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An Exploratory Study of the Legal and Non-Legal Factors Associated With Exoneration for Wrongful Conviction: The Power of DNA Evidence

Maeve Olney[1] and Scott Bonn[2]

Abstract

This study provides an exploratory quantitative examination of wrongful criminal conviction. Certain legal factors and perhaps some non-legal factors are related to wrongful conviction. Using data pertaining to all known exonerations in the United States from 1989 to 2012, we explore the extent to which deoxyribonucleic acid (DNA) testing and/or race of a convicted innocent are related to that person's exoneration. Controlling for race, the availability of DNA testing increases the likelihood of exoneration for murder or sexual assault. We also find that race is a significant factor in the wrongful conviction and exoneration of Blacks for murder or sexual assault. This finding regarding race warrants further research. The role of DNA in exonerating the innocent is critical to public policy proposals aimed at reducing wrongful conviction. Understanding how DNA may prevent and correct wrongful conviction is crucial because conviction of factually innocent defendants represents the ultimate failure of justice.

Keywords

criminal court, criminal justice policy, race

Introduction

Sociologists have long explored and revealed patterns of injustice in criminal processing in the United States. Such studies, however, have primarily focused on key

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decision points prior to and up until conviction. Few public policy changes resulting from this research have been aimed at preventing future injustices. Claims of systemic injustice become particularly troubling in cases of alleged or real conviction of innocent defendants. What do we make of this system's factual errors as they relate to demonstrated patterns of structural injustice?

This study provides a quantitative exploration of wrongful criminal conviction and exoneration in the United States. Using data pertaining to all known cases of exoneration in the United States from 1989 to 2012, we explore the extent to which legal and non-legal factors are related to wrongful conviction. We focus our findings on the importance of deoxyribonucleic acid (DNA) evidence in exoneration, but suggest that future research should further explore the extent to which the defendant race is related to the likelihood of wrongful conviction for violent crimes.

Prior Research on Wrongful Conviction

Wrongful conviction refers to the conviction of defendants who are factually innocent of any wrongdoing related to the crime for which they were formally charged (Acker & Redlich, 2011; Huff, Rattner, & Sagarin, 1996a). The parameters of wrongful conviction established by Gross and Shaffer (2012) in their report on the National Registry of Exonerations are also of particular use in this study, as the data set is adapted from that Registry. Both a legal concept and a legal process, exoneration is an official judicial declaration that a defendant is not guilty of a crime for which he or she was convicted (Acker & Redlich, 2011; Gross & Shaffer, 2012). Exonerations refer to convictions overturned on the basis of new evidence that satisfies either or both of the following premises:

- the establishment of the defendant's factual innocence post-conviction (i.e., evidence retroactively excludes the defendant from the list of possible suspects related to the crime), or
- the probability that the new evidence in question, if it had been presented at the original trial or if it were to be presented at a new trial, would bring about a different judicial outcome (i.e., an acquittal; Scheck, Neufeld, & Dwyer, 2003).

Persons who have undergone the exoneration process are exonerees, while a convicted innocent is someone who has been wrongly convicted of a crime that he or she did not commit, with respect to the definition of wrongful conviction provided above. Convicted innocents may or may not also be exonerees.

In this study, we rely on the phrase "criminal processing system" to describe the system of processes, institutions, and actors typically referred to as the "criminal justice system." We borrow this phrase from Belknap and Potter (2006 p. 168), who argue that, in analyses of failures of justice, "criminal processing" is a more appropriate term to describe this system. Wrongful conviction perhaps epitomizes the sense that this system fails to ensure justice for all who enter it.

No method exists to conclusively establish the number of convicted innocents. A defendant is formally presumed innocent in the criminal processing system until his or

her conviction, at which point the system shifts toward a presumption of guilt—the presumption that the courts have not erred in establishing culpability (Acker & Redlich, 2011; Cassel & Bernstein, 2001). The criminal processing system takes no meaningful steps to measure the number of convicted innocents. Repeated research indicates that decision-makers tend to deny that the problem warrants a systemic examination (Ramsey & Frank, 2007; B. Smith, Zalman, & Kiger, 2011).

A variety of studies suggest that innocent defendants are convicted in at least 1% of all convictions (B. Smith et al., 2011). At this rate, in a system that incarcerates at least two million people, at least 20,000 convicted innocents currently occupy U.S. prisons (Alexander, 2012; Cassel & Bernstein, 2001; Ramsey & Frank, 2007; B. Smith et al., 2011). Advances in DNA collection and testing have accelerated both awareness of wrongful conviction and the number of convictions that may be overturned (Ramsey & Frank, 2007). However, estimates of wrongful conviction frequency based on DNA exonerations represent just a fraction of all wrongful convictions, as DNA evidence is available in only a fraction of all criminal cases (Risinger, 2007). Moreover, estimates are likely low because only a small number of individuals who claim innocence are able to draw the attention of organizations with the resources to exonerate them (Ramsey & Frank, 2007).

The best existing measure of the problem is exoneration; it, however, only measures the number of formal recognitions of factual innocence and not the total number of convicted innocents (Gross & Shaffer, 2012; Risinger, 2007). To date, the most comprehensive record available is the National Registry of Exonerations, which compiles information about both DNA-based and non-DNA-based exonerations (Gross & Shaffer, 2012).

Systemic errors that lead to the conviction of the innocent are cause for concern. Beyond denying justice to crime victims, the failure to apprehend factually guilty offenders endangers the original victim(s) and threatens public safety by leaving the real perpetrator(s) free (Ramsey & Frank, 2007). Conviction of the innocent represents the failure of the criminal processing system to ensure the constitutionally protected liberty of innocent defendants (Ramsey & Frank, 2007; Risinger, 2007). Furthermore, wrongful conviction also erodes public confidence in the criminal processing system by causing the public to question its authority, legitimacy, integrity, credibility, effectiveness, and cohesiveness (Huff, Rattner, & Sagarin, 1996a; Ramsey & Frank, 2007; Risinger, 2007; Zalman, Larson, & Smith, 2011).

Incarcerated convicted innocents are frequently subjected to violence or the threat of violence, both of which are common in American prisons. This can wreak lasting physical and psychological havoc on prisoners (Sabo, Kupers, & London, 2001). Exonerees are often ineligible for post-release programs (such as housing, employment, mental health, and education programs) that assist recently released prisoners in their community reentry. Many exonerees cannot provide documentation to explain gaps in employment history that resulted from false imprisonment (Garrett, 2011; Scheck et al., 2003). Finally, the stigma of criminality that is attached to convicted innocents often does not dissipate following exonerations: The original "guilty" label often sticks (Acker & Redlich, 2011).

Legal Factors Related to Wrongful Conviction

Scholars have identified a variety of legal factors that contribute to wrongful conviction. These include eyewitness misidentification; problematic forensics (contaminated and/or mishandled evidence, insufficient technology, deteriorated evidence, and/or lack of DNA evidence); "junk science" (e.g., blood typing, fingerprint analysis, etc.); false confessions; inadequate defense counsel; police and prosecutorial misconduct; and the use of informant testimony. Wrongful convictions are almost never the product of just one of these factors, though research suggests that DNA is one of the most important tools in preventing and uncovering wrongful convictions.

DNA can be used in forensic analysis of crime scenes to include or exclude individuals as suspects in the crime. This process—DNA profiling—has proven instrumental in cases of wrongful conviction. Analyses of DNA involve identifying variations within specific regions of the human genome of one sample and then matching the resulting profile with profiles of other DNA samples. The original DNA sample is taken from the crime scene and is usually compared with the DNA of any suspects, the crime victim(s), and sometimes the National DNA Database (Naughton & Tan, 2011). DNA evidence can link individuals to, or exclude them from, involvement in a crime scene. This process can also aid in exoneration efforts if testing is conducted post-conviction.

The expansion of DNA profiling has irrevocably altered criminal processing in the United States; it has helped exonerate hundreds of convicted innocents and has, in some cases, also helped law enforcement to identify the real perpetrator. Of 997 exonerations profiled in the National Registry of Exonerations, DNA evidence was crucial to 339. However, some key problems with forensic evidence and forensic testing present an ongoing problem in identifying wrongful convictions. These problems stem both from the lack of forensics and mishandled and/or contaminated evidence.

The "lack of forensics" can refer to the unavailability of forensic/biological evidence, or to the unavailability of means to test such evidence. For factual innocents convicted prior to the advent of reliable and valid means of testing forensic evidence, their lack of forensic testing falls in the latter category. It was not until the late 1980s that scientists realized that DNA testing (albeit primitive by today's standards) could be used in criminal investigations (Scheck et al., 2003). The rate of exonerations has accelerated with each year that DNA testing has advanced, indicating that at least some of those convicted innocents could have been acquitted if they had been tried at a time when DNA testing was available (Gross & Shaffer, 2012; Scheck & Neufeld, 2001).

Wrongful convictions also result when no biological evidence is left at a crime scene. Factually innocent defendants facing murder or sexual assault charges theoretically may be able to prove their innocence pre-conviction using DNA testing, since perpetrators of these offenses frequently leave behind biological evidence (usually blood or semen; Garrett, 2011). However, the absence of biological evidence can impede efforts to prove factual innocence. DNA tests have, in recent years, become increasingly "sensitive and discriminating" (Scheck et al., 2003). Scientists can now

extract viable DNA samples from ever older, more deteriorated, and smaller pieces of evidence, and can more easily identify differences in DNA sequences. Our legal system now considers DNA evidence so reliable that it is admissible in every court as both proof of innocence and proof of guilt (Acker & Redlich, 2011; Scheck et al., 2003).

Nevertheless, even when biological evidence is available, not all defendants are able to utilize DNA testing. Technological advances have raised the cost of the tests, and the financial burden of a DNA test may hinder an innocent defendant's chances at avoiding conviction (Garrett, 2011). Furthermore, if an innocent defendant is convicted at least in part because no DNA testing is done, that individual may face additional challenges if the associated biological evidence is lost or destroyed in the years following conviction (Garrett, 2011; Scheck & Neufeld, 2001). The Supreme Court has not considered the question of whether or not states have an obligation to preserve evidence after trial, even if such evidence might help challenge a conviction on factual grounds. Standards regarding the preservation of evidence thus vary from state to state (Acker & Redlich, 2011).

Legal barriers at the post-conviction stage also impede access to DNA testing (Scheck & Neufeld, 2001). Between 1989 and 2003, 19% of known exonerations were based on post-conviction DNA testing that conclusively proved the exonerees' innocence. Since 2004, that rate has climbed to 42% (Gross & Shaffer, 2012). This indicates that access to post-conviction DNA testing is a critical component of exoneration, and that more convicted innocents could be exonerated using this method (S. Russell, 2012a). The National Commission on the Future of DNA Evidence, a Justice Department panel, released a report in 1999 urging prosecutors to consent to post-conviction DNA testing for defendants who maintain innocence (Scheck & Neufeld, 2001).

Still, many states' laws limit the amount of time that a convicted innocent has to present newly discovered evidence of innocence. These statutes of limitations typically extend 6 months or fewer (Scheck & Neufeld, 2001). Adding to this roadblock is the Supreme Court's 2009 ruling in *D.A.'s Office v. Osborne* that convicts have no constitutional right to post-conviction DNA testing (Acker & Redlich, 2011). That ruling was particularly problematic given that conclusive evidence of innocence (which DNA testing can provide) is required for exoneration; simply raising reasonable doubt of guilt post-conviction is insufficient (S. Russell, 2012b). Despite an overall increase in the acceptability, reliability, and availability of DNA testing, factually innocent defendants still risk conviction because of several legal and practical barriers to its use. Convicted innocents face the possibility that they will never be exonerated.

The mishandling and contamination of forensic evidence presents serious challenges to those trying to prove their innocence. Biological evidence from which DNA can be extracted is highly susceptible to mishandling and contamination (Garrett, 2011; Naughton & Tan, 2011). Some errors, though not harmless, are accidental; they result from mistakes in lab procedure or unintentional contamination during transference of evidence from the crime scene to the lab or during the storage period. DNA evidence can also be misinterpreted as a *prima facie* proof of guilt. The mere presence

of an individual's DNA at a crime scene, though incriminating, does not always conclusively prove guilt. Though DNA evidence is considered the current gold standard of forensic evidence, it can be unintentionally mishandled, contaminated, or misinterpreted (Scheck et al., 2003).

In other instances, however, the mishandling or contamination of forensic evidence results from intentional misconduct of laboratory or criminal processing personnel. Police may intentionally damage or misplace evidence "in bad faith" (Acker & Redlich, 2011). Scheck et al. (2003) report instances of "white coat fraud," in which laboratory personnel have fraudulently reported untrue forensic "findings" that have led to the conviction of innocent defendants. Garrett (2011) reports that laboratory personnel and forensic analysts have, in some cases, intentionally failed to conduct DNA testing that could have eliminated a convicted innocent from the pool of likely suspects. Reliance on DNA evidence to conclusively prove guilt or innocence requires a high degree of systemic ethical and legal accountability from laboratory and criminal processing actors.

Non-Legal Factors Related to Wrongful Conviction

A growing body of evidence now indicates that sociological or non-legal factors may also contribute to wrongful conviction. Defendant race has been a particular focus here; much research on racial discrimination in criminal processing has demonstrated patterns suggesting that Blacks are disproportionately represented in all stages of the system (Chambers, 1995). To best explore the issue of racial bias in criminal processing, criminologists have undertaken research of the major decision points within the system (arrest, pre-trial, trial, conviction, sentencing, incarceration, death penalty, and release). The available literature generally indicates that racial disparities exist at all levels of the system that cannot be explained by racial group differences in offending parties (Alexander, 2012; Freiburger & Hilinski, 2010; Kansal, 2005; Liptak, 2008; Parker, Dewees, & Radelet, 2001; Phillips, 2008; G. D. Russell, 1994; E. Smith & Hattery, 2011; Steffensmeier, Ulmer, & Kramer, 1998; Street, 2001; Taslitz, 2006; Tellis, Rodriguez, & Spohn, 2010; Tonry, 2010; Zatz & Rodriguez, 2006).

While many studies have examined the role of race in these areas of criminal processing, relatively little has been written about racial effects in patterns of wrongful conviction, likely because of persistent gaps in available data. The relevant studies have largely concluded that Blacks and Hispanics may be disproportionately at risk of wrongful conviction compared with Whites, and that these groups are overrepresented in available samples of exonerees (Bedau & Radelet, 1987; Garrett, 2011; Gross, Jacoby, Matheson, Montgomery, & Patil, 2005; Holmes, 2001; Huff et al., 1996a; Huff et al., 1996b; Parker et al., 2001; Scheck et al., 2003; E. Smith & Hattery, 2011; Taslitz, 2006). None of the available literature attempts to establish a cause for racial disparity in wrongful conviction (Taslitz, 2006).

Prior research has shown that young Black males typically receive the harshest sentencing decisions, and that relative to Whites, Blacks are typically less economically, socially, and politically powerful and have fewer resources at their disposal to

avoid wrongful conviction (Steffensmeier et al., 1998; Tellis et al., 2010). In addition, some scholars have suggested that Black men may be disproportionately perceived as sexual predators, based on stereotypes that label them as dangerous, inherently violent, and hyper-heterosexual (Collins, 2005). This stereotype is "more often applied to poor and working-class men than to their affluent counterparts" (Collins, 2005 p. 158). Accordingly, there are some theoretical underpinnings to the suggestion that race (being Black, in particular) may operate independently of the legal factors in predicting wrongful conviction for violent crime, particularly sexual assault.

Data and Methods

For this analysis, we use data provided by the National Registry of Exonerations, a joint project of the University of Michigan Law School and the Center on Wrongful Convictions at Northwestern University School of Law. This registry is an evolving data set that records exonerations in the United States since 1989. Because the Registry adds and/or amends cases periodically, we chose to work from the sample size provided on its website as of November 27, 2012. The Registry is the first central database from which samples of exoneration can be drawn. This addresses a concern previously held by scholars that no such option existed (Leo, 2005).

Our hypotheses for this study were as follows:

Hypothesis 1 (H1): Post-conviction DNA testing increases the likelihood of being exonerated for wrongful conviction of murder or sexual assault.
Hypothesis 2 (H2): Blacks are more likely to be exonerated using post-conviction DNA testing than other races.
Hypothesis 3 (H3): Black exonerees experience, on average, more time between conviction and exoneration than all others.
Hypothesis 4 (H4): Post-conviction DNA testing increases the likelihood of being exonerated for wrongful conviction of murder or sexual assault, controlling for race.
Hypothesis 5 (H5): Being Black increases the likelihood of being exonerated for wrongful conviction of murder or sexual assault, controlling for DNA testing.

To perform our analysis, we recoded the data into the following variables:

Last name (of exoneree)
Age (of exoneree at time crime was committed, in years)
White
1 = White
0 = Other
Black
1 = Black
0 = Other
Hispanic

1 = Hispanic
0 = Other

Murder (was exoneree originally convicted of murder?)
1 = Murder
0 = Other

SAssault (was exoneree originally convicted of sexual assault?)
1 = Sexual assault
0 = Other

MurSeAs (was exoneree originally convicted of murder OR sexual assault?)
1 = Murder OR sexual assault
0 = Other

ViolCrim (was exoneree originally convicted of a violent crime?)
1 = Violent crime
0 = Other

Length (length of time, in years, between conviction and exoneration)

DNA (was DNA central to establishing innocence of exoneree?)
1 = Yes
0 = No.

Creating dummy variables for the three most common racial groups—White (Caucasian), Black, and Hispanic—and for the crimes of which the exonerees were originally convicted enabled us to compare the primary category of interest with all other possible categories of the same variable. Nearly every exoneree featured in the data set fell into one of these three racial groups. Racial information was not provided in the data set for 25 exonerees, so we excluded these cases, leaving a sample size (*N*) of 997. In addition, for those exonerees where age was not provided, we entered the mean age of the sample (27). If age was the only variable missing from a case, we did not exclude that case from the sample.

We ran independent samples *t* tests to identify possible differences in mean age and length of time to exonerate for each dichotomous race and crime variable. We also conducted chi-square tests to identify any significant differences in racial composition for the crime and DNA variables. The chi-square distribution is used in the common chi-square tests for goodness of fit of an observed distribution to a theoretical one, the independence of two criteria of classification of qualitative data, and in confidence interval estimation for a population standard deviation of a normal distribution from a sample standard deviation. Finally, we used logistic regression to predict the outcome of dichotomous dependent variables based on one or more independent variables of interest, as identified by the *t* tests and chi-square tests.

Findings

As Table 1 reveals, 455 (45.6%) exonerees in the data set were wrongly convicted of murder. A total of 215 (21.6%) were wrongly convicted of sexual assault, and 913 (91.6%) of the exonerees were wrongly convicted of a violent crime, which may include any of the following crimes: accessory to murder, assault, violent attempt,

Table 1. Variable Descriptive Statistics for the Data Set (*N* = 997).

Variable	Frequency	%
Crime		
Murder dummy		
Murder = 1	455	45.6
Other = 0	542	54.4
Sexual assault dummy		
Sexual assault = 1	215	21.6
Other = 0	782	78.4
Violent crime dummy		
Violent crime = 1	913	91.6
Other = 0	84	8.4
Murder OR Sexual assault dummy		
Murder or sexual assault = 1	670	67.2
Other = 0	327	32.8
Race		
White dummy		
White = 1	381	38.2
Other = 0	616	61.8
Black dummy		
Black = 1	475	47.6
Other = 0	522	52.4
Hispanic dummy		
Hispanic = 1	123	12.3
Other = 0	874	87.7
Unclassified other	18	
DNA		
DNA crucial to exoneration		
Yes = 1	339	34.0
No = 0	658	66.0
White, Yes	107	28.1
White, No	274	71.9
Black, Yes	208	43.8
Black, No	267	56.2
Hispanic, Yes	21	17.1
Hispanic, No	102	82.9
	M (years)	
Age		
Overall	27.09	
White	29.74	
Black	25.27	
Hispanic	25.49	
Length		
Overall	11.62	
White	10.73	
Black	13.32	
Hispanic	8.14	

Source. The National Registry of Exonerations.
Note. DNA = deoxyribonucleic acid.

attempted murder, child abuse, child sex abuse, kidnapping, manslaughter, murder, robbery, sexual assault, or supporting terrorism. Finally, 670 (67.2%) of the exonerees were wrongly convicted of either murder or sexual assault.

In addition, 381 (38.2%) of the exonerees in the data set were White, 475 (47.6%) were classified as Black, and 123 (12.3%) were Hispanic. In total, 18 (1.8%) exonerees were not classified as White, Black, or Hispanic using the dummy variables created and were thus labeled "Other."

We also broke down each crime dummy variable by race. Of the 455 wrongful murder convictions, 171 (37.6%) belonged to Whites, 217 (47.7%) belonged to Blacks, and 62 (13.6%) belonged to Hispanics. The 5 (1.1%) remaining wrongful murder convictions belonged to the exonerees without classification into one of the dummy race variables. Of the 215 wrongful sexual assault convictions, 70 (32.6%) belonged to Whites, 132 (61.4%) belonged to Blacks, and 12 (5.6%) belonged to Hispanics. Again, the 1 (0.4%) remaining wrongful sexual assault conviction belonged to an exoneree without classification into one of the dummy race variables. Of the 913 wrongful convictions for all violent crimes (listed previously), 345 (37.8%) belonged to Whites, 442 (48.4%) belonged to Blacks, 110 (12.0%) belonged to Hispanics, and the remaining 16 (1.8%) belonged to exonerees without racial classification. Finally, of the 670 wrongful murder OR sexual assault convictions, 241 (36.0%) belonged to Whites, 349 (52.1%) belonged to Blacks, 74 (11.0%) belonged to Hispanics, and the remaining 6 (0.9%) belonged to exonerees without racial classification.

DNA was crucial to the exoneration of 339 (34.0%) of the exonerees in the data set and not crucial to the exoneration of 658 (66.0%). DNA was crucial to the exoneration of 107 Whites, 208 Blacks, and 21 Hispanics, comprising 28.1%, 43.8%, and 17.1% of each racial group, respectively. The mean age of the exonerees at the time of the crime was 27.09 years. For Whites, the mean age was 29.74 years, whereas for Blacks the mean age was 25.27 years and for Hispanics the mean age was 25.49 years. The mean length of time between conviction and exoneration for the entire data set was 11.62 years. For Whites, the mean length of time to exonerate was 10.73 years. For Hispanics, the mean length of time to exonerate was even lower, at 8.14 years. However, for Blacks, the mean length of time between conviction and exoneration was higher, at 13.32 years.

The *t* tests depicted in Table 2 provided a comparison of means for the length of time to exonerate by race and the length of time to exonerate for all subjects. The *t*-test statistics indicate the extent to which length of time to exonerate is impacted by race. Positive and statistically significant *T* scores would indicate that members of a certain racial classification experience a longer mean length of time to exonerate than exonerees of other races. The results of the *t* tests reveal that Black exonerees were likely to experience a longer time between conviction and exoneration relative to all others.

We used chi-square tests to analyze the relationship between race of the exoneree and the crime (or type of crime) for which he or she was wrongly convicted, as well as between the race of the exoneree and whether or not DNA evidence was crucial to the exoneration. These results are detailed in Table 3 and Table 4. In Table 3, the results were not significant for Whites, Blacks, or Hispanics wrongly convicted of murder. The results were also not significant for Whites wrongly convicted of sexual assault.

Table 2. Comparison of Mean Length of Time to Exonerate by Race (N = 979).

Variable	M (Race)	M (Other)	t	Mean difference	SE	df
White (White = 1)	10.73	12.18	−2.809*	−1.45	.516	833
Black (Black = 1)	13.32	10.08	6.495**	3.241	.499	995[a]
Hispanic (Hispanic = 1)	8.14	12.11	−5.206**	−3.975	.763	995[a]

Note. Mean is the length of time to exonerate in years.
[a]Equal variances are assumed.
*p < .01. **p < .001.

Table 3. Distribution of Types of Crime by Race for Murder and for Sexual Assault (N = 979).

	Murder		Sexual assault	
Variable	(% W/l)	Pearson's χ^2 (1 df)	(% W/l)	Pearson's χ^2 (1 df)
White				
White	171 (37.6)	0.142	70 (32.6)	3.715
Other	284 (62.4)		145 (67.4)	
Black				
Black	217 (47.7)	0.001	132 (61.4)	20.783**
Other	238 (52.3)		83 (38.6)	
Hispanic				
Hispanic	62 (13.6)	1.287	12 (5.6)	11.567*
Other	393 (86.4)		203 (94.4)	

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

However, the results were significant for Blacks and Hispanics convicted of sexual assault. A total of 61.4% of exonerees wrongly convicted of sexual assault were Black, versus 38.6% who were not Black (20.783, p < .001). In addition, 5.6% of exonerees wrongly convicted of sexual assault were Hispanic, versus 94.4% who were not Hispanic (11.567, p < .01).

Table 4 details the relationship between race and the use of DNA to establish innocence post-conviction. For a total of 339 exonerees in the data set, post-conviction DNA testing was crucial to establishing factual innocence. This was true for all races considered: for 31.6% of White exonerees versus exonerees who were not White (68.4%; 9.624, p < .01), for 61.4% of Black exonerees versus exonerees who were not Black (38.6%; 38.728, p < .001), and for 6.2% of Hispanic exonerees versus exonerees who were not Hispanic (93.8%; 17.919, p < .001).

In Tables 5 to 7, we present the logistic regression coefficient and odds ratio for all independent variables but discuss the findings in terms of odds ratio for dichotomous independent variables and in terms of log odds for continuous independent variables. Table 5 depicts the results of logistic regression tests for the likelihood of DNA

Table 4. Distributions of DNA Exoneration by Race (*N* = 979).

	DNA	
Variable	(% W/l)	Pearson's χ^2 (1 *df*)
White		
White	107 (31.6)	9.624*
Other	232 (68.4)	
Black		
Black	208 (61.4)	38.728**
Other	131 (38.6)	
Hispanic		
Hispanic	21 (6.2)	17.919**
Other	318 (93.8)	

Note. DNA = deoxyribonucleic acid.
*p < .01. **p < .001.

Table 5. Logistic Regression Coefficients and Odds Ratios for DNA Exoneration by Race (N = 997).

	White		Black		Hispanic	
Variable	*b*	Odds ratio	*b*	Odds ratio	*b*	Odds ratio
DNA	−0.436* (.141)	0.646	0.844** (.137)	2.325	−1.022** (.250)	0.360
Constant	−0.504** (.083)	0.604	−1.094** (.101)	0.335	−0.559** (.070)	0.572
Wald χ^2(*df*)	36.723 (1)		117.334 (1)			63.150 (1)
Log likelihood	1,268.494		1,239.316		1,258.418	

Note. Standard errors are given in parentheses. DNA = deoxyribonucleic acid.
*p < .01. **p < .001.

Table 6. Logistic Regression Coefficients and Odds Ratios for Murder OR Sexual Assault: DNA Exoneration (*N* = 997).

	Murder or sexual assault	
Variable	*B*	Odds ratio
DNA	1.936** (.195)	6.930
Constant	0.226* (.078)	1.253
Wald's χ^2 (*df*)	8.287 (1)	
Log likelihood	1,129.043	

Note. Standard errors are given in parentheses. DNA = deoxyribonucleic acid.
*p < .01. **p < .001.

Table 7. Multivariate Logistic Regression Results for "Murder OR Sexual Assault" (N = 997).

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
White	−0.109	−0.167	−0.159						
Odds ratio	0.897 (.144)	0.846 (.148)	0.853 (.147)	—	—	—	—	—	—
Black	—	—	—	0.427**	0.277	0.300*	—	—	—
Odds ratio				1.533 (.141)	1.319 (.148)	1.350 (.147)			
Hispanic	—	—	—	—	—	—	−0.443*	0.011	−0.068
Odds ratio							0.642 (.202)	1.011 (.210)	0.935 (.207)
Age	−0.041***			−0.038***			−0.044***		
Odds ratio	0.960 (.008)	—	—	0.962 (.008)	—	—	0.957 (.008)	—	—
Length	—	0.117***	—	—	0.114***	—	—	0.118***	—
Odds ratio		1.124 (.011)			1.121 (.011)			1.125 (.011)	
DNA	—	—	1.922***	—	—	1.881***	—	—	1.930***
Odds ratio			6.832 (.195)			6.558 (.197)			6.887 (.196)
Constant	1.894*** (.222)	−0.419** (.141)	0.292** (.100)	1.581*** (.242)	−0.584*** (.134)	0.106 (.098)	1.981*** (.227)	−0.496*** (.132)	0.236** (.085)
Wald χ^2 (df)	72.687 (2)	8.777 (2)	8.572 (2)	42.546 (2)	18.866 (2)	1.162 (2)	76.040 (2)	14.084 (2)	7.759 (2)
Log likelihood	1,228.430	1,119.970	1,127.875	1,219.780	1,117.733	1,124.860	1,124.291	1,121.239	1,128.937

Note. Standard errors are given in parentheses. DNA = deoxyribonucleic acid.
*p < .05. **p < .01. ***p < .001.

exoneration of all crimes by race. The results indicate that Blacks are more likely to benefit from DNA testing than all others. White exonerees are .646 times as likely to be exonerated on the basis of DNA evidence relative to all others (−.436, $p < .01$). The fit is significantly better than a constant only model ($\chi^2 = 36.723$ and 1 *df*). Black exonerees are 2.325 times as likely to be exonerated on the basis of DNA evidence relative to all others (.844, $p < .001$). The fit is significantly better than a constant only model ($\chi^2 = 117.334$ and 1 *df*). Hispanic exonerees are .36 times as likely to be exonerated on the basis of DNA evidence relative to all others (−1.022, $p < .001$). The fit is significantly better than a constant only model ($\chi^2 = 63.150$ and 1 *df*).

Table 6 depicts the results of logistic regression tests for the likelihood of DNA exoneration for either murder or sexual assault. It shows that exonerees for whom post-conviction DNA testing was available for their wrongful murder or sexual assault conviction were 6.93 times as likely to be exonerated than those for whom such testing was not used in their exoneration efforts (1.936, $p < .001$). The fit is significantly better than a constant only model ($\chi^2 = 8.287$ and 1 *df*).

To test the robustness of the univariate logistic regression models, we ran multivariate logistic regression models with two independent variables with one of the two being race in each model. Table 7 depicts the results of multivariate logistic regression for the dependent variable "Murder or Sexual assault." In Model 1, a one-unit increase in age decreases the log odds of exoneration for wrongful murder OR sexual assault conviction for White exonerees by −.041 while controlling for the effects of being White (or not). The dichotomous independent variable being White (or not) is not significant in the model. The fit is significantly better than a constant only model ($\chi^2 = 72.687$ and 2 *df*).

In Model 2, a one-unit increase in the length of time between conviction and exoneration increases the log odds of exoneration for wrongful murder OR sexual assault conviction by .117 while controlling for the effects of being White (or not). The dichotomous independent variable being White (or not) is not significant in the model. The fit is significantly better than a constant only model ($\chi^2 = 8.777$ and 2 *df*). In Model 3, the odds ratio indicates that use of post-conviction DNA testing increases the likelihood of exoneration by 6.832 while controlling for the effects of being White (or not). The dichotomous independent variable being White (or not) is not significant in Model 3. The fit is significantly better than a constant only model ($\chi^2 = 8.572$ and 2 *df*).

In Model 4, a one-unit increase in age decreases the log odds of exoneration for wrongful murder OR sexual assault conviction for exonerees by −.038 controlling for the effects of being Black (or not). The odds ratio indicates that Blacks wrongly convicted of murder OR sexual assault are .427 times as likely to be exonerated while controlling for age, relative to all others. The fit is significantly better than a constant only model ($\chi^2 = 42.546$ and 2 *df*).

In Model 5, a one-unit increase in length of time between conviction and exoneration increases the log odds of exoneration for wrongful murder OR sexual assault conviction for exonerees by .114 controlling for the effects of being Black (or not). The dichotomous independent variable being Black (or not) is not significant in the model. The fit is significantly better than a constant only model ($\chi^2 = 18.866$ and 2 *df*).

In Model 6, the odds ratio indicates that those who have access to post-conviction DNA testing are 6.558 as likely to be exonerated for murder OR sexual assault controlling for the effects of being Black (or not). The odds ratio indicates that Blacks are .300 times as likely to be exonerated for wrongful murder OR sexual assault conviction while controlling for DNA analysis. The fit is significantly better than a constant only model ($\chi^2 = 1.162$ and 2 *df*).

In Model 7, a one-unit increase in age decreases the log odds of exoneration for wrongful murder OR sexual assault conviction by −.044 controlling for the effects of being Hispanic (or not). The odds ratio indicates that Hispanics, relative to all others, are −.443 times as likely to be exonerated for wrongful murder OR sexual assault conviction while controlling for age. The fit is significantly better than a constant only model ($\chi^2 = 76.040$ and 2 *df*).

In Model 8, a one-unit increase in length of time between conviction and exoneration increases the log odds of exoneration for wrongful murder OR sexual assault conviction by .118 while controlling for being Hispanic (or not). The dichotomous independent variable being Hispanic (or not) is not significant. The fit is significantly better than a constant only model ($\chi^2 = 14.084$ and 2 *df*).

In Model 9, the odds ratio indicates that those who have access to post-conviction DNA testing are 6.887 times as likely to be exonerated for murder OR sexual assault, controlling for being Hispanic (or not). The dichotomous independent variable being Hispanic (or not) is not significant in the model. The fit is significantly better than a constant only model ($\chi^2 = 7.759$ and 2 *df*).

Discussion

We found important support for H1. That is, the availability of DNA testing significantly increased the likelihood of exoneration for murder or sexual assault. The univariate logistic regression findings (see Table 5) revealed that those with access to DNA testing were 6.93 times as likely to be exonerated for murder or sexual assault relative to those without such access. This provides powerful support for the need to have access to DNA testing in the criminal processing system, particularly for violent crimes.

The chi-square and univariate logistic regression analyses supported H2 that Blacks will benefit from DNA testing to a greater extent than either Whites or Hispanics. The chi-square results (see Table 4) indicate that Blacks comprise 61.4% of those who benefitted from DNA testing but only 47.6% of all exonerees. The univariate logistic regression results (see Table 5) demonstrate that Black exonerees were 2.32 times as likely as non-Blacks to be exonerated of wrongful conviction based on DNA testing. In contrast, being either White or Hispanic actually decreased the likelihood of being exonerated using DNA testing relative to all others.

The *t* tests depicted in Table 2 support H3 that Black exonerees experienced longer periods of time between conviction and exoneration than non-Blacks. Specifically, Blacks averaged 13.32 years between conviction and exoneration whereas all others experienced 10.08 years on average. This is in contrast to White exonerees, who

experienced shorter lengths of time to exonerate than non-Whites. Similar to Whites, Hispanic exonerees experienced shorter lengths of time to exonerate than those who were not Hispanic.

We found support for H4 in our multivariate logistic regression analyses (see Table 7). Specifically, DNA testing increases the likelihood of being exonerated for wrongful murder or sexual assault conviction, controlling for race. In fact, DNA testing was a significant predictor of exoneration for murder or sexual assault while controlling for being White (6.83 times as likely), Black (6.56 times as likely), or Hispanic (6.89 times as likely). Thus, all races in the study benefitted from the availability of DNA testing in their exoneration from wrongful conviction for murder or sexual assault. This important finding is central to this study and indicates that the legal factor of DNA testing works independently of race to aid those who are wrongfully convicted of violent crime.

We also found support for H5. The same multivariate logistic regression analyses (see Table 7) demonstrate that being Black increases the likelihood of exoneration for wrongful conviction of murder or sexual assault while controlling for the availability of DNA testing. Specifically, Blacks are 1.35 times as likely to be exonerated for wrongful conviction of murder or sexual assault while controlling for DNA testing. Blacks were the only racial group to have significant findings in our analyses involving race and DNA. This is a powerful finding because it indicates that the sociological or non-legal factor of being Black influences the likelihood of exoneration for murder or sexual assault while controlling for the important legal and scientific factor of DNA testing.

The support we found for H5 demonstrates an existing paradox between sociology and the law. That is, the presence of objective legal and subjective non-legal factors can impact the likelihood of exoneration independently of one another. The variable being Black (or not) is a distinctly sociological (non-legal) variable, while the variable of post-conviction DNA testing is a distinctly legal one. The objectivity of DNA evidence disrupts the subjective narrative process inherent to law. That is, in criminal proceedings in the American adversarial system, both the prosecution and the defense make use of narrative to construct stories to explain (or disprove) the defendant's alleged criminal involvement. DNA evidence inserts the objective reality of a defendant's factual guilt or innocence, thereby disallowing this narrative process.

DNA evidence should theoretically also reduce the extent to which discrimination occurs in this narrative process of law, and in many cases, it does. Indeed, our findings indicate that, controlling for race, DNA typically provides a strong indicator of likelihood of exoneration. Nevertheless, legal narratives may be constructed using stereotypes and biases based on sociological variables like race. DNA evidence establishing or denying a defendant's guilt introduced into this narrative may successfully stop the use of such stereotypes in legal narrative and thus has important implications for remedying racial discrimination as a possible non-legal factor in the conviction of the innocent. Still, our findings reveal that being Black influences the likelihood of exoneration for murder or sexual assault while controlling for DNA testing. This result

indicates that race may play a significant role in wrongful conviction. More research is warranted on this controversial issue.

As previously noted, much literature suggests that there are patterns of racial discrimination at all stages of criminal processing. Race may operate independently of the legal causes of wrongful conviction and may contribute to its occurrence. However, based on the limitations of this study, we cannot say at this time whether racial threat does or does not play a role in wrongful conviction. Our findings here should be considered exploratory; we hope that they will encourage further empirical research on the role of race, racial stereotypes, and perceived dangerousness in wrongful conviction.

Study Limitations and Possible Avenues for Future Research

While the available data set provides perhaps the most comprehensive information about wrongful conviction in the United States to date, a few limitations do exist. The available data do not provide us with a full count of the number of exonerations that have occurred, nor the number of innocent people who have been wrongly convicted. Exoneration does not necessarily prove that a defendant is innocent; inevitably, some exonerated defendants will actually have been guilty of the crimes for which they were convicted. Using exoneration as the sole measure of wrongful conviction excludes from analysis innocent defendants who have not sought, or who have not been successful in obtaining, exoneration. There are likely more wrongful convictions than there are exonerations (Gross & Shaffer, 2012). This study is also limited by our inability to control for victim race and gender of victims and defendants. Because the available data did not include information about exonerees' prior records, we cannot exclude the possibility that a defendant's prior record impacts the likelihood of a wrongful conviction, especially if police and prosecutors are more likely to focus their attention on suspects with prior criminal histories.

This study did not examine the link between exoneration and inadequate assistance of defense counsel. Scholars have identified inadequate/ineffective assistance of counsel (IAC) as a major contributing factor to the conviction of the innocent. Defense attorneys for the indigent (especially those in public defenders' offices) handle overwhelming numbers of cases. Up to 80% of all criminal defendants are unable to afford an attorney (Bright, 2002). Therefore public defense attorneys, who are frequently underpaid, often do not have the time to devote thorough attention to any one client's case (Bright, 2002; Scheck et al., 2003). IAC is primarily attributed to poverty, which disproportionately impacts racial minorities, but we found no prior literature suggesting that there is a racial effect or racial bias in patterns of IAC. Future research might examine a possible link between race and the likelihood of receiving inadequate assistance of counsel. A final and related limitation of this study lies in our inability to explore the impact of the racial composition of juries and the race of prosecutors on the convictions of the exonerees in the data set. Perhaps future research will overcome this issue.

Future researchers should bear in mind that it is not the malicious and/or prejudicial actions of any particular person or group that results in disparate racial effects within the criminal processing system. An analysis that places blame on individuals for structural disparities does little to mitigate racial effects in any system, criminal processing included (Powell, Jeffries, Newhart, & Stiens, 2006). Accordingly, future research that explores the relationship between race and wrongful conviction must be careful to focus on the power of structural systems, rather than individual actors, to reinforce and perpetuate biases.

Policy Considerations

This study demonstrated that, in most cases and controlling for race, post-conviction DNA testing increases the likelihood of exoneration. This finding suggests that the criminal processing system should make use of DNA testing in all cases in which such evidence may implicate or clear a suspect pre-conviction (Scheck et al., 2003). DNA testing is particularly important in felony cases involving murder and sexual assault, which carry the most severe sentences. As noted earlier, the objectivity of DNA testing may also help reduce racial discrimination in criminal processing. Our findings suggest that it is imperative that biological evidence left at crime scenes be collected and preserved wherever possible, and that DNA evidence should be retained until at least one test has been performed.

Exoneration organizations ("innocence projects") all across the country work to uncover wrongful convictions and clear the names of convicted innocents. However, these organizations are typically non-profits without adequate resources to research every claim of factual innocence with which they are presented. Equipping these organizations with the resources they need—primarily through the use of federal and state funds—would assist them in correcting erroneous convictions. In addition, policy makers should consider the findings of criminologists, exoneration groups, and innocence commissions when determining how to avoid convicting the innocent in the future (Acker & Redlich, 2011). A further step would be the authorization of governmental innocence commissions, tasked with the independent examination of claims of wrongful conviction, and with identifying problem areas in criminal processing before such convictions occur (Scheck et al., 2003).

The federal government has begun to acknowledge its need to avoid wrongful conviction. In 2004, Congress enacted the Innocence Protection Act, which acknowledges the right of federal convicts to access DNA testing, requires the preservation of biological evidence in federal cases, and allocates increased funding to defense attorneys in state death penalty cases (Garrett, 2011). While the Act is a definite step toward minimizing wrongful federal convictions, more action is needed to prevent erroneous convictions in both federal and state courts. Similar legislation should be enacted in every state to ensure that innocent defendants in state court have the opportunity to prove their innocence post-conviction, primarily through DNA testing where such evidence exists.

Our study suggests that, of known exonerations since 1989, the race of the defendant may be a factor in wrongful conviction, particularly for Blacks wrongly convicted

of murder or sexual assault. This finding calls for further research to empirically examine the nature of the relationship between race and wrongful conviction, with consideration given to the factors that limited the scope of this study. Those factors include victim race, defendants' prior records, inadequate assistance of counsel, and racial composition of juries.

Conclusion

The findings we have reported here present the criminal processing system with some serious issues that warrant review and consideration. A large body of literature has established the legal causes of wrongful conviction and has also identified specific reforms that could be implemented to reduce the frequency with which those causes lead to the conviction of the innocent. Of these reforms, increasing access to pre-conviction DNA testing in cases where such evidence exists is perhaps the most vital. Indeed, we found that the availability of DNA testing increases a convicted innocent's likelihood of exoneration for murder or sexual assault (controlling for other factors, including race). We have outlined the specific reforms that could make use of this finding to reduce wrongful convictions. Meaningful legislative reform that addresses the importance of the preservation and testing of DNA evidence could prevent the conviction of the innocent and overturn existing erroneous convictions. This study also suggests that, in conjunction with legal or procedural errors, the race of the defendant may play a role in wrongful conviction. This finding should encourage scholars to re-examine prior literature on racial discrimination in criminal processing and conduct empirical research on the role that such discrimination may play in wrongful conviction, with an eye toward expanding on this preliminary study.

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