The Influence of Forensic Evidence on the Case Outcomes of Rape Incidents*

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The study focuses on the influence of forensic evidence on the processing of rape incidents. It utilizes a prospective analysis of official record data that followed cases from the time of police report to final criminal disposition. The results indicate that forensic evidence is auxiliary, occasional, and non-determinative in the majority of rape cases. Victim willingness to testify and injuries to the victim are the strongest predictors of case outcomes. Additionally, the study finds that the relationship between the victim and suspect does not affect the likelihood of charging or conviction.

In 1971 Susan Griffin (1972) called rape the "all-American crime." Rape is one of the most frequently committed violent felonies. However, it is also one of the most underreported. Data from the U.S. Department of Justice (2005) estimate that 60 percent of rapes go unreported. And, of those rapes that are reported, there is a lower conviction rate than for many other violent crimes (Campbell, 2008; Spohn, 2008). In the face of these dismal attributes is an emerging belief that scientific technology will transform the criminal investigation and adjudication of rape incidents, increasing the chances of identifying and convicting offenders. For instance, there are hopes that the DNA analysis of biological fluids and stains will increase the ability to link offenders to their victims with high statistical probability. Furthermore, it is presumed that in cases of stranger rape, DNA analysis, in conjunction with CODIS (Combined DNA Index System), holds the potential to connect otherwise unknown assailants with their victims through an examination of biological evidence left behind on the victim, on his or her clothing, or at the scene.

Despite significant scientific advancements as well as a substantial growth in forensic services (Durose, 2008), little published research exists on the use and impact of forensic evidence in rape cases. Therefore, and to a great extent, the inherent value of forensic evidence for improving case outcomes remains an assumption that needs to be assessed (Pratt et al., 2006). This need was recognized by the National Institute of Justice (NIJ). In 2006 they sponsored a research program to investigate the role of scientific evidence in criminal case processing. As part of the NIJ effort, data were collected on recorded rape incidents. The present study reports on the influences of

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extralegal and legal factors on the progression of rape cases through the various stages of the criminal justice process. Unlike prior studies, it includes a detailed examination of the specific role played by forensic evidence in the handling of rape incidents.

INFLUENCES ON RAPE CASE OUTCOMES

Since the 1980s, rape studies consistently demonstrate that legal factors, such as weapons use, sustained injuries, and forensic evidence, are more important than victim and assailant characteristics in moving cases through the criminal justice process. This finding remains constant in studies of arrest (LaFree, 1981), investigation (Frazier and Haney, 1996), charging (Campbell et al., 2009; Frazier and Haney, 1996; Spohn, Beichner, and Davis-Frenzel, 2001; Spohn and Holleran, 2004), prosecution (Campbell et al., 2009; Gray-Eurom, Seaberg, and Wears, 2002; Kingsnorth, McIntosh, and Wentworth, 1999), conviction (Campbell et al., 2009), and sentencing (Feldberg, 1997; Kingsnorth, McIntosh, and Wentworth, 1999). Despite the strength of this finding, research also suggests that legal factors may be trumped by any doubts that law enforcement and prosecutors might have regarding the victim's perceived credibility (Spears and Spohn, 1997).

The literature also suggests that the influence of any and all factors varies with the stage of criminal case processing. For example, the willingness of a victim to undergo a sexual assault examination increases the perceived credibility of the victim and the likelihood of arrest and charging (Alderden, 2009; Bouffard, 2000; McGregor, DuMont, and Myhr, 2002). Bouffard's (2000) investigation of 326 rape cases finds that submitting to a rape kit examination increases the believability of the victim, the likelihood that the case would remain open, and the probability of an arrest. Alderden (2009) demonstrates that the presence of either victim injuries or witness reports increases the probability of an arrest. Additionally, the presence of an assailant's DNA taken from a rape kit, even without the identification of a suspect, contributes to case clearance as well as to its presentation to the prosecutor (Alderden, 2009).

During the prosecutorial stage, the issue of victim credibility appears, again, to be a very important factor in determining whether a case will continue through the criminal justice process. Threats to victim credibility are found to thwart case progression. Credibility is put at risk when there is evidence of victim substance use at the time of the rape (Campbell, 2008; Campbell et al., 2009; Spohn and Holleran, 2001; Spohn and Spears, 1996; cf. Frazier and Haney, 1996) and when cases involve younger victims. In terms of the latter instance, credibility is often questioned by district attorneys who suspect that the reported rape is fabricated to hide consensual sexual activity (Kingsnorth, MacIntosh, and Wentworth, 1999; Spears and Spohn, 1997; Spohn and Spears, 1996; cf. Campbell et al., 2009). Further tarnishing the potential credibility of a victim is the relationship that she or he has with the suspect. Several studies find that prosecutors are less likely to file charges if the victim is known to the offender (Albonetti, 1987; Simon, 1996; Spohn and Holleran, 2001). They suggest that a prior relationship with the suspect may raise questions about the truthfulness of the

victim's story or may lead the victim to refuse to cooperate as the case moves forward (Myers and Hagan, 1979; Vera Institute of Justice, 1981). Apart from the issue of credibility and in contrast to predictors of arrest, some studies find that victim injuries do not increase the chances of charges being filed by the prosecutor (McGregor et al., 1999). And there appears to be no literature pointing to a relationship between the availability of forensic evidence and the issuance of a charge.

The impact of forensic evidence receives more consideration in research on adjudication and sentencing. Nonetheless, the results are equivocal. Feldberg's (1997) examination of the extent to which medical testimony addressing rape kit evidence (presence of semen, penetration, physical/emotional trauma) affects adjudication and sentencing suggests that it does not contribute to guilty verdicts or to the severity of sentences. Similarly, Ingemann-Hansen et al. (2008) found that forensic-evidence factors did not contribute to conviction in a study of 277 sexual-violence cases in Denmark. Yet Campbell et al. (2009) observed that medical forensic evidence collected by a nurse in a sexual-assault-examination program accounted for significant unique variance in case outcomes, above and beyond other factors, in 137 rape incidents. Overall, it can be said that the literature is mixed in terms of the importance of forensic evidence in the processing of rape cases.

More important, though, and despite these differences, most of the existing literature stops short of tracking the flow of forensic evidence across the entire criminal justice process. Thus, the results obtained by prior research do not provide a complete picture of rape case processing or of a full range of factors that might influence its progression. The current study fills this gap in the literature by including a prospective analysis of official record data that follows rape cases in two jurisdictions from the time of a police incident report to final disposition. Furthermore, in addition to considering the legal and extralegal factors that are found currently in the literature, the present study also includes various and very specific measures of forensic evidence. Thus, the current study considers the presence and type of crime scene evidence (i.e., biological, latent prints, pattern evidence, firearms, natural and synthetic materials, generic objects, drugs); whether it was submitted to the crime laboratory or examined by the laboratory; and whether the evidence linked the suspect to the crime scene, victim, or both. Additionally, the study follows the sample of rape cases from incident report to final outcome and documents those factors that predict progression from one stage to the next and, finally, for the relatively small number of cases remaining at the end of the process, to conviction.

DATA AND METHODS

The present study used a prospective analysis of official record data on rape cases committed in Los Angeles County and Indianapolis, spanning the time of police incident report to final criminal disposition. These sites were selected as part of the larger National Institute of Justice (NIJ) study to provide geographic (e.g., county and city

crime-laboratory services) and demographic diversity (e.g., LA County: 48 percent Latino, 9 percent black, and 13 percent Asian vs. Indianapolis: 4 percent Latino, 25 percent black, and 1 percent Asian). It is important to note that the study sites are just 2 of 389 publicly funded crime laboratories in the United States (Durose, 2008). In 2005 the nation's forensic crime laboratories received evidence from an estimated 2.7 million criminal investigations and employed an estimated 11,900 full-time personnel. About half of full-time crime-laboratory employees worked in state laboratories. The median budget among these laboratories was $1.7 million (Durose, 2008).

With regard to the study sites, the Los Angeles Sheriff's Department (LASD) Scientific Services Bureau (SSB) Crime Laboratory 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 LASD. As of 2006, the SSB had a staff of 123 testifying analysts and 92 support personnel. The SSB has 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 and receives over 70,000 evidence submissions annually.

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. In 2006 the agency had a budget of approximately $4.7 million with 62 full-time employees. The IMCFSA receives approximately 47,000 evidence submissions annually (see NIJ Final Report for a detailed description of the study sites, http://www.ncjrs.gov/pdffiles1/nij/grants/-23 977.pdf).

Sample Design. Data analyses were based on a random sample (45 percent) of the population of reported rape incidents, stratified by site, for the year 2003. The total number of rape incidents was 381 (Los Angeles County, N=231, and Indianapolis, N=150). Cases involving juvenile suspects were eliminated from the data set due to the lack of access to their prosecutorial files. Although data collection began in 2006, the study year 2003 was selected so as to maximize the likelihood that cases would have reached their endpoints and data on their processing would be most complete.

Variables and Measures. Descriptive and impact data were collected from three sources: police incident and investigation reports, crime lab reports, and prosecutor case files. Permission to access these data files was granted by the respective sheriff/chief of police, crime laboratory director, and district attorney in each site. Table 1 illustrates the key legal and extralegal variables and their measures. In addition, various measures of forensic evidence were included in the analyses. Specifically, the current study focused on biological, fingerprint, pattern, firearms/weapons, natural and synthetic materials, generic objects, electronic/printed data, trace, and drug evidence as well as various substrates contained within each of these categories. The

Table 1
Key Study Variables

Variables	Measures
Forensic	
crime scene location(s)	specific locations (e.g., bar, car, park, house)
Types of evidence and 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
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
Number of eyewitness(es)	1=0 2=1 3=2+
Victim reports to police	1=yes 0=no
Witness reports 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
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
Attorney type	1=private counsel 0=public defender
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 convictions	total number

types and quantities of physical evidence collected at crime scenes were identified by reviewing police reports. It is important to note that no attempt was made to assess, independently, whether there was physical evidence at crime scenes that was present, but not collected.

Analytical Strategy. Criminal case processing resembles a funnel in which a large number of cases enter the system but few remain at the point of conviction. This is especially true of rape cases as they suffer from significant criminal case mortality. Consequently, and to maintain statistical power across all analyses, the current study used pooled data across the two sites. By using pooled data, the study was unable to parse out site-specific factors that might have influenced case-processing outcomes. Thus, the study did not address the impact that differences in jurisdictional context, i.e., police culture, prosecutorial attitudes towards rape, and sentencing guidelines, might have had on case processing. Instead, analyses included only a dummy coded variable for the sites (i.e., 1=Los Angeles 0=Indianapolis).

The study explored the effects of forensic evidence on four different rape incident outcomes: 1) whether a reported incident resulted in an arrest, 2) whether an arrested case was referred to the prosecutor, 3) whether the district attorney formally charged the suspect (or suspects), and 4) whether a prosecuted defendant was convicted. Since each of the four outcomes is binary, the models used logistic regression analysis.

The Correction of Selection Bias. Criminal justice case processing can be thought of as a multistage process. First, there is the decision to arrest a suspect. Second, if an arrest occurs, a decision is made on whether to refer the case to the prosecutor. Next, there is a decision as to whether to issue a charge. If charged, the case continues through adjudication to the point where decisions are made regarding acquittal or conviction. Methodologically, there are three problems with simply treating these decision points as separate instances. For one, by doing so, each phase of the case process is left disconnected, while in practice a decision at one stage affects the next. Second, separate results make it difficult to reach summary judgments about the overall influence of explanatory variables. And third, the parameter estimates for the separate analysis of each decision point will be biased (Berk, 1983; Heckman, 1979).

For example, the decision to refer a case to the district attorney results in a selected pool of suspects who have exceeded a threshold on the criteria that determine the choice of case referral. When such a 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 case referral to the district attorney (for all arrested suspects), formally filed charges (for all case referrals), and prosecution (for defendants with formal charges and then entering the likelihoods (i.e., inverse Mills ratio) calculated from these equations into the appropriate models.

Analytical Models. As discussed above, the Heckman two-stage correction estimate was used to analyze criminal justice outcomes. The first step applied probit analyses to estimate selection into the respective processing stage (i.e., the selection models). Likelihood estimates (inverse Mills ratio) were subsequently employed in the stage-2 logistic regression models (the substantive or outcome models) to correct for selection bias. The predictors used in the selection models (stage-1 probit models) are outlined below.

Predictors for the Selection Models

Arrest	**Referral**	**Charged**
Witness reports	Witness reports	Witness reports
Victim reports	Victim reports	Victim reports
Intimate/family	Intimate/family	Intimate/family
Friend/acquaintance	Friend/acquaintance	Friend/acquaintance
Crime scene evidence	Crime scene evidence	Crime scene evidence
Time incident to report	Time incident to arrest	Time incident to arrest
	Direct arrest	Direct arrest

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-2 (i.e., outcome model) estimates.

In addition, it is important to note that when there is overlap in the predictors 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 present study, the concern is with the collinearity between one particular regressor (the inverse Mills ratio) and the other predictor variables. As explained by Belsley, Kuh, and 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 VIFs 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 VIFs for each model. In each case, the VIF value between the correction factor and the respective predictor variables did not exceed 2.5.

As mentioned previously, data for this study came from a larger project sponsored by the NIJ that 1) estimated the percentage of crime scenes from which one or more types of forensic evidence were collected; 2) described the kinds of forensic evidence collected at crime scenes; 3) tracked 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) assessed the impact of forensic evidence on case-processing outcomes. In the current study, presentation of data related to these goals proceeds as follows. First, descriptive statistics associated with the first three goals are presented in Tables 2 and 3. Next, Figure 1 presents a general picture of case processing. Finally, to assess the effect of forensic evidence on case outcomes, a series of logistic regression equations (Tables 4 and 5) are employed utilizing the Heckman estimation procedures.

RESULTS

The database included 381 randomly selected rape incident reports (see Table 2). All of the victims were female and all of the suspects were male. The majority of the victims were minorities, although 41 percent of the victims were white. The majority of suspects were black (44 percent) or Latino (31 percent). With regard to age, victims tended to be in their teens or in their twenties. On the other hand, a large percentage of suspects were 30 years of age or older (45 percent). The overwhelming majority of rapes were among people who knew each other, either as intimates/family (45 percent) or as friends/acquaintances (35 percent). Victims received medical treatment for their injuries in 63.5 percent of cases. Two-thirds of rapes occurred in residential settings. There were very few witness reports to the police (16 percent), but 49 percent of rape cases had a victim who participated in police and prosecutorial investigations. Fifty-nine percent of rape incidents resulted in an arrest but only 13 percent of cases had a conviction. Of the 226 cases with an arrest, 13.1 percent (N=30) of arrests occurred within ten minutes of reports of the incidents. In 88 percent of these 30 cases, the victim knew the suspect, and therefore, was able to identify the perpetrator. Thus, the average time it took for the victim to report the incident to the police was approximately four days and the mean time from report to arrest was about three days. For the entire sample, the average time it took for the victim to report the inci-

Table 2
Descriptive Characteristics of Rape Incidents (N=381)

Victim	
% female	100
% < 20	45.8
% 20-29	24.6
% 30+	30.6
White	41.2
Black	31.5
Latino	25.8
Asian	1.5
Suspect	
% male	100
% < 20	18.8
% 20-29	36.3
% 30+	44.9
White	24.2
Black	43.7
Latino	30.6
Asian	1.6
Victim/Suspect Relationship	
% intimate/family	45.4
% friend/acquaintance	35.4
% stranger	19.2
% victim received medical treatment	63.5
Crime Location	
% car	9.3
% bar	1.0
% park	4.4
% school	1.9
% retail store	1.0
% house/apt.	64.9
% street	8.0
% other (e.g., hotel/motel, restaurant, hospital)	9.5
# of Witnesses	
% 0	76.1
% 1	12.2
% 2+	11.8
% *witness report to police*	16.3
% *victim report to police*	49.1
% *arrests*	59.3
% *DA referral*	34.9
% *charged*	15.7
% *convictions*	12.9
% *arrested within*	10
minutes of incident	13.1
Time from incident to police report (mean days)	8.77
Time from incident to arrest (mean days)	42.08

dent to the police was almost nine days and the mean time from report to arrest was approximately forty-two days.

Forensic Evidence Collected, Submitted, and Examined. Forensic evidence and substrates were gathered in almost 60 percent of rape incidents (see Table 3). Biological evidence was the primary type of evidence collected (47 percent). Sexual assault kits (the principal form of biological evidence collection) were used in 46 percent of incidents. Natural and synthetic materials were collected in 38.8 percent of the cases, predominately as found on clothing (35 percent). Clothing was also the main substrate used by crime laboratories to locate stains and other biological materials. In 8 percent of the cases, bed and bath materials were collected but latent prints,

trace evidence, generic objects, and firearms/weapons rarely were recovered. The data suggest that latent prints were submitted for laboratory examination more often than they were collected (see Table 3). However, it is often the case that print evidence is not identified by name in the case file until the evidence/substrate is submitted to the laboratory and a specific request is made to find and compare the prints to others retrieved or contained in an electronic database.

The data reveal a dramatic decline (approximately 43 percent) in volume between evidence that was collected and that which was then submitted to crime laboratories for examination (see Table 3). The largest decline occurred between the collection and submission of evidence from sexual assault kits (44 percent). Only 53 percent of submitted evidence was actually examined by the laboratories (see Table 3). Again, this decline was greatest for sexual assault kits. Several forms of submitted evidence were more routinely examined, including semen, vaginal, blood, and latent print evidence.

Tracking Cases Through the Criminal Justice System. Figure 1 tracks rape arrests as they move through the justice process, controlling for the presence/absence of collected forensic evidence. Bivariate contrasts between rates of arrest with and without forensic evidence indicate that cases with crime scene evidence were more likely to have arrests than cases without evidence ($t=3.52$, $p=.000$). There were also significant differences between the two groups in terms of charging ($t=2.67$, $p=.008$) and conviction ($t=3.09$, $p=.002$). The percentage of cases referred to the district attorney, though, was not significantly different between cases with and without evidence.

The data in Figure 1 clearly highlight the funnel effect of criminal case processing. With regard to cases with forensic evidence, there was a 45 percent decline in the number of arrests actually referred to the district attorney. For cases without evidence the decrease was 33 percent. Cases also were further siphoned off as they moved from referral to charging, with a 46 percent reduction in volume for cases with evidence and 72 percent for those lacking evidence.

Predictors of Criminal Justice Outcomes

Arrest. Three variables were significant predictors of arrest (see Table 4). First, arrests were more likely if the victim reported the incident to the police and participated in the investigation (odds ratio = 24.09). Second, there was a greater probability of arrest when the rape occurred between friends/acquaintances (odds ratio= 12.63). And third, rapes between intimates/family members also significantly predicted arrest (odds ratio=6.77). More important, none of the forensic or extralegal variables predicted arrest.

Referral. The only significant predictor of referral to the district attorney was the study site. Cases from Los Angeles were approximately ten times more likely to be referred than those in Indianapolis. To a large extent, this outcome can be attributed to site differences in the timing of prosecutorial screening. In Los Angeles, cases were screened post-arrest and upon referral to the district attorney's office, while in

Table 3
Crime Scene Evidence for Rape Cases

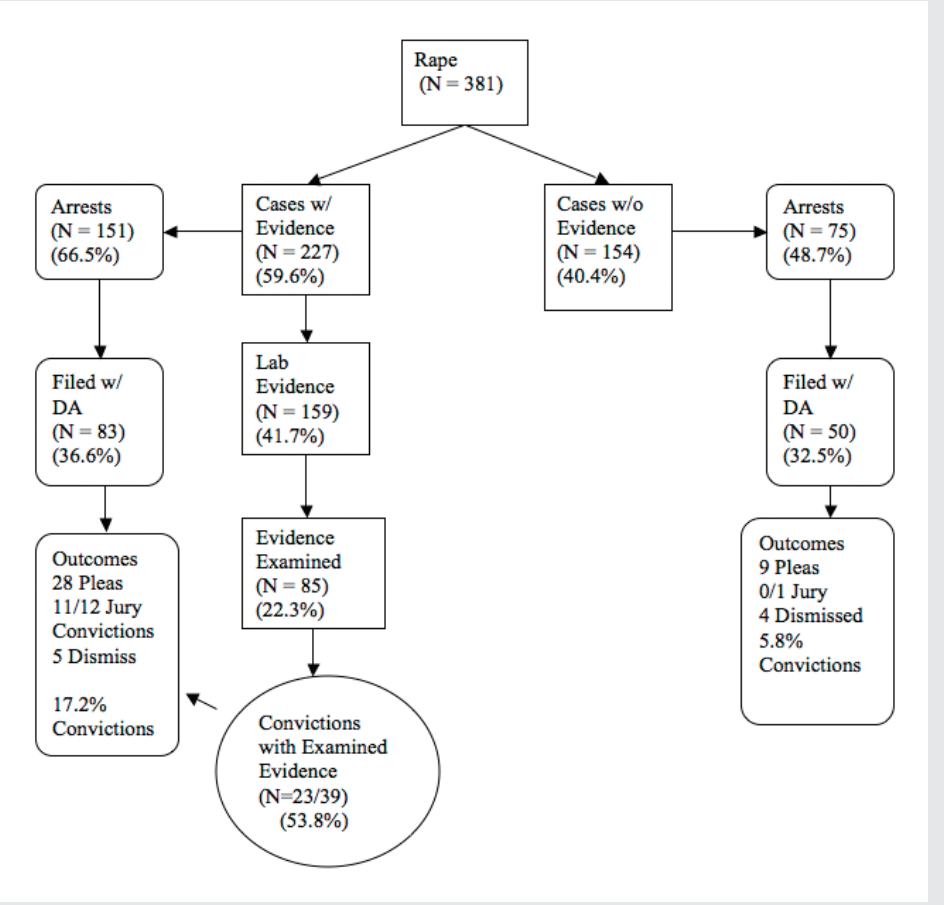
Evidence Type	N	Collected		Submitted		Examined	
		n	%	n	%	n	%
Total	381	227	59.6	159	41.7	85	22.3
Biological (sexual assault kit, blood, semen, DNA, saliva)		178	46.7	125	32.8	54	14.2
Fingerprints		19	5.0	26	6.8	18	4.7
Pattern Evidence (footprint)		4	1.0	1	.2	0	0
Firearms/Weapons (gun and other weapons)		5	1.3	1	.2	1	.2
Natural/Synthetic Materials (clothes, bath and bedding, carpet, bindings)		148	38.8	72	18.9	19	5.0
Generic Objects (vehicle, container, door, walls, furniture)		9	2.4	0	0	0	0
Electronic/Printed Data (documents, computer, phone)		8	2.1	1	.2%	0	0
Trace (hair, paper, glass, cigarette butt), plastic, metal, soil)		17	4.5	17	4.5	5	1.3
Drugs		2	.5	12	3.1	9	2.4

Indianapolis, screening occurred both pre- and post-arrest. Nonetheless, it is important to note that 41 percent of cases with arrests were not referred to prosecutors. Of the cases referred, 94 percent were incidents in which the suspect was known to the victim.

Charging. The strongest predictor of case charging was victim medical treatment (odds ratio = 55.14). This measure can be viewed as a proxy variable for the seriousness of the event, which, in turn, may have increased the prosecutor's belief in the credibility of the victim's statements, as well as enhanced perceptions of the culpability of the suspect. The strength of this variable in predicting the issuance of a charge is supported by findings in prior research. Additionally, the present study showed that the arrest of a suspect within ten minutes of the incident significantly increased the likelihood of a charge (odds ratio = 38.14).

Although analyses indicate that laboratory-examined evidence was almost eleven times more likely to result in the decision to charge, in the majority of cases (66 percent), the decision occurred before laboratory analysis. Thus, the decision was

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



made independently of forensic examination and, as uncovered by the analyses, without evidence linking a suspect to the victim or crime scene. Thus, the data suggest that the decision to test submitted evidence was made by the prosecutors only after the decision was made to charge the case.

Conviction. Overall, 81.4 percent of charged cases resulted in convictions. Of the charged cases with forensic evidence, the conviction rate was 86.7 percent as opposed to 64.3 percent in cases without forensic evidence. The data in Table 5 indicate that the strongest predictors of conviction were the same as for charging: victim's receipt of medical treatment (odds ratio = 18.08) and suspect arrest within ten minutes of the incident (odds ratio = 16.59). Forensic evidence variables were unrelated to conviction.

Table 4
Likelihood of Arrests and DA Referrals for Rape Incidents

	Arrest		Referral	
	Estimate	Odds Ratio	Estimate	Odds Ratio
Witness reports to police	-1.44	.238	-.989	.372
	(1.07)		(.902)	
Victim reports to police	3.18	24.09**	-.434	.648
	(1.01)		(2.39)	
Intimate/Family	1.91	6.77**	1.03	2.79
	(.598)		(1.49)	
Friend/Acquaintance	2.54	12.63***	.498	1.65
	(.655)		(1.08)	
Time to report incident	.009	1.01	.017	1.02
	(.006)		(.013)	
Crime scene evidence	.596	1.81	.530	1.70
	(.452)		(.776)	
Sexual assault kit	.155	1.17	.295	1.34
	(.421)		(.384)	
Los Angeles	-.284	.753	2.33	10.25*
	(.999)		(.757)	
Victim teen	1.61	1.18	.699	2.01
	(.307)		(.431)	
Victim black	.360	1.43	-.106	.899
	(.516)		(.405)	
Victim Latina	.591	1.81	-.112	.894
	(.486)		(.623)	
Suspect black	.581	1.79	.405	1.50
	(.597)		(.504)	
Suspect Latino	.211	1.24	-.109	.896
	(.548)		(.994)	
Victim medical treatment			.283	1.33
			(.380)	
Arrest within 10 minutes of crime incident			-.110	.895
			(.434)	
Probability of arrest			.384	1.47
			(2.98)	
-2 Log Likelihood	380.82***		233.99***	
Cox & Snell R square	.297		.276	

Note: All evidence categories were entered individually into each model. Robust standard errors are in parentheses. Stranger is the reference category for victim/suspect relationship. Indianapolis is the reference site category. * $p < .05$ ** $p < .01$ *** $p = .000$

Table 5
Likelihood of Charges and Convictions for Rape Incidents

	Charge		Conviction	
	Estimate	Odds Ratio	Estimate	Odds Ratio
Witness reports to police	.068	1.07	.684	1.98
	(1.47)		(5.65)	
Victim reports to police	1.32	3.73	2.32	10.18
	(1.87)		(1.67)	
Intimate/Family	5.97	390.16	.961	2.62
	(3.16)		(1.02)	
Friend/Acquaintance	3.54	34.31	.575	1.77
	(2.97)		(1.67)	
Time to report incident	.018	1.00	-.018	.907
	(.013)		(.056)	
Lab examined evidence	2.48	11.79**	.894	2.44
	(.721)		(.623)	
Sexual assault kit	-.227	.758	.431	1.54
	(.661)		(.614)	
Los Angeles	-6.04	.022*	-.220	.802
	(2.63)		(1.54)	
Victim teen	.852	2.34	.543	1.72
	(1.13)		(.920)	
Victim adult (20-29)	-.175	.840	-.774	.461
	(1.13)		(1.09)	
Victim black	-1.21	.298	-2.47	.085
	(2.01)		(1.77)	
Victim Latina	-3.55	.029	-1.50	.224
	(4.98)		(12.28)	
Suspect black	-.217	.805	.314	1.37
	(2.07)		(.914)	
Suspect Latino	4.07	58.25	.831	2.30
	(4.99)		(1.83)	
Victim medical treatment	4.01	55.14**	2.90	18.08**
	(1.23)		(.874)	
Arrest within 10 minutes of crime incident	3.64	38.14*	2.81	16.59***
	(1.74)		(.791)	
Probability of referral	6.78	878.79***		
	(1.67)			
Probability of charges			4.11	61.18***
			(.507)	
-2 Log Likelihood	75.02***		35.16***	
Cox & Snell R square	.556		.651	

Note: All evidence categories were entered individually into each model. Robust standard errors are in parentheses. Stranger is the reference category for victim/suspect relationship. Indianapolis is the reference site category. * $p < .05$ ** $p < .01$ *** $p = .000$

Seventy-seven percent of rape dispositions occurred as a result of a plea bargaining and 23 percent by trial. Out of those cases resolved through trial, 92.3 percent had forensic evidence. The trial-conviction rate for cases with forensic evidence was 91.7 percent. The results of a logistic regression analysis (not shown) that compared plea convictions with trial convictions indicated that only victim medical treatment (odds ratio = 41.87) significantly differentiated between these outcomes. The continued strength of this predictor across the stages of rape case processing underscores its impact on perceptions of victim credibility and of suspect culpability.

Forensic Evidence and Stranger-Rape Incidents. The findings from the present study demonstrate that reports of rape incidents generally involve people who know each other and whose relationship may affect victim credibility, victim cooperation, and suspect culpability. These issues may also have an impact on criminal justice decision making. Thus, in cases with victims and suspects who are known to one another, once sexual penetration is established and the victim identifies the suspect, matters of consent, reconciliation, and often fear can result in prosecutorial reluctance to issue a charge. However, this may not be the case for rape incidents that involve strangers. Here, forensic evidence may hold greater promise by helping to identify assailants otherwise unknown to the victim. And with scientific corroboration and the absence of interpersonal factors that can influence credibility, cooperation, and culpability, prosecutors may be more willing to move a case forward. Consequently, the study examined the influence of forensic evidence on stranger-rape cases.

There were 73 (19.2 percent of the sample) stranger-rape cases. Of these cases, 65.8 percent (N= 48) had forensic evidence, and arrests were made for almost 36 percent (N=26) of the reports. Bivariate analyses demonstrated that the arrest rate for cases with forensic evidence (47.9 percent) differed significantly from the non-forensic cases (12.0 percent; t=3.21, p= .002). However, there were no statistically significant differences in case outcomes post-arrest. The lack of significance may be due to the small number of cases referred to the district attorney (N=9, 8 with forensic evidence) and the even smaller number that were charged (N=6, 5 with forensic evidence). The conviction rate for forensic cases was 10.4 percent. None of the cases without forensic evidence produced a conviction.

Due to the attrition of cases through the criminal justice process, multivariate analyses of post-arrest outcomes were not possible. However, the findings from a logistic regression analysis of arrests suggest the potential value of forensic evidence for processing stranger-rape cases. Rape cases with forensic evidence were twenty-four times more likely to produce an arrest than those cases lacking such evidence. Thus, further research needs to be undertaken that explicitly explores case outcomes as they apply specifically to stranger-rape cases.

DISSCUSION

Similar to prior studies (Frazier and Haney, 1996; Spears and Spohn, 1997), the results

Table 6
Likelihood of Arrest for Stranger Rape Incidents

	Arrest	
	Estimate	Odds Ratio
Witness reports to police	-1.98	.138
	(1.32)	
Victim reports to police	1.83	6.22
Time to report incident	.008	1.01
	(.007)	
	(1.27)	
Crime scene evidence	3.22	24.90*
	(1.26)	
Sexual assault kit	-.560	.571
	(.817)	
Los Angeles	-3.67	.025*
	(1.76)	
Victim teen	2.81	16.63*
	(1.13)	
Victim black	1.06	2.89
	(.858)	
Victim Latina	2.09	8.09
	(1.61)	
Suspect black	-1.61	.200
	(1.29)	
Suspect Latino	1.64	5.16
	(1.25)	
-2 Log Likelihood	51.06***	
Cox & Snell R square	.453	

All evidence categories were entered individually into each model. Robust standard errors are in parentheses. * $p < .05$ ** $p < .01$ *** $p = .001$

Across the two sites, there were six rape cases with linking evidence. These cases resulted in three arrests that led to two referrals, one charged case, and one conviction by plea. All six had biological evidence that provided an association between victim and suspect. In the three cases that resulted in an arrest, the victim and suspect had an intimate or family relationship. The three cases without an arrest occurred between strangers.

of the present project demonstrate a consistent funneling out of rape cases from the criminal justice process. This funneling commences from the outset with almost 41 percent of reported incidents not cleared by arrest. It continues at the next stage with 41.6 percent of arrests not being referred to prosecutors. And of those rape incidents with arrests, 61.5 percent were rejected for prosecution. The significant drop in cases at the prosecutorial stage is may be due to attempts by the prosecutor to "avoid uncertainty" (Albonetti, 1987) by filing charges primarily in cases where the odds of conviction are good and rejecting those cases where conviction is less likely. Here, the prosecutor's "concern with convictability" (Frohman, 1997) is based on "an anticipation and consideration of how others (i.e., jury and defense) will interpret and respond to a case" (Frohmann, 1997:535). Results from the present study suggest that uncertainty and convictability are tied to perceptions of the victim's credibility and the suspect's culpability.

In addition to the role played by prosecutors, the study results highlight the discretionary powers of the police. Police discretion is exercised at three investigative junctures. First, a police officer must decide whether the rape incident is substantiated. Second, a police officer must decide whether they are going to use formal social control and arrest a suspect. Finally, if an arrest is made, officers must decide to refer the case to the DA. As indicated above, approximately 42 percent of arrests were not referred for prosecution. The primary reasons why officers did not refer cases to the DA were related to the victim's failure to cooperate with the police investigation (24 percent), the unavailability of victims (26 percent), and the lack of sufficient evidence to corroborate a rape claim (45 percent). Horney and Spohn (1996) have suggested that the behavior of the police during the investigation itself might influence the victim's willingness to cooperate. For instance, they suggest that investigators may convey signals to the victim that her report is not believed by the police. Thus, police perceptions of the crime as "not real" or "not serious" might directly influence the arrest and referral decisions. Furthermore, these perceptions might indirectly influence the likelihood of a case referral, if they resulted in a subsequent withdrawal of the victim's cooperation. Overall, the results underscore law enforcement's role as gatekeepers to the formal criminal justice system.

The present study also confirms prior research that shows a greater likelihood of filing a charge and reaching a conviction when injuries suffered by the victim are serious (Frazier and Haney, 1996; Spohn, Beichner, and Davis-Frenzel, 2001; Spohn and Holleran, 2001; McGregor et al., 2002; Ingemann-Hansen et al., 2008). Again, this finding speaks to the issue of victim credibility. She or he may be perceived as more believable if there are injuries to corroborate allegations of nonconsensual intercourse. This is particularly important in cases involving people known to one another where prosecutors may believe that an injury can counteract juror skepticism about rape allegations.

Although victim-suspect relationships may raise flags for prosecutors, much like Spohn and Holleran (2001), the present study finds that the relationship did not affect

the likelihood of prosecutors issuing a charge. Prosecutors are no less likely to file charges if the victim and suspect were acquaintances, relatives, or intimate partners than if they were complete strangers. However, a relationship between a victim and suspect did increase the likelihood of an arrest. This may be due to the ease with which a suspect is identifiable by the victim and with police satisfaction with the victim's claims.

With regard to forensic evidence, the analyses demonstrate that case outcomes for rape are not driven by forensic evidence variables. The results indicate that only six cases had evidence that actually linked a suspect to the crime scene and only one of these cases resulted in a conviction. Although the data point to an association between forensic evidence and district attorney charges, the results suggest that in the majority of cases, charging precedes the examination of evidence. In addition, the association between forensic evidence and case charging also reflects careful screening and case selection by prosecutors. Overall, the study results reflect the conception that forensic evidence is auxiliary, occasional, and non-determinative for the majority of rape cases.

CONCLUSIONS

The National Academy of Sciences (NAS) report (2009) highlights the deficiencies of forensic science and calls for the formulation of strong standards and protocols for analyzing and reporting evidence. Recommendations are made for the development of consistent policies and practices across laboratories and for laboratory personnel. In addition, it calls for a more uniform vocabulary to be used by forensic experts when testifying. Most important, the report calls into question many forensic techniques—such as fingerprint, bite-mark, and tool-mark analyses—concluding that they are not supported by research that establishes their accuracy and reliability. Thus, the NAS report raises a fundamental question: Iis there a scientific basis for forensic scientists' claims? The current study raises equally important questions: Does forensic science make a difference with regard to criminal justice outcomes in rape cases? And does the availability of forensic evidence improve arrest and conviction rates above traditional investigative practices?

The jury is still out on both the scientific basis and outcome value of forensic evidence. More rigorous and well-designed research is needed. Nonetheless, results from the present study have implications for criminal justice policy and practice, especially as they relate to the current concerns over rape case backlogs (Human Rights Watch, 2009). For instance, the findings suggest that a screening procedure based on victim/suspect relationship should be used to prioritize cases in terms of evidence examination and prosecution. As was stated above, the vast majority of sexual assaults are committed by someone known to the victim. In these cases, identification is not the issue. And the typical defense that the sexual activity was consensual even further reduces the value of DNA and other forms of forensic evidence for the prosecution

and conviction of a suspect in cases where the parties are known to one another. Thus, based on the study data, two types of cases should receive precedence for testing: stranger rapes and those incidents in which the victim and suspect have a friendship/acquaintance relationship but where the suspect claims that she or he did not have sexual contact with the victim. Clearly, exceptions to these priorities will be need to be made so that criminal justice practice is in agreement with societal values. For instance, cases in which the victim is a child or adolescent should be tagged for priority testing. Additionally, consistent with criminal justice concerns over efficacy and expedience (Packer, 1964), any case that has other forms of evidence (e.g., witnesses, police observation, an arrest in another case) and needs biological confirmation to enhance the likelihood of a successful prosecution should also receive priority.

Ultimately, testing all rape kits may best serve the current and future public interest. However, for the time being, fiscal and organizational realities dictate that priorities be established. By relying on empirical evidence, such as that which is offered in this study, the criminal justice system will begin the process of rationalizing testing decisions. **jsj**

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