asian	6.5
Other	2.8
Suspect:	
% male	93.1
% < 20	28.3
% 20-29	48.8
% 30+	22.9
White	12.1
Black	60.1
Latino	26.6
Asian	1.0
Other	.2
Victim/Suspect Relationship:	
% intimate/family	6.0
% friend/acquaintance	19.5
% stranger	74.5
% victim received medical treatment	10.0
Crime Location:	
% car	5.0
% bar	1.5
% park	1.7

Table 21 Continued. Descriptive Characteristics of Robbery Incidents (N=1081)

% school	.6
% retail store	21.1
% house/apt.	17.9
% street	36.4
% other (e.g., hotel/motel, restaurant, hospital)	15.8
# of Witnesses:	
% 0	51.9
% 1	29.6
% 2+	18.5
% witness report to police	30.4
% victim report to police	45.8
% arrests	22.6
% DA referral	15.7
% charged	14.1
% convictions	12.6
% arrested within 10 minutes of incident	9.4
time from incident to police report (mean days)	2.38
time from incident to arrest (mean days)	56.16

Table 22. Crime Scene Evidence for Robbery Cases

Evidence Type	N=	Collected		Submitted		Examined	
		n	%	n	%	n	%
Total	1081	268	24.8%	118	10.9%	107	9.9%
Biological		11	1.0%	8	0.7%	5	0.5%
blood		4	0.4%	4	0.4%	2	0.2%
DNA		4	0.4%	3	0.3%	3	0.3%
saliva		2	0.2%	3	0.3%	3	0.3%
urine		0	0.0%	2	0.2%	1	0.1%
biological, other		1	0.1%	0	0.0%	0	0.0%
Latent Prints		101	9.3%	93	8.6%	87	8.0%
fingerprints		93	8.6%	88	8.1%	82	7.6%
palm prints		11	1.0%	8	0.7%	7	0.6%
Pattern Evidence		13	1.2%	2	0.2%	2	0.2%
footprint		4	0.4%	0	0.0%	0	0.0%
footwear		3	0.3%	1	0.1%	1	0.1%
shoe print		5	0.5%	2	0.2%	2	0.2%
tools/marks		2	0.2%	0	0.0%	0	0.0%
tire prints		0	0.0%	0	0.0%	0	0.0%
Firearms/Weapons		59	5.5%	18	1.7%	14	1.3%
gun		19	1.8%	13	1.2%	5	0.5%
bullet		7	0.6%	3	0.3%	3	0.3%
casing		10	0.9%	3	0.3%	3	0.3%
cartridge		14	1.3%	7	0.6%	6	0.6%
other weapons		27	2.5%	4	0.4%	3	0.3%
Natural/Synthetic Materials		66	6.2%	6	0.6%	6	0.6%
binding		13	1.2%	3	0.3%	3	0.3%
clothing		53	4.9%	3	0.3%	2	0.2%
bed/bath		3	0.3%	0	0.0%	0	0.0%
pavement		1	0.1%	0	0.0%	0	0.0%
Generic Objects		35	3.2%	6	0.6%	4	0.4%
vehicle		10	0.9%	1	0.1%	0	0.0%

container	12	1.1%	5	0.5%	4	0.4%
floor	5	0.5%	0	0.0%	0	0.0%
walls	1	0.1%	0	0.0%	0	0.0%
door	7	0.6%	0	0.0%	0	0.0%
window	1	0.1%	0	0.0%	0	0.0%
furniture	2	0.2%	0	0.0%	0	0.0%
Electronic/Printed Data	30	2.8%	4	0.4%	4	0.4%
documents	23	2.1%	4	0.4%	4	0.4%
handwriting	1	0.1%	0	0.0%	0	0.0%
electronics	7	0.6%	0	0.0%	0	0.0%
computer	1	0.1%	0	0.0%	0	0.0%
Trace	30	2.8 %	2	0.2%	2	0.2%
metal fragments	4	0.4%	0	0.0%	0	0.0%
glass	4	0.4%	0	0.0%	0	0.0%
plastic	9	0.8%	0	0.0%	0	0.0%
fibers	1	0.1%	0	0.0%	0	0.0%
paper	8	0.7%	1	0.1%	1	0.1%
cigarette butt	2	0.2%	0	0.0%	0	0.0%
rubber	2	0.2%	0	0.0%	0	0.0%
hair	0	0.0%	1	0.1%	1	0.1%
Drugs	13	1.2%	11	1.0%	11	1.0%
Other	12	1.1%	13	1.2%	13	1.2%

with individualizations of physical evidence, most of it Latent Prints (41) and other material including saliva (2 cases), a shoe print and a cartridge case. Consequently, Latent Print examinations yielded individualizations in about 44% of cases where prints were submitted to the laboratory for examination. Physical evidence provided one exclusion.

Tracking Cases through the Justice System

Figure 9 tracks sampled cases through the criminal justice. Bivariate comparisons were made between cases with/without collected physical evidence and the progress of the case through the justice process. Whereas less than one-quarter (24.8%) of cases had physical evidence and substrates collected, 48.1% of those cases resulted in arrest compared with only 14.1% of cases without collected evidence. The contrasts between rates of arrest with and without physical evidence were substantial and statistically significant ($t=12.33$, $p=.000$). Significant differences also were found for case referral ($t=10.31$, $p=.000$), charging ($t=11.36$, $p=.000$) and conviction ($t=9.82$, $p=.000$). With respect to the percent of cases with physical evidence, robbery is much like aggravated assault – collected at a moderate rate (less than homicide and rape but more that burglary) but its presence seemed to have a broader impact on case movement than seen in other offense types.

Predictors of Criminal Justice Outcomes

Arrest

The data in Table 23 reveal that evidence collected at crime scenes had a significant impact on arrests (odds ratio = 6.54). In particular, firearms and latent print evidence were predictors of arrest (not shown). However, lab submitted evidence was not significant. Similar to other crimes in the study, the likelihood of arrest increased with witness reports and if the robbery occurred among friends/acquaintances. Arrests for robbery also were more likely in Los Angeles compared to the smaller Indiana sites. None of the extralegal factors were significant predictors of arrest.

Explaining the Association between Crime Scene Evidence and Arrest

Figure 10 provides insight into how physical evidence, in combination with other investigative strategies, led to arrests. Of the 129 robbery cases with an arrest, 21 (16.3%) cases had evidence examined prior to arrest. A higher percent of physical evidence cases with an arrest had tangible evidence (17.8%). An additional 22.5% of cases were cleared through direct arrest techniques. Thus, the combination of examined and tangible evidence and direct arrests accounted for 56.6% of arrests. For cases without evidence, 26.1% (30 cases) were cleared through direct arrest techniques. Overall, of the 244 cases with an arrest, 52 cases (21.3%) had laboratory examined evidence, and 21 of those examinations occurred prior to arrest.

The collection of Firearms evidence at robbery scenes was the most visible type of evidence collected. Firearms evidence was also symbolic in that it helped define the seriousness of the crime and that the offender was armed, even before submission and examination of the evidence in the laboratory. However, a relatively small percentage of the evidence was

ultimately examined and an even smaller percentage linked the suspect with the crime scene or victim. The aggregate robbery sample for the five jurisdictions yielded only a single case

Figure 9. Flowchart of Forensic Evidence and Criminal Justice Outcomes for Robbery Incidents

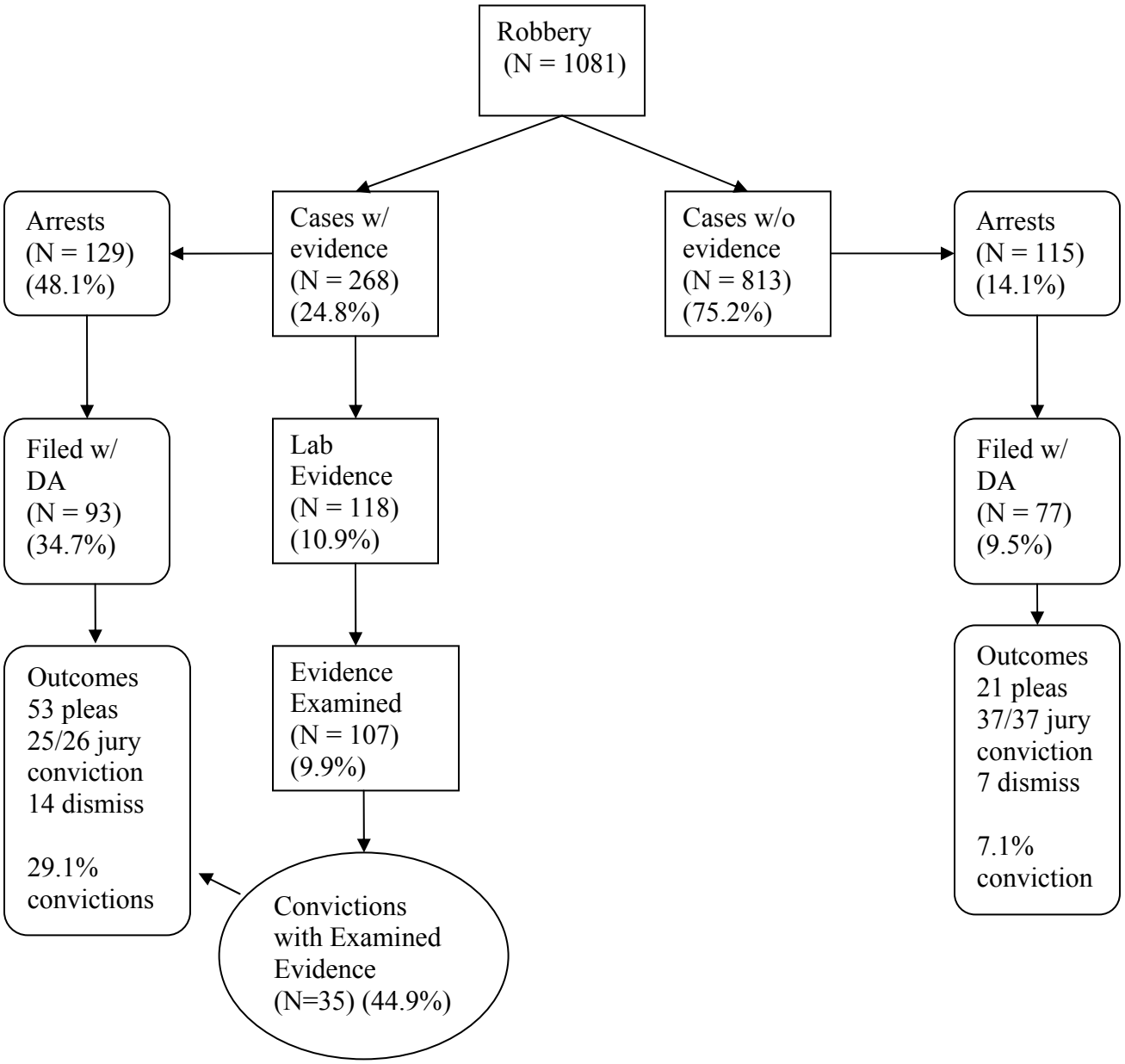
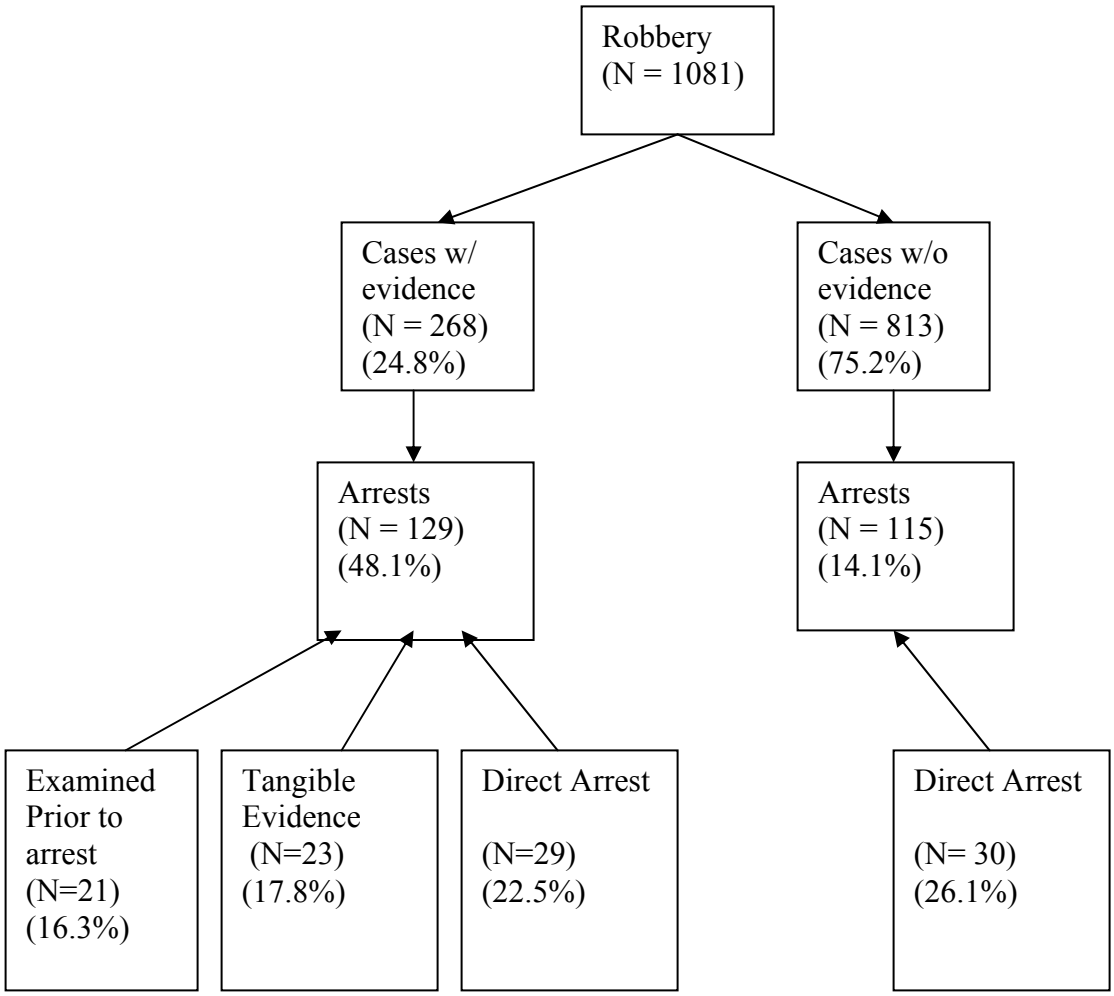


Table 23. Likelihood of Criminal Justice Outcomes for Robbery

	ARREST		REFERRAL		CHARGES		CONVICTION	
	Estimate	Odds Ratio	Estimate	Odds Ratio	Estimate	Odds Ratio	Estimate	Odds Ratio
Witness Reports to Police	.452	1.57*	-.093	.911	2.13	8.37*	-.004	.996
	(.227)		(.412)		(.977)		(1.00)	
Victim Reports to Police	.748	2.11	-.416	.659	2.65	14.18	2.26	9.62*
	(.573)		(1.65)		(1.58)		(1.08)	
Intimate/Family	.607	1.84	-1.03	.359	35.93	4.04*	37.37	1.70***
	(.581)		(1.28)		(.444)		(.638)	
Friend/Acquaintance	1.20	3.32***	-2.28	.103	1.12	3.07	.215	1.24
	(.312)		(1.61)		(1.31)		(1.06)	
Crime Scene Evidence	1.88	6.54***	-.334	.716	2.72	15.15	-1.74	.175
	(.176)		(.725)		(1.61)		(2.90)	
Lab Examined Evidence	1.33	3.77	-.129	.879	.110	1.12	-.316	.729
	(.221)		(.489)		(1.28)		(.939)	
Victim Medical Treatment			.810	2.25	.124	1.13	37.54	2.00***
			(.630)		(.648)		(.409)	
Arrest within 10 Minutes of Crime Incident			.414	1.51	-.480	.619	-1.07	.343
			(.378)		(.495)		(.626)	
Direct Arrest			.179	1.20	.573	1.77	1.55	4.72
			(.423)		(.839)		(.991)	
Los Angeles	1.42	4.11*	.	.	.	.	.	.
	(.621)							
Indianapolis	-.009	.991	.	.	.	.	.	.
	(.244)							
Correction Factor			.982	.374	1.92	6.83	.670	11.14*
			(.896)		(2.08)		(1.15)	
Naglekerke's R-square	.231		.159		.231		.245	

Correction (selection) variables control for the time from the incident to arrest, victim and suspect age, race/ethnicity and sex. All evidence categories were entered individually into each model. Robust Standard Errors are in parentheses. Stranger is the reference category for victim/suspect relationship. Pooled small Indiana sites (Evansville, Fort Wayne, South Bend) is the reference site category. (.) = constant or lack of correlation. * $p < .05$ ** $p < .01$ *** $p = .000$

Figure 10. Flowchart of Forensic Evidence and Arrest Outcomes for Robbery Incidents



Direct Arrest = suspect admission, suspect surrender, suspect apprehended, suspect arrested in another case, police observation, suspect named, traffic stop, recovered property

Descriptive Arrest = vehicle description, citizen observation, photo ID, suspect description, line-up

Tangible Evidence = A physical item of evidence that, without scientific analysis, is of evidentiary value to the case (e.g., stolen property, driver's license)

In which Firearms evidence produced an individualization. It was fingerprint evidence that produced the most individualizations.

Referrals to DA

No variables in the logistic regression model predicted referral.

Charging

Witness reports and intimate/family relationships between victims and suspects increased the odds of DA charges 8.37 and 4.04 times, respectively. None of the various forensic variables predicted charging.

Conviction

Three case characteristic variables were significant predictors of conviction. Victims' reports to police were the strongest predictor (odds ratio = 9.62) of robbery convictions. In addition, cases in which the victim received medical treatment and the victim and suspect had intimate/family relationships were 2.00 and 1.70 times more likely to have a conviction, respectively. Finally, one extralegal variable was related significantly to conviction. Cases with White female victims were more likely to result in conviction.

Seventy-eight of the 93 cases charged, where physical evidence was collected, resulted in conviction (83.9%). Fifty-eight of the 65 cases without physical evidence collected resulted in conviction (89.2%). In all, 35 convictions had physical evidence that was examined in crime laboratories. Overall, only five cases had evidence that linked the suspect to the victim or crime scene. Four of five (80%) of these cases had an arrest, all four cases were referred to and charged by the DA, and 3 cases resulted in convictions (3 pleas). All four cases had latent print evidence.

Plea/Trial

The majority (54.4%) of charged cases were resolved through pleas. Unlike prior offense discussions, however, robberies are notable in having the highest percent of cases adjudicated through trial. A significantly higher percent of cases with crime scene evidence (68%) was resolved through plea compared to cases without evidence (36%) ($t=3.85$, $p=.000$).

Sentencing

The average length of prison/jail terms given to convicted robbery defendants was 75.2 months and the median was 60.0 months. Sentences for plea convictions (66.1 months) were shorter than convictions by trial (91.6 months). The results of the multiple regression analysis (Table 24) indicate that plea conviction was a significant predictor of sentence length. The only other significant variable was that cases with young adult victims (ages 20-29) received longer sentences than cases with older adults (ages 30+).

Table 24. Predictors of Sentence Length for Robbery Convictions

	B	*S.E.*	*Sig.*
Witness reports	24.56	17.01	.152
Victim reports	58.35	84.95	.494
Intimate	14.06	59.94	.815
Acquaintance	- 5.11	24.93	.838
Victim medical treatment	.988	26.36	.970
Suspect arrested within 10 minutes of incident	-10.00	16.00	.534
Public defender	34.10	25.41	.183
Plea bargain	**-74.45**	**24.72**	**.003**
# prior arrests	1.02	1.18	.392
# prior convictions	-.821	1.51	.587
Lab examined evidence	34.31	19.68	.085
Los Angeles	-72.20	93.23	.441
Indianapolis	6.36	28.81	.826
Victim teen	-8.64	24.32	.723
Victim young adult	**36.15**	**17.78**	**.045**
Victim black male	-40.72	26.02	.121
Victim Latino	10.99	24.36	.653
Victim black female	-18.56	33.84	.585
Victim Latina	40.58	37.97	.288
Suspect black male	- .884	20.56	.966
Suspect Latino	10.36	25.89	.690
Suspect black female	74.28	44.04	.095
Suspect Latina	-146.55	230.05	.526
R^2	.334		
Mean sentence (months)	75.19		
Median sentence (months)	60.00		

Hard to Solve Cases

Approximately 64% (N=694) of all robberies in the sample could be termed "hard to solve," stranger-to-stranger crimes with no witnesses. Overall, there were 104 arrests (15%) for hard to solve cases. The rate of arrest for all other cases was 36.1% (t=8.20, p=.000). There were 62 convictions (8.9% of all hard to solve cases), 17 of which had laboratory examined evidence (27.4%). The rate of conviction for all other cases in the sample was 19.1% (74 convictions) (t=4.87, p=.000). Approximately 24% of these cases had lab examined evidence.

Discussion

The study results showed that only 22.6% of robberies resulted in arrests. Robberies were not solved by investigation primarily because of the lack of witnesses and other forms of evidence. The cases that were solved were those where a witness reported the offense to police, those involving acquaintances, and those with physical evidence (primarily latent prints and firearms). When police are conducting investigations, they are heavily dependent on the willingness of victims, witnesses, and area residents to provide information regarding a case, particularly the offender's identity. Robberies typically do not involve physical interaction between offender and victim, and only 10% of robbery victims received medical treatment. In such cases, one would not expect to find or recover the quantity of physical evidence as in cases where there is such interaction. The data support this perspective. Only 25% of the robbery incidents had crime scene evidence collected. In addition, police had difficulty in solving robberies because the victim and offender tended to be strangers. These results support those of D'Alessio and Stolzenberg (2003) and Eitle et al. (2005) who found that incidents between strangers had decreased odds of clearance for robbery. In addition, the study findings are consistent with previous research (D'Alessio and Stolzenberg, 2003; Eitle et al., 2005; Roberts, 2008) that show no significant gender or race/ethnicity effects on clearing robberies.

Unlike rape incidents, where the greatest amount of case attrition resulted from prosecutors' decisions not to accept or charge cases, the steep decline of robbery incidents occurred because few cases had arrests. This does not mean that there was no filtering of cases by police and prosecutors but that the drop-off of cases was less dramatic post-arrest than for other violent crimes. In this regard, the robbery data more closely resemble burglary arrest outcomes than those of assault, homicide or rape. On the other hand, similar to assault and homicide cases, a large majority of robbery arrests were referred to the DA and charged for prosecution.

Finally, the bivariate contrasts of rates of arrest, prosecutor referral, charging and conviction with and without physical evidence were substantial and statistically significant . However, at the multivariate level, with the exception of arrest, forensic evidence was not predictive of successful criminal justice outcomes. Overall, only 11% of the cases had physical evidence submitted to labs and 10% of cases actually had evidence examined by labs. While fingerprint evidence was collected (9.3%) and examined (8.0%) most frequently, firearms evidence was collected (5.5%) in a substantial percentage of cases, but was rarely examined (1.3%). It also appeared that the cases with direct arrests and scientific and tangible evidence in combination led to significantly higher than average rates of arrest. As will be noted in the study

conclusions, the combination of forensic and tangible evidence and mode of investigation is an area meriting additional research. The ultimate value of forensic evidence to an investigation and prosecution is clearly dependent upon these other investigation parameters of a case and all must be included in any treatment of strategies to exploit the available information.

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Chapter IX

Conclusions & Discussion

In spite of the increased attention paid to forensic evidence over the past decade, there is little published empirical data identifying the types of evidence routinely collected, and the extent to which this evidence is submitted to and examined in forensic crime laboratories. There is even less research that describes the role and impact of such evidence on criminal justice outcomes. While the current study shows that forensic evidence can affect case processing decisions, it is not uniform across all crimes and all evidence types; the effects of evidence vary depending upon criminal offense, variety of forensic evidence, the criminal decision level, and other characteristics of the case. The current study attempted to fill this gap in knowledge by examining the role and impact of forensic evidence on five felony crimes across five jurisdictions.

Given the varied nature of the criminal offenses, as well as contextual differences across study sites, the project reached the following conclusions:

1. The study data revealed that the collection of forensic evidence from crime scenes (and victims) was very extensive in homicides and, to a lesser extent, rapes; it was much more limited for assault, burglary and robbery offenses.

2. With the exception of homicides (89%), few of the reported crime incidents had forensic evidence that was submitted to crime laboratories. While the rate of submission of evidence for rape was 32%, submission rates in assaults, burglaries and robberies were under 15% of reported offenses.

3. With the exception of homicides (81%), the overall percent of reported crime incidents that had physical evidence examined in crime labs was low. Less than 20% of rape cases and less than 10% of assault, burglary and robbery incidents had lab examined evidence. Of evidence submitted to labs, however, rates of examination, with the exception of rape cases (58%), exceeded 70%. Consequently, it is clear that criminal justice officials external to the laboratory screen much of the forensic evidence and have a major influence on evidence examination priorities and practices.

4. The most frequently collected, submitted and examined forms of evidence were fingerprints, firearms and biological (blood and semen). For the sites included in this study and for the time period reviewed, DNA testing was rarely performed across all offenses and was concentrated in homicides and, to a lesser extent, rapes.

5. Although rates of arrest and conviction in study sites were low, the study rates were quite similar to national arrest and conviction data (see Table 4).

6. The contrasts between rates of arrest, prosecutor referral, charging and conviction for the crimes of aggravated assault, burglary, and robbery with and without physical evidence

collected were all substantial and statistically significant. For the crime of rape, differences were significant for all decision levels except for prosecutor referral.

7. At the logistic regression level, crime scene evidence was a consistent predictor of arrest across all crimes, but a very low percentage of arrests actually had physical evidence examined before the arrest. The exact role played by forensic evidence at investigation and prosecution levels is complex and dependent upon many factors.

8. Post-arrest, the predictive power of forensic evidence varied by crime type and criminal justice outcome. Lab examined evidence was a significant predictor of case charges for aggravated assault and rape. Forensic evidence also was associated with sentence length for assault and homicide. None of the measures of forensic evidence, however, were significant predictors of case conviction regardless of crime. In all, few independent variables successfully predicted trial/plea outcome largely due to the very high rate in which charged cases resulted in conviction.

9. While collected forensic evidence was a consistent predictor of arrest across all offense types, the other consistent predictors of criminal justice outcomes were typically non-forensic, legal and situational variables: victim and witness reports, victim/suspect relationships, victim medical treatment, and arrest methods.

10. Very few reported crime incidents had forensic evidence that linked a suspect to the crime scene and/or victim (~2% of all cases, 6% of cases with crime scene evidence, and 12% of cases with examined evidence.) In terms of examined evidence, however, those percentages elevate to x% and y%. However, the conviction rate for the cases with linking forensic evidence was significantly higher than cases without such evidence. Furthermore, conviction rates were higher for offenses with two or more forms of individualizing evidence that associated offenders with crime scenes.

The study results were consistent with previous research. Peterson et al. (1987) compared felony case filings from six jurisdictions through a random sampling from three calendar years (1975, 1978 and 1981) in order to assess the rates at which forensic evidence was used and its impact on case outcomes. Similar to the current results, their data indicated that forensic evidence had a significant effect on the clearance rates of assaults, burglaries and robberies. On the other hand, prosecutors preferred the testimony of police investigators and eyewitnesses when making decisions to charge, in part, because laboratory results were unavailable at the time of charging. This was particularly true in sexual assault cases. Where the accused does not deny sexual contact with the victim, the significance of the forensic evidence was largely moot. Prosecutors perceived the value of forensic evidence in acquaintance rape cases to be primarily corroborative of other evidence, and seldom was forensic evidence alone sufficient to convict. However, in cases with a child victim and situations where either the defendant denies having sexual intercourse with the victim or the victim's identification of her assailant is questionable, the laboratory results may be critically important.

The current study findings also replicated Peterson et al.'s (1987) results regarding plea bargaining and sentence length. In both studies, sentences tended to be more severe for trial

convictions than for conviction through plea bargain. Unlike the Peterson et al. findings, however, forensic evidence was not predictive of plea agreements, nor was it associated consistently with sentence length (forensic evidence variables were significant in assault and homicide sentencing models).

In addition, the results confirm the findings of earlier aggregate research (Pare et al., 2007) that the types of crimes that occur in a community affect crime clearance. Consistent with previous research, the study found that property crimes (burglary) were more difficult to clear than violent crimes. Gottfredson and Hindelang (1979) believed that the response of the legal system, including the police, is affected by seriousness of offense. Police put more investigative effort into more serious offenses. Thus, violent crimes should be more likely to be cleared than property crimes and incidents with an injured victim should be more likely to be cleared than incidents with an uninjured victim. Supporting the argument that more serious incidents are more likely to be cleared (Gottfredson & Hindelang, 1979), crime incidents having an injured victim, had greater odds of clearance. Also, consistent with previous findings (D'Alessio & Stolzenberg, 2003; Eitle et al., 2005), odds of clearance in all five study crimes in the present study were much higher when the offender was known to the victim (especially if an intimate or family member) than when the offender was a stranger.

Finally, the findings support Strom & Hickman's (2010) conclusions regarding the processing of forensic evidence. In their study, Strom and Hickman (2010) identify the number and distributions of unsolved homicides (14%), rape cases (18%), and property crimes (23%) in which forensic evidence was not submitted to the crime laboratories for analysis. The study makes the vital point that there are two kinds of backlog in forensic science. First, evidence submitted to crime laboratories might not be processed promptly, which creates a risk of 'justice delayed'. Second, law-enforcement agencies do not always submit forensic evidence from unsolved cases for testing, which creates a risk of 'justice denied'. The results of the present study not only support Strom & Hickman's findings but, in fact, paint a more worrisome picture of the underutilization of forensic evidence. Forensic evidence not only goes unexamined in unsolved cases, but in the vast majority of <u>all</u> assault, burglary, rape, and robbery incidents. Only a small fraction of available forensic evidence present at scenes of serious crime is submitted to forensic crime laboratories and undergoes examination.

A number of reasons have been established as to why evidence might not be submitted to crime labs. Law enforcement might not submit evidence if an investigator questions if a crime has, in fact, occurred and/or if the investigator questions if the case merits full investigation. Investigators may also not submit evidence if a suspect had not been identified, if the investigator believes the case will not be charged by a prosecutor, and because of delays in receiving laboratory results because of long turn around tines. Equally important, even if evidence is submitted, in many cases, the evidence is not analyzed. Data from the present study illustrate, that to a large extent, the decisions to analyze submitted evidence are directly and indirectly affected by a prosecutors' assessments of the case. Implicit prosecutor approval is often needed for investigators to request a laboratory analysis and to avoid what otherwise would be viewed as an unnecessary use of laboratory resources. Investigators and prosecutors perceive laboratory resources as precious commodities that are not to be requested or consumed casually.

Studies of the charging process demonstrate that prosecutors exercise their discretion and reject a significant percentage of cases at screening (Frazier and Haney 1996; Spears and Spohn 1997). This research also indicates that case rejections are motivated primarily by prosecutors' attempts to "avoid uncertainty" (Albonetti 1987) by filing charges in cases where the odds of conviction are good and rejecting charges in cases where conviction is unlikely. These studies suggest that prosecutors' assessments of convictability are based primarily, although not exclusively, upon legal factors such as the seriousness of the offense (Albonetti 1987; Jacoby, et al. 1982; Rauma 1984; Schmidt and Steury 1989), the strength of evidence (including forensic) in the case (Albonetti 1987; Jacoby, et al. 1982; Nagel and Hagan 1983), and the culpability of the defendant (Albonetti 1987; Schmidt and Steury 1989; Swiggert and Farrell 1976). Several studies conclude that prosecutors' assessments of convictability, and thus their charging decisions, also reflect the influence of suspect and victim characteristics. In deciding whether to go forward with a case, in other words, prosecutors attempt to predict how the background, behavior, and motivation of the suspect and victim will be interpreted and evaluated by other decision makers, and especially by potential jurors. As Frohmann (1997:535) notes, "concern with convictability creates a 'downstream orientation' in prosecutorial decision making, that is, an anticipation and consideration of how others (i.e., jury and defense) will interpret and respond to a case."

While forensic laboratories included in the current study did not analyze biological evidence and stains on a consistent basis, Appendix A shows that their use of DNA testing in such cases has grown substantially since 2003. While DNA testing procedures has the potential to individualize evidence and to link offenders to crime scenes and victims (Beaver, 2010), the present study has shown that even cases with strong forensic evidence are subject to investigator and prosecutor screening that assess the credibility of the victim and are amenable to defenses, including consent, that render DNA evidence less dispositive. It may be that stranger property offenses and those where 'touch DNA' is present, may constitute the offense category where DNA will have its major impact in the future.

The views expressed in the Forensic Evidence Processing section of the May 2010 issue of Criminology and Public Policy (Vol. 9, Issue 2) raise some excellent questions that should be reviewed critically by the forensic field. Brief articles addressing unanalyzed evidence (Strom and Hickman, 2010), the independence of crime laboratories (Cowan and Koppl, 2010), and the benefits, imitations and ethical concerns of the searching of DNA databases (Beaver, 2010; Roth, 2010). Increased resources devoted to DNA analysis and database searching can certainly yield important results, but the costs and benefits to the criminal justice process must be assessed carefully. Research may show that the discriminating and individualizing power of DNA evidence has its greatest impact on property crimes and those offenses with high percentages of stranger offenders. Personal crimes of violence and particularly those committed between acquaintances, intimates and family members should be carefully evaluated prior to forensic analysis, because in those offenses DNA individualizing evidence may have limited benefits.

Given the recent economic downturn and the scarcity of resources in the criminal justice system, it is possible that DNA-based cases will displace non-DNA based cases, rather than leading to a dramatic increase in total forensic cases. After all, the criminal justice system has a limited number of police, prosecutors, courtrooms and prisons. Given that prosecutors inevitably

must choose only a fraction of cases to pursue from the greater number available, they may develop a bias toward DNA-based evidence in allocating resources. Thus, prosecutors faced with limited resources will logically prefer those cases in which proof of scientific certainty is readily available, caompared to those that rely only on victim and witness statements. If so, then the typical prosecutor's docket will likely contain a percentage of DNA-based cases disproportionate to the percentage of such cases in the pool at large. In order to achieve such projections, DNA testing must also maintain its current 'gold standard' reputation as the most reliable form of forensic testing. There may also be a reshuffling of resources devoted to forensic analysis away from the forensic testing of evidence in cases where consent becomes the primary issue of legal dispute.

Social Science/Forensic Science Research Needs

In closing, the present NIJ project has also led the researchers to identify ten follow-up research projects that would further inquiries into the role and impact of forensic evidence in the judicial system.

1. This research should be replicated and refined in other jurisdictions around the nation. In particular, studies should expand and strengthen their qualitative components as they assess decision processes at important criminal justice decision levels.

2. The filtering of forensic evidence, from collection at the crime scene to ultimate usage by investigators and prosecutors, requires additional study. The tracking of evidence utilization in various offense categories should expose factors that shape decisions to collect evidence, submit it to laboratories, and to request examination.

3. A major finding of the study was that most evidence goes unexamined, but its presence in cases was associated with arrest and movement of cases through the justice process. Added studies are needed to review how unexamined forensic and tangible evidence teams with other conventional investigative procedures to lead to arrests.

4. Cost studies, much like that completed by Roman et al., 2008, are needed to estimate the costs of various forensic analytical procedures applied to types of physical evidence. Such cost data must be linked to studies that determine the value of forensic investigations; together, they will constitute a more comprehensive view of such evidence.

5. Improved crime laboratory information management systems (LIMS) that assess the cost and impact of forensic evidence analysis need to be developed, implemented and adopted by crime laboratories around the nation. Such systems will enable the collection of research data on a routine basis of the type described in this study.

6. The present study's finding that two or more forms of individualizing/linking forensic evidence in cases lead to higher rates of conviction should be investigated in additional studies.

7. Alternative systems for evaluating and prioritizing forensic evidence upon its submission to forensic crime laboratories need evaluation. Priority systems must be anchored in

empirical data that have tracked the types of forensic evidence that provide most useful information to investigators and prosecutors in various offense categories.

8. Sexual assault kit backlogs are a serious and pressing problem in many forensic crime laboratories around the nation. Added studies are needed that investigate the reasons for such backlogs, as well as research examining the role examined forensic evidence plays in sexual assault investigations and criteria for assigning priorities to collected evidence.

9. Research studying the submission of biological evidence and forensic DNA analysis in property and personal crimes is needed. The cost and benefits of forensic DNA testing, including inquiries of CODIS database systems, need evaluation for property as well as personal offenses.

10. Additional studies of the role and impact of forensic evidence at the level of adjudication are also needed. The role of the prosecutor in shaping forensic testing policies needs investigation. In particular, the impact of forensic evidence in prosecutors' decisions to take cases to trial vs. offering pleas needs review, as well as the role played by forensic evidence in negotiating pleas and offering charge/sentence bargains.

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APPENDIX A

Unique/Associative Evidence and the Increase in DNA Analysis and Databasing

In addition to the evidence examinations and relationships covered previously in this report, the project also reviewed the types and prevalence of individualized evidence that specifically associated the suspect/defendant to the crime scene and/or victim. The data in the following tables were derived from data collected in 2003 for Los Angeles and Indianapolis and 2003-05 for selected offenses in the smaller Indiana communities. The ability of these laboratories to individualize case evidence and associate suspected offenders with crime scenes and victims has grown dramatically in the past six years through the development of DNA analysis capabilities and the growth of databases. This section will review the ability of the Los Angeles, Indianapolis, and Indiana State Police forensic laboratories to link offenders to their crimes in the present study, but will also briefly describe the growth in DNA testing capabilities of these laboratories in the years since data were gathered for the present study.

Evidence Uniquely Associated Offenders to their Crimes

There were a total of 87 offenses reviewed in the project database that yielded uniquely identified evidence that associated suspects/offenders with the crime scene and or victim (see Table A1, bottom row). Whereas physical evidence may contribute to an investigation and prosecution in many ways, the unique/associative evidence is often times considered the most powerful and telling type of scientific evidence. The uniquely identified or individualized evidence associates an item of questioned evidence (of unknown source) with a standard whose origin is known. In addition, the physical evidence in these 87 cases also associated one or more suspects or offenders with the crime scene or victim. The latent fingerprint, for example, not only was shown to come from a particular individual, but the print was determined to be a suspect's and was found at the crime scene in question (see Chapter II). Or, a spent projectile was found in a victim or at the scene of a shooting that was determined to have been fired from a suspect's weapon. A biological fluid stain may have been discovered in or on the crime victim and, through DNA testing, was found to have originated from a particular person suspected of committing the crime.

Although not shown in Table A1 there were 45 additional instances of evidence being collected and individualized, but it did not associate or link a suspect to the scene or victim. A common situation where this occurs is where the evidence found at the crime scene was the victim's or bystander and, consequently, not that of the suspect's. Latent fingerprint, firearms, and biological evidence all occasionally fell into this category and, although the evidence was individualized, it did not link the suspect to the crime. This is why 'elimination' prints are often taken from victims of crimes and their family members so the latent prints that are developed can be excluded from consideration in a search for the offender's prints.

Table A1 also tabulates the criminal justice outcomes for these offenses. The second 'Totals' column shows the number of cases for which outcome data were present (85). For all such cases we found 70 that resulted in arrest and 55 that resulted in conviction. The bottom third of the table shows that the types of uniquely identified forensic evidence that associated

offenders with the scene/victim fell into the primary categories of biological substances (26 offenses), firearms related evidence (10 offenses), latent prints (46 offenses), and combinations of the above evidence in four additional offenses. There was a single (1) case where trace evidence was individualized and associated the offender to the scene. The table is also divided into cases where a single item (top third of the table) of evidence was found (there were 16 instances in which a single biological stain was individualized and was found to associate the suspect to the scene or victim), and in the middle third of the table where there were two or more types of specific evidence that associated the defendant to the scene. For example, there were a total of ten (10) offenses where two or more different biological stains were individualized and linked the suspect with the scene/victim. There were a total of five offenses where two or more types of firearms evidence were individualized and linked the offender to the crime.

There were almost three times as many offenses (64) where single forms of individualized evidence associated the offender with the crime as where two or more types of that evidence associated the defendant with the crime (23). As mentioned above, another category in the table notes the number of offenses where a combination of evidence types (Combo) was individualized and associated the suspect with the crime scene or victim. There were four (4) such offenses.

The table also presents arrest and conviction data for the offenses in which there was a particular type(s) of individualized associative evidence. Outcome (arrest and conviction) data were available in 85/87 offenses. For the top Biological evidence category, there were 16 offenses where biological evidence was uniquely associative, and there were 15 offenses where case disposition outcome data were available. There were 14 arrests and 11 of the 14 resulted in a conviction for a rate of 78.6%. Latent prints were present in 43 offenses and for which 42 offenses yielded case disposition data. The conviction rate for these latent print cases was 20/29 or 69%. Overall, disposition data were present in 62 offenses were evidence uniquely associated a suspect with a crime. The overall conviction rate was 34/48 or 70.8% for all offenses with a single type of uniquely associated evidence. Rates were slightly higher for biological evidence (78.6%) than for latent prints and firearms.

The middle portion of the table lists offenses in which there were two or more types of forensic evidence present that uniquely associated the offender to the crime. There are a fewer number (23) offenses represented here than in the top portion of the table with single forms of unique/associative evidence. Compared with the categories at the top of the table, there are many fewer latent print cases (3) represented and not as many biological (10) and firearms (5) cases, as well. It appears, then, that single instances of associative latent print evidence appear much more frequently than with multiple forms of that evidence

What is also striking is the difference in conviction rates for these cases. Overall, the conviction rates are substantially higher (22/23 or 95.7%) where two or more individualizations are present that associate the offender to the crime, compared with a single form of individualized/associative evidence noted above where the conviction rate was 70.8%. It appears that gathering more items of a single type of evidence, and more combinations of different types of evidence, that connect the offender to the scene is productive. Although speculative at this stage, it may be that a single form of evidence can be "explained away" by the defendant as

being accidental or some type of error on investigators' part. However, it may be far more difficult to explain two or more forms of evidence that uniquely associate the defendant to the crime.

Subsequent tables show that homicide is the crime category where the greatest number of offenses (43) has one or more categories of forensic evidence that associate the offender to the crime scene (see Table A4). Given the volume of physical evidence collected from homicide scenes it is not surprising that more of this evidence would be found to associate uniquely the defendant with the scene. Homicides also have the greatest variety of evidence available. The conviction rates for homicides with a single type of individualized evidence associating the offender with the crime are 75%. In contrast, a much higher percentage of homicide arrests (94.1%) yielding two or more forms of associative evidence result in conviction.

There were a total of fourteen rapes (Table A5) identified with unique associative evidence, most of which contain biological fluids/stains, along with latent prints. Most (11/14) of these cases had a single type of biological or latent print evidence present. Rapes with a single form of individualizing evidence present resulted in conviction (6/9 or 66.7%) of the time. All three of the rape arrests with multiple forms of individualizing/associative evidence, and for which disposition data were available, resulted in conviction. Sixteen of seventeen burglaries (Table A3) in this review had a single form of individualized associative evidence available (latent prints) but also had one of the lowest rates of conviction (25%). It appears that latent prints as the lone type of physical evidence in burglary cases are seldom sufficient to convict. In contrast, robberies (Table A6), that also had primarily a single form of associative evidence present (10 of 11 cases), namely latent prints, led to convictions an average of 81.8 % of the time. Additional research is needed to determine why the latent print evidence in robberies is associated with such higher rates of conviction. There was a single assault that had latent print uniquely associative evidence present.

It appears that the strategy of locating and examining multiple forms of physical evidence that uniquely associate the defendant with the crime is productive from an investigation and prosecution standpoint. While a single type of evidence, usually a latent fingerprint that associates the defendant to the crime has value, but it appears additional individualized associative evidence results in a higher percentage of convictions.

DNA Analysis Operations

Biological evidence was one of the three principal forms of forensic evidence (along with latent prints and firearms related evidence) that was collected and examined in the study jurisdictions. Biological evidence analysis is also that area of forensic examinations in the various study sites that has grown the most in scope and sophistication in years following the data gathered in this study – principally in 2003. The project team also recognizes that DNA testing was centered mostly in the homicide and rape offense categories during the study and was not particularly widespread in other offenses. For this reason, this additional section has been added to explain how the DNA analytical abilities in the study jurisdictions have grown in the years since the data were gathered for the study.

Analysts from the various laboratories report the advantage of PCR-based STR typing over previous methods. STR typing allows for the analysis of minute samples with highly discriminating results. Additionally, STR typing permits the use of databases for match searches and is amenable to automation, and certain steps have been simplified as a result. However, the entire process, from sample intake to report writing is still lengthy and laborious. This obstacle combined with the limited resources of the laboratories imposes restrictions on the types of crimes that will be worked and the number of samples that will be examined. As in Los Angeles, the Indiana laboratories are practicing case prioritization and sample screening (for the likely probative samples).

The advances in technology since 2003 have expanded the investigative and analytical capabilities of the laboratories in the study. The proven success of CODIS and the present ability to analyze touch and low-copy-number DNA samples has affected practices in the field and at the laboratory. Crime scene personnel are now collecting and submitting samples previous ignored or less considered (e.g., swabbing of steering wheels, cartridge casings, and the mouths of bottles and cans). The advances in analyses seen by the laboratories present a dilemma: current methods allow for the analysis of new types of samples, and this new capability has increased the number of submissions to the laboratories. However, the entire process of DNA typing is still a labor-intensive process, and therefore, the new analytical capabilities have further impacted the caseload and backlog of the forensic laboratories. The practice of case prioritization, sample screening, and sample submission caps are several responses to the challenge made by the labs. Another response is a rethinking of the present case management system and workflow—one analyst from the Indianapolis lab stated that the process is more streamlined than in the past. As with the Los Angeles County crime laboratory, the Indianapolis and Indiana State Police laboratories are faced with increased caseloads as a result of technological advances yet are still hampered by limited resources and labor-intensive techniques.

Los Angeles

The Forensic Biology Section has undergone significant changes in its structure and performance between 2003 and the present. First, the section (operations and laboratory) has moved to the new Hertzberg-Davis Forensic Science Center. The larger office and laboratory space has allowed the section to increase its personnel, both in supporting staff and criminalists. Today, the section has 31 fully trained analysts with 27 serving as bench criminalists and the remaining 4 in other capacities (3 Forensic Biology supervisors and 1 analyst in Operations). By March 2010, the section is expected to have 37 fully trained analysts, of which five will serve as section supervisors. The present caseload is about 4 to 8 cases for conventional serology analysts (not fully trained in DNA) and about 12 to 15 cases per DNA analyst.

In 2003, the section completed 340 conventional serology cases (with an additional 521 cases under a special grant). In the same year, the section completed 89 DNA cases with an additional 141 DNA profiles generated from selected evidence under a special grant. Moreover, the section received 42 offender hits and 37 case-to-case hits on CODIS casework submissions. In 2007, the section completed 323 conventional serology cases and 361 DNA cases. Consequently, it can be seen there was almost a four-fold (363%) increase in DNA cases. In the

same year, the section received 92 offender hits and 18 case-to-case hits on CODIS casework submissions. In the past year alone, from July 2008 to July 2009, the section as a whole completed about 800 forensic biology cases, so the increase in DNA cases continues.

LASD Forensic Biology personnel serve in various capacities and often carry more than one responsibility. Personnel include the section supervisors, the DNA technical leader, the CODIS administrators, the training supervisors, the bench criminalists and the field response criminalists. In response to the continuous technological advances seen in forensic biology, the section recently created a research and development position. The R & D criminalist will evaluate and validate emerging serological and DNA technologies. The technological advances seen in the section include robotic platforms and other instrumentation that further automate procedures for DNA extraction, quantitation and typing. However, many forensic samples are not amenable to current automated procedures, and thus require a manual approach. The increase in automation and sample capacity of current methods has allowed for the batching of samples for mass processing, which is more efficient and economic than the case-by-case approach. Recent advances have also expanded the analytical capability of the section: Y-STR and mini-STR analysis has allowed for the testing of samples previously highly problematic or beyond reach. Additionally, the section is now performing analysis on hard evidence (blood, saliva, etc.) from property crimes in select jurisdictions, and is receiving a 74% offender hit match on CODIS submissions. The section has also seen in recent years an increase in political pressure and public scrutiny on the operations of the laboratory, which has influenced its conduct.

Indianapolis-Marion County

In Indianapolis-Marion County Forensic Services Agency has continued to grow in size and complexity since 2003 when data were gathered for this project. Overall, the laboratory has increased to 68.6 full time equivalent personnel, up from 54.2 in 2004, the earliest year for which staffing data was available. The I-MCFSA budget has steadily increased in recent years, reaching $7.2 million in 2008. The laboratory is ASCLD accredited and in addition to supplying full criminalistics services (firearms, trace, latent prints, questioned documents, drug chemistry, trace, and biology) also maintains a crime scene unit of 18 crime scene specialists and 4 evidence technicians.

The Biology Unit, consisting of DNA analysis and serology, has grown to 10 analysts. The DNA Section develops DNA profiles from crime scene samples for comparison with known standards from suspects, and for submission into the Combine DNA Index System (CODIS). All DNA cases begin with the examination of evidence by forensic examiners in the Serology Section where they scan the evidence using visual, microscopic, and chemical techniques in a search for potential biological stains. If found, sample stains are documented and prepared for the DNA Section. This may involve a check of clothing, bedding, weapons and other forms of evidence for stains that are routed to the DNA Section. Case submissions and completions in the DNA section have grown dramatically -- from 15 cases in 2004 to 171 cases in 2007. In fact, the number of DNA case completions increased to 305 in 2008 which represents more than a 20 fold increase over 2004. Compared with 5 DNA CODIS hits in 2005, the agency recorded 39 CODIS hits in 2008, including 9 homicides, 11 rapes, 6 robberies and 11 burglaries.

Indiana State Police (Evansville, Fort Wayne, and South Bend (Lowell))

At year-end 2007 the Laboratory Division of the Indiana State Police had grown to a total of 180 scientists and support staff. Also significant was the opening of the new, state of the art Indianapolis Regional Laboratory in 2007. Throughout the three regional and central Indianapolis laboratories in the state, Biology section analysts had grown to 51, up from 25 analysts in 2003. There were three Biology analysts in Evansville, three in Fort Wayne, and seven in Lowell (South Bend), and thirty-eight analysts in the central laboratory in Indianapolis. Overall, completed scientific cases throughout the system increased from 12,867 cases in 2003 to 14, 239 cases in 2007, an increase of 10.6%. Backlogged cases throughout the system were reduced in that same time period from 9,274 cases to 2,655 cases.

The Forensic Biology Section provides for the determination and identification of body fluids, DNA extraction, amplification and typing, and DNA profile comparisons and statistical analyses, as well as maintenance of searches of the offender database. Statewide, the Biology Section completed 3,543 cases in 2007, up from 1,304 cases in 2003. The biggest caseload increase occurred in the central Indianapolis laboratory whose cases completed rose from 595 cases in 2003 to 2,803 cases in 2007, almost a five fold increase. DNA casework in the regional laboratories also increased with DNA cases performed in Evansville increasing from 85 in 2003 to 194 in 2007, Fort Wayne increasing from 83 in 2003 to 156 in 2007, and in Lowell (South Bend) increasing from 78 in 2003 to 126 in 2007.

In 2007, a staff DNA database was established, including 239 current and former Indiana State Police employees and vendor laboratory employees. This database is regularly searched against forensic casework profiles to ensure contamination has not occurred and that unknown profiles are in fact from designated criminal investigations. The laboratory system continues to outsource DNA analyses to Strand Analytical Laboratories, and 44,000 new offenders were profiled in 2007 and added to the database. While the number of CODIS hits hovered around 100 for each of the previous four years going back to 2003, the number of CODIS hits increased to 442 in 2007, with about three-quarters of them State forensic and offender hits.

DNA Individualizations

Project staff also totaled the number of biological evidence DNA individualizations in all randomly selected offenses examined in the project (Table A7). The reader can see there were a total of 75 offenses in which DNA individualizations were reported, regardless of association value discussed previously. The great majority of DNA individualizations, 55 offenses (73.3%), occurred in homicides. The 55 homicides in which DNA individualizations were reported represented 13.8% of the 400 homicide cases sampled. Rape offense DNA individualizations were the next largest group representing 20% of all DNA individualizations. DNA individualizations were reported in 15/602 or 2.5% of rape offenses. The remaining five DNA individualizations (6.7%) were reported in robberies, burglaries and aggravated assaults.

Table A1 Combined Data From All Offenses

# Item(s) of Unique Assoc. Evid	Evid. Type	Totals(all)	Totals	Arrest	%	Conviction	%
One	Bio	16	15	14	93.33	11	78.57
	Firearms	5	5	5	100.00	3	60.00
	Latents	43	42	29	69.05	20	68.97
Sub Total		64	62	48	77.42	34	70.83
Two or more	Bio	10	10	9	90.00	9	100.00
	Firearms	5	5	5	100.00	4	80.00
	Latents	3	3	3	100.00	3	100.00
	Trace	1	1	1	100.00	1	100.00
	Combo	4	4	4	100.00	4	100.00
Sub Total		23	23	22	95.65	21	95.45

Total Bio		26	25	23		20	
Tot Firearms		10	10	10		7	
Total Latents		46	45	32		23	
Total Trace		1	1	1		1	
Total Comb		4	4	4		4	
Grand Total		87	85	70	82.35	55	78.57

TABLE A2
ASSAULT UNIQUE ASSOCIATIVE EVIDENCE

# Item(s) of Unique Assoc. Evid	Evid. Type	Totals (all)	Totals	Arrest	%	Conviction	%
One	Latents	1	1	1	100.00	1	100.00
Sub Total			1	1	100.00	1	100.00

					Average		Average
Total Bio							
Tot Firearms		0	0	0		0	
Total Latents		1	1	1		1	
Total Comb		0	0	0		0	
Grand Total		1	1	1	100.00	1	100.00

*Arrest and Conviction totals and percentages only calculated for cases with known outcomes.

*No Evansville unique assoc. evid. And all LA cases had unknown dispositions.

TABLE A3
BURGLARY UNIQUE ASSOCIATIVE EVIDENCE

# Item(s) of Unique Assoc. Evid	Evid. Type	Totals (all)	Totals	Arrest	%	Conviction	%
One	Latents	16	15	8	53.33	4	50.00
Sub Total			15	8	53.33	4	50.00
Two+	Bio	1	1	0	0.00	0	0.00
Sub Total			1	0	0.00	0	0.00

					Average		Average
Total Bio		1	1	0		0	
Total Latents		16	15	8		4	
Grand Total		17	16	8	26.67	4	25.00

*Arrest and Conviction totals and percentages only calculated for cases with known outcomes.
*South Bend had no burglaries with unique evidence.

TABLE A4
HOMICIDE UNIQUE ASSOCIATIVE EVIDENCE

# Item(s) of Unique Assoc. Evid	Evid. Type		Totals	Arrest	%	Conviction	%
One	Bio	7	7	7	100.00	6	85.71
	Firearms	5	5	5	100.00	3	60.00
	Latents	13	13	8	61.54	6	75.00
Sub Total		25	25	20	80.00	15	75.00
Two+	Bio	7	7	7	100.00	7	100.00
	Firearms	5	5	5	100.00	4	80.00
	Latents	3	2	2	100.00	2	100.00
	Combo	3	3	3	100.00	3	100.00
Sub Total		18	17	17	100.00	16	94.12

					Average		Average
Total Bio		14	14	14		13	
Tot Firearms		10	10	10		7	
Total Latents		16	15	10		8	
Total Comb		3	3	3		3	
Grand Total		43	42	37	94.51	31	85.82

*Arrest and Conviction totals and percentages only calculated for cases with known outcomes.

TABLE A5
RAPE UNIQUE ASSOCIATIVE EVIDENCE

# Item(s) of Unique Assoc. Evid	Evid. Type	Totals (all)	Totals	Arrest	%	Conviction	%
One	Bio	8	7	6	85.71	4	66.67
	Latents	3	3	3	100.00	2	66.67
Sub Total			10	9	90.00	6	66.67
Two+	Bio	2	2	2	100.00	2	100.00
	Bio/Latents	1	1	1	100.00	1	100.00
Sub Total			3	3	100.00	3	100.00

					Average		Average
Total Bio		10	9	8		6	
Tot Firearms							
Total Latents		3	3	3		2	
Total Comb		1	1	1		1	
Grand Total		14	13	12	96.43	9	83.33

*Arrest and Conviction totals and percentages only calculated for cases with known outcomes.

*The only Evansville case with unique assoc evid had an unknown disposition.
Fort Wayne had no cases with unique assoc
evid.

TABLE A6
ROBBERY UNIQUE ASSOCIATIVE EVIDENCE

# Item(s) of Unique Assoc. Evid	Evid. Type	Totals (all)	Totals	Arrest	%	Conviction	%
One	Bio	1	1	1	100.00	1	100.00
	Latents	10	10	9	90.00	7	70.00
Sub Total			11	10	90.91	8	80.00
Two+	Trace	1	1	1	100.00	1	100.00
Sub Total			1	1	100.00	1	100.00

					Average		Average
Total Bio		1	1	1		1	
Tot Firearms			-	-		-	
Total Latents		10	10	9		7	
Total Trace		1	1	1		1	
Grand Total		12	12	11	96.67	9	90.00

*Arrest and Conviction totals and percentages only calculated for cases with known outcomes.
*No robbery cases with unique evidence for South Bend

TABLE A7 Total number of cases involving uniquely identified DNA (biological evidence)

Site	Crime	Total	Site Total
EV	HO	6	
	RA	3	
	RO	2	11
	BU	0	
	AS	0	
FW	HO	8	
	RA	0	
	RO	0	9
	BU	0	
	AS	1	
IN	HO	5	
	RA	1	
	RO	0	8
	BU	1	
	AS	1	
LA	HO	24	
	RA	2	
	RO	0	26
	BU	0	
	AS	0	
SB	HO	12	
	RA	9	
	RO	0	21
	BU	0	
	AS	0	

Crime Total	
HO	55
RA	15
RO	2
BU	1
AS	2
Grand Total	75