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5-2023

The Contribution of Forensic Science to Wrongful Convictions: An Analysis of Forensic Expert Testimony

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The Contribution of Forensic Science to Wrongful Convictions: An Analysis of Forensic
Expert Testimony

by

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A Thesis
Submitted to the Honors College of
The University of Southern Mississippi
in Partial Fulfillment
of Honors Requirements

May 2023

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ABSTRACT

The purpose of this study was to explore the progression and potential improvement of forensic science in court. Errors is forensic science have contributed to the problem of wrongful convictions, but research surrounding forensic expert testimony over the last decade is lacking. The way that an expert explains evidence in court is important to gain a broader understanding for how forensic science may fail. The testimonies of forensic experts were analyzed both quantitatively and qualitatively to further understand the shortcomings in the field at the end of its journey through the criminal justice system. The results showed that the testimonies included a balance of technical terminology, scientific data, and simplified explanations of evidence. The balance of explanations within the testimonies is promising to reaching a level of validity and credibility in the field.

Keywords: wrongful conviction, exoneration, forensic science, testimony, DNA analysis, misleading evidence

DEDICATION

I would like to dedicate this thesis to my mother who provided constant support throughout this process and to my friend, Olivia Wallace, for all of her encouragement and advice. Thank you for everything.

ACKNOWLEDGMENTS

I would like to thank my thesis advisor, Dr. Joshua Hill, for all of his support, guidance, and patience throughout this process. I would also like to that the Honors College for their assistance. If not for their advice and support, this research would not be possible.

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LIST OF ABBREVIATIONS

DOJ   Department of Justice

FBI   Federal Bureau of Investigation

IP   The Innocence Project

NAS   National Academy of Science

NRE   The National Registry of Exonerations

PCAST   President's Council of Advisors on Science and Technology

CHAPTER I: INTRODUCTION

Since its introduction to criminal courts in the late 1800s, forensic science has generally been considered an accepted and reliable science. Courts in the United States have legitimized several disciplines within forensic science despite a lack of proper scrutiny of certain forensic techniques (Meterko, 2016). For instance, in the case of Bennie Starks who was convicted of sexual assault in 1986, a self-proclaimed expert in forensic odontology presented bite mark evidence in the courtroom which supposedly found sixty-two similarities between Stark's teeth and the bitemark on the victim's shoulder (Gabel, 2014). However, independent evaluations of this evidence discredited the initial conclusions twenty years later. These conclusions were made with flawed methodology and improper preservation and photography techniques (Gabel, 2014). This is just one example of forensic evidence used in convictions later being discredited or proved erroneous resulting in a person's exoneration. While forensic science has been a useful tool in both investigations and trials, it has also contributed to the problem of wrongful convictions (Meterko, 2016). Misapplications of forensic science, whether in testing of evidence or misleading testimonies by forensic analysts, have been identified as a contributing factor to a growing number of wrongful convictions over the last forty years.

To analyze the individual factors contributing to wrongful convictions, the full scope of wrongful convictions needs to be understood. Wrongful convictions are identified through exonerations. Exonerations can include official actions such as pardons, acquittals, or dismissals which serve to clear an individual of a crime through evidence of their innocence (Bonventre, 2021). The actual number of wrongful

convictions cannot be accurately determined from exonerations as the number of exonerations is estimated to only be a fraction of total number of wrongful convictions in the United States. Currently, there are two main resources which collect information about exonerations. First, the National Registry of Exonerations, a project created in 2012 by the University of California Irvine, the University of Michigan Law School, and Michigan State University, is a database that provides a comprehensive list of all known exonerations in the United States. As of September 2022, the National Registry of Exoneration reports more than 3,200 exonerations since 1989 (*The National Registry of Exonerations*, n.d.-a). Secondly, the Innocence Project collects information on exonerations that occurred through the use of DNA evidence. Both resources are vital tools to understanding the phenomenon and circumstances of wrongful convictions.

The impacts of wrongful convictions are not limited to the system as a whole. The sheer number of known wrongful convictions does pose a threat to the validity of the criminal justice system in its pursuit of justice and the trust of the public to convict the actual offenders. But more than this, the errors made in the criminal justice system that led to wrongful convictions harms the innocent individuals who were wrongfully convicted and, therefore, were themselves victims of injustice. Additionally, the original victims of the crime who's real offender was not initially brought to justice, and in some cases, never brought to justice are also heavily impacted. The effects of wrongful convictions are a cause for concern, both within the criminal justice system and for the individuals caught in the middle. The criminal justice system is designed to prevent injustices from occurring. To accomplish this, it is made up of several different interacting parts. Police departments, crime labs, and the courts, while all working for the

same system, are kept separate. This separation is intended to limit the potential for errors, or at the very least to provide more opportunities to find errors before they result in injustices. The standard that guilt must be proved "beyond a reasonable doubt" should further protect individuals from a misplaced verdict. With all of these protections designed to prevent individuals from being convicted of crimes they did not commit; one cannot help but ask: where did we go wrong?

Many researchers have attempted to identify the main issues that lead to wrongful convictions. There are six contributing factors to wrongful convictions that have been categorized by the National Registry of Exonerations: false eyewitness identification, false confessions, perjury/false accusations, false or misleading forensic evidence, official misconduct, and inadequate legal defense (*The National Registry of Exonerations*, n.d.-b). The main causes for wrongful convictions identified in cases that used DNA evidence tend to differ from the identified causes in cases that did not use DNA evidence. This is due in part to the types of crimes present in each category. Cases with access to DNA evidence are usually homicides, sexual assaults, or other violent crimes (West & Meterko, 2016). Additionally, cases without access to DNA evidence face more difficultly in definitively proving a person's innocence. Therefore, they generally must perform more in-depth investigations. These in-depth investigations reveal problems that might be present but that are not necessarily identified in cases that used DNA to prove innocence (West & Meterko, 2016). In DNA exoneration cases, false eyewitness identifications are the leading factor to wrongful convictions, followed by false or misleading forensic evidence, false confessions, and finally, the use of informants (West & Meterko, 2016). In any particular case, several of these factors may appear

simultaneously which can contribute to the complexity of the situation. For the purpose of this research, the false or misleading forensic evidence will be the main focus. It would be impossible to determine if the forensic evidence in a case was the sole factor leading to the wrongful conviction or if it played only a small role in the final outcome. This is due to the fact that the specific reasons that lead a jury to their conclusion cannot be known. The weight the jury places on certain evidence or testimony in a particular case would need to be determined to truly isolate what factor had the greatest impact in each wrongful conviction case. Despite this, understanding the shortcomings in forensic expert testimony on forensic evidence can help inform professionals seeking to reform or improve forensic practices.

Research surrounding the analysis of forensic expert testimony in connection to wrongful convictions is lacking. The one notable research on this matter was conducted in 2009 by Brandon L. Garrett and Peter J. Neufeld on the prosecution experts used in exoneration cases between 1989 and 2009. The study located transcripts for 137 cases and identified invalid testimony in sixty percent of those cases. Interestingly, their study suggested that forensic practices were improving through modern advancements in the science, which may suggest that the contribution of forensic science to wrongful convictions should be decreasing over time (Garrett & Neufeld, 2009). Consequently, it is imperative to determine if forensic science as a field has reached a level of credibility and reliability. To accomplish this, this research will focus on exonerations that occurred between 2010 and 2022. The transcripts of these cases will be analyzed in hopes to shed more light on the issue of forensic testimony in criminal cases. The analysis of expert

testimony in exoneration cases from 2010 to 2022 will also help determine the need for further improvements in forensic science.

CHAPTER II: LITERATURE REVIEW

Wrongful Convictions

Research surrounding wrongful convictions began as early as 1913 with Edwin Borchard's work on the ways in which unjust convictions were approached in European systems, but the knowledge and understanding of this subject gained traction in the 1980s (Gould & Leo, 2010). Since then, literature analyzing the frequency and causes of wrongful convictions in our criminal justice system has grown significantly. Furthermore, the introduction of DNA testing to criminal courts in 1989 brought the media's attention to wrongful convictions. The attention from the media solidified for the public that wrongful convictions do occur, which in turn, provided innocent defendants more opportunities to be cleared (Gould & Leo, 2010). Over the next several decades, more than 350 people were exonerated using DNA evidence, and even more people were exonerated through means other than DNA.

These cases have allowed for researchers to identify several factors that contribute to wrongful convictions in a wide variety of cases. Understanding each factor involved in wrongful convictions is especially important because these factors should not be assumed as the sole cause leading to a conviction. Therefore, a single factor cannot be considered alone as a direct cause, but rather should be observed as a contributing cause working together with other factors in a case. Unfortunately, some factors such as prosecutorial misconduct, inadequate defense counsel, police misconduct, or racial discrimination are difficult to document or prove as compared to false eyewitness identifications or mistakes in forensic science, which can be more readily discovered and addressed (West & Meterko, 2016). This can further complicate matters as each instance

of misconduct in wrongful conviction cases may be difficult to identify. Current research surrounding the factors involved in wrongful convictions typically analyze exonerations with DNA evidence and exonerations without DNA evidence separately. Therefore, the factors for both types of cases will be briefly described.

DNA Exonerations

West & Meterko analyzed DNA exonerations documented in the Innocence Project from 1989 to 2014. They found that seventy-two percent of cases between that time involved eyewitness misidentification, forty-seven percent involved misapplication of forensic science, twenty-seven percent involved false confessions, and fifteen percent involved the use of informants (West & Meterko, 2016). Eyewitness identifications are typically conducted through a lineup or photo array. In this arrangement, six or seven people or photos are shown to the eyewitness who is prompted to pick if any of those people are the person who committed the crime (Rakoff & Loftus, 2018). Issues can arise when those administering the test give further prompting that might encourage the eyewitness to pick a certain person. Furthermore, limitations to an individual's memory to accurately identify an individual after some time has passed may also impact the results for a correct identification (Rakoff & Loftus, 2018). The complicated nature of eyewitness misidentification lies in that eyewitnesses are rarely intentionally lying. Witnesses can perceive their memory and ability to correctly identify someone with an unreasonable amount of confidence. However, the ability for a witness to accurately identify someone decreases when a witness is under extreme stress during the time that they encountered an individual and when the person being identified is of a different race than the witness (Rakoff & Loftus, 2018). For the purpose of DNA cases, the

misapplication of forensic science is defined by the Innocence Project as the forensic analysis and/or testimony of forensic evidence which was improperly used to suggest someone's guilt without valid methods or empirical data, but later was conclusively proven incorrect through post-conviction forensic testing which proved the person's innocence (*Forensic Problems and Wrongful Convictions*, 2009). False confessions are typically viewed by the public as something that does not occur, and so great weight may be placed on confession evidence (Leo, 2008). However, false confessions can occur through a combination of several factors. Most notably, police interrogation techniques involving some form of psychological coercion either through the promise of some benefit for confessing or the threat of physical harm or harm of a harsher sentence if an individual does not confess can influence an individual to falsely give a confession (Leo, 2008). The use of informants to secure a conviction creates problems when the informants are presented with incentives to testify, such as leniency in their own cases (*Informing Injustice: The Disturbing Use of Jailhouse Informants*, 2019).

Non-DNA Exonerations

Two additional factors that are seen more often in non-DNA exonerations are inadequate legal defense and official misconduct. Inadequate legal defense may include practices such as a lack of sufficient communication with their client, inadequate attempt at discovery before the trial, a failure to perform a thorough investigation, not obtaining experts or testing physical evidence, and an ineffective cross-examination during trial (Krieger, 2011). Official misconduct refers to police personnel, prosecutors, or government officials who "significantly abused their authority or the judicial process in a manner that contributed to the exoneree's conviction" (*The National Registry of*

Exonerations, n.d.-b). That is not to say that the previous factors discussed with DNA exonerations do not appear in non-DNA exonerations. In fact, eyewitness misidentification, false or misleading forensic evidence, false confessions, and informants are common factors present in non-DNA exonerations. The reason for inadequate legal defense and official misconduct to appear more evidently in non-DNA exonerations cases is likely due to the necessity for deeper investigations in these cases because they do not have access to DNA for testing. The courts place a great emphasis on the definitiveness of convictions and are generally hesitant to consider decided cases unless there is a significant amount of evidence to suggest error (Gross et al., 2005). Therefore, it is more likely for a case to be reconsidered and exonerated solely on the grounds of post-conviction DNA analysis. DNA evidence is generally considered to irrefutably prove whether an individual could or could not have contributed to the sample. This evidence may contradict the initial eyewitness identification, forensic evidence, confessions, or other testimony present in the case. The process of post-conviction DNA testing results in the identification of error in the previous evidentiary elements. But for non-DNA exonerations, a compelling amount of evidence needs to be presented in order for a defendant to be granted relief from the court. DNA cannot be used to show that eyewitness identifications or other forensic evidence had to be erroneous. So, it is more likely for inadequate legal defense or official misconduct to be addressed when handling non-DNA exoneration cases. The main studies on both DNA and non-DNA exoneration cases can be seen in Table 1.

Table 1: Exoneration Research

Study	Focus	Findings
Gross et al., 2005	This study analyzed the patterns within the exonerations they located during 1989 and 2003. This study took place before a national database for exonerations existed, and so, they identified these exonerations through media sources. It is likely that there were more exonerations that occurred between these years that were not covered in the media, and therefore, not present in their analysis.	They found 340 cases between these years. There was a sharp increase of exonerations per year over this 15-year period, starting with an average of twelve a year between 1989 to 1994 all the way up to an average of over forty a year after 2000. Sixty percent of the 340 cases were for murder and thirty-six percent were for sexual assaults. Of the murder cases, fifty percent included eyewitness misidentification, fifty-six percent contained reported perjury, and twenty percent of those cases involved false confessions. Of sexual assault cases, eighty-eight percent contained eyewitness misidentification, twenty-five percent had reported perjury, and seven percent involved false confessions
Garrett & Neufeld, 2009	This study focused on forensic testimony by prosecution experts in trials where individuals were later exonerated through DNA evidence. They looked at trial transcripts of 137 cases and reviewed each case for the inaccurate or misleading use of empirical population data as well as the presence of conclusions about the	They found that 80 percent of the cases contained invalid forensic science testimony across a wide range of forensic fields. The most common forensic evidence present in the invalid testimonies were serological evidence (57 cases) or hair comparison evidence (25 cases). Furthermore, they identified six types of

	probative value. Of evidence without sound empirical data.	invalid testimony: non-probative evidence that was presented as probative, exculpatory evidence was discounted, inaccurate frequencies or statistics were provided, statistics were presented without empirical support, non-numerical statements were given without empirical support, and conclusions were made that evidence originated from the defendant.
West & Meterko, 2015	This study preformed a comprehensive review of 325 cases between 1989 and 2014 documented in the IP database. They analyzed trial transcripts, police reports, forensic laboratory reports, public appeals, and information provided by post-conviction lawyers and credible media sources. Because the focus was on cases within the IP database, the analysis only included DNA exoneration cases.	Of the cases in their study, sixty-four percent were sexual assault cases, twenty-seven percent included both sexual assault and homicide, seven percent were solely homicide, and two percent involved other types of violent crime. The real perpetrator was identified in only forty-nine percent of the cases, most of which were identified with DNA databases. Four main factors were documented as causes that lead to the wrongful convictions. Seventy-two percent of cases contained eyewitness misidentification. Forty-seven percent of cases had false or misleading forensic evidence. Twenty-seven percent of cases involved false confessions. Fifteen percent of cases involved the use of informants.

Meterko, 2017	This study reviewed DNA exonerations that specifically contained the misapplication of forensic science. The study included 158 cases. Information on the cases was derived from post-conviction attorneys, summaries provided from the NRE and IP databases, media coverage, and case documents such as transcripts, police reports, and forensic laboratory reports, and other documents about the cases stored within The Innocent Record.	Forty-six percent of all exonerations in the IP database at the time of this study contained the misapplication of forensic science. Serology evidence was the most common type of forensic science present in these cases. Microscopic hair comparison was the second most common type of forensic evidence followed by bite mark comparison, DNA analysis, dog scent, and fingerprint analysis. The study also identified a decrease in the number of cases involving the misapplication of forensic science each year after 1989. Cases containing the misapplication of forensic science peaked with 61 cases between 1985-1989. There were only 7 cases for 2005 onward.

Number of Exonerations

Despite the struggles for cases without access to DNA evidence to prove innocence, non-DNA exonerations occur in greater numbers than DNA exonerations. In 2022 alone, there were only 16 DNA exonerations, but 267 non-DNA exonerations occurred (*The National Registry of Exonerations*, n.d.-c). The total number of non-DNA exonerations per year since 1989 has consistently increased whereas the number of DNA exonerations each year has stayed relatively consistent (*The National Registry of Exonerations*, n.d.-c). If it is easier to definitively prove an individuals' innocence by

using DNA evidence, then it may be expected for DNA exonerations to occur in greater numbers. Even so, non-DNA exonerations occur much more frequently. There are several reasons to explain why this is the case. First, not every crime will result in DNA evidence. For instance, unlike homicides or sexual assaults, a robbery or drug possession/sale will likely not include any DNA evidence. Secondly, in order to use DNA evidence to prove someone's innocence, that evidence would need to have been collected and stored as evidence for later testing to occur. However, many departments do not require evidence to be maintained in storage after convictions occur, except for homicides which requires all evidence to be kept even after convictions. This creates barriers in the instance that there was DNA at a crime scene, but that DNA evidence is no longer available for a defendant to use when seeking to prove their innocence.

Forensic Science

The field of forensic science is composed of a variety of different disciplines such as toxicology, serology and DNA analysis, firearm identification, fingerprint comparison, odontology, hair comparison, etc. The collection of forensic evidence starts at a crime scene where an officer or a crime scene investigator locates, documents, and collects items of evidentiary value. From there, investigators may send evidence to a crime lab for further testing and analysis. The results from the analysis of forensic evidence are used to inform investigations and presented in trial when necessary.

The application of forensic science to criminal investigation took off in the 1800s and 1900s. The first major modern milestone for the field can be identified as the theory regarding the inherent uniqueness of fingerprints proposed by Henry Faulds and William James Herschel in 1880 (*Exploring the History of Forensic Science through the Ages*,

n.d.). This theory was later applied by Sir Francis Galton and Edward Henry in criminal investigations. But even before then, there was hints of more scientific practices during criminal investigations. One example is the conviction of a man named Warwick in 1816. Investigators analyzed and compared footprints and cloth impressions found at the scene to link Warwick to the murder (*Exploring the History of Forensic Science through the Ages*, n.d.). Warwick's case demonstrates the progression of criminal investigations to a more analytical and scientific approach. The scientific approach in investigating crimes has changed and evolved through research and new discoveries over the years to form the current field that exists today. However, it is important to note that the forensic sciences are not without error. The National Academy of Science (NAS) released a report in 2009 that critiqued the validity and reliability of forensic science. Another report from 2014 released by the President's Council of Advisors on Science and Technology (PCAST) followed up on the issues identified in the 2009 report. Both reports showed concern for forensic science methods and procedures while also presented recommendations for reforms to strengthen the science.

DNA Analysis and Serology

Before DNA analysis was common practice, forensic analysts used ABO blood-typing to exclude or include a suspect. Serology and ABO blood-typing is scientifically grounded and uses population data that has been empirically validated (Garrett, 2011). Despite this, serology and ABO blood-typing faced shortcomings in defining the clear boundaries of what the evidence could show. In Garrett and Neufeld's analysis of forensic science testimony, fifty-eight percent of cases involving serology evidence contained invalid testimony (Garrett & Neufeld, 2009). The most prevalent error

occurred when analysts did not explain how a victim's blood type can mask the blood type of the perpetrator (Garrett & Neufeld, 2009). For instance, if both the victim and the suspect had the same blood type, it would be impossible to conclude that the suspect could have contributed to the sample. The sample should be a mixed substance with a combination of fluid from both the victim and assailant. In a situation where the victim and suspect share blood types, the victim's markers could cover up any markers of the assailant resulting in an inconclusive result. However, forensic science experts did not address the inconclusiveness of serology tests and instead presented population data that included the suspect without acknowledging how the victim's blood type would affect the results (Garrett & Neufeld, 2009). ABO blood-typing was eventually replaced with DNA analysis.

DNA analysis also uses population statistics to determine the likelihood that a random person of the population would share the genetic markers of the DNA profile collected. Originally, DNA analysis identified 13 loci for comparison, but the number of loci identified during analysis changed to 20 loci in 2017 (Wyner et al., 2020). DNA analysis allows for a higher power of discrimination because there are more variables among different individuals which makes it more reliable in identification. Unfortunately, DNA analysis is not immune to mistakes. While less common, DNA analysts can misinterpret population statistics leading to improper conclusions (Garrett, 2011). Furthermore, when testifying on DNA analysis, analysts cannot claim a one-hundred percent match to a suspect. While DNA analysis can result in very compelling population statistics such as one in 1 billion random individuals would match a certain profile, there is still a chance that the DNA profile could be matched to another individual besides the

suspect. For this reason, when an expert presents DNA analysis in court, they must

present the evidence using probability or percentage statements both of which can be

misleading, even if accurate, depending on how the analyst describes the evidence.

Bitemark Comparison

Forensic odontology refers to the use of dental evidence to identify individuals. It

is most useful in identifying remains that cannot be identified through other means

(Mohammed et al., 2022). Bitemark comparison, a subfield of forensic odontology,

applied the same scientific approach of analyzing dental patterns to match a bitemark

impression found on skin or other materials to include or exclude a suspect as the

individual who left the bite mark (Souviron & Haller, 2017). It was first introduced in

criminal courts during the case of Texas v. Doyle in 1954 (Koen & Bowers, 2017).

Investigators found a piece of cheese with a bite mark indentation which was "matched"

to a suspect's dental information (Koen & Bowers, 2017). Following this case, bite mark

comparison was permitted in court as scientifically sound evidence up until DNA

analysis entered the courts and proved error in previous identifications that relied on bite

mark comparison evidence. In the recent years, the validity of bite mark comparison has

been called into question. The elasticity of skin can result in distortion of any impression

left behind (Pretty & Sweet, 2001). Even experienced forensic odontologists have been

shown to disagree on conclusions with their peers on whether something is a bite mark, if

a bite mark is from an animal or a human, and if the bite mark was left by an adult or

child; even more concerning, forensic odontologists have changed their own conclusions

when analyzing the same case after a period of time had passed (Reesu & Brown, 2016).

Microscopic Hair Comparison

The use of microscopic hair comparison in criminal investigations relies on the basis that an individual's hair will contain microscopic patterns that can be distinguished as similar to or different from a sample of hair collected from crime scenes (Oien, 2009). Hair evidence is common to find at crime scenes, and so, microscopic hair comparison can assist investigators by determining potential links between a suspect and crime scene or a suspect and a victim, depending on where the hair was found (Oien, 2009). Microscopic hair comparison primarily focuses on class information. That is, identifying characteristics that a group of individuals would share rather than the specific identification of an individual. Much like bite mark comparison, microscopic hair comparison has also suffered questions of validity once DNA evidence proved error in previous cases that relied on hair comparison. In 2015, the FBI and DOJ released a statement regarding an internal review conducted in partnership with the Innocence Project and the National Association of Criminal Defense Lawyers that reanalyzed 3000 cases containing microscopic hair comparison before 1990 (Bonventre, 2021). This review found that in at least ninety percent of cases involving inculpatory evidence, or evidence that included the suspect as a possible contributor to the sample, the testimony of experts contained error (Bonventre, 2021). For this reason, microscopic hair comparison is also now tested for either nuclear or mitochondrial DNA when possible (Oien, 2009).

Improvements

The errors in forensic science are not limited to serology, bite mark comparison, and microscopic hair comparison. While these three areas appear more often in the

current literature surrounding erroneous evidence in exoneration cases, other fields of forensic science appear as well. The reason for other fields of forensic science do not show up as frequently in exoneration cases may mean these fields are more reliable. However, it also may be due to the rate at which other types of evidence are present in investigations and if that evidence is used to specifically identify a suspect. For example, shoeprint comparison may not be possible for a majority of cases simply because no shoeprints were found at a crime scene to use for comparison. Alternatively, fingerprint comparison does appear in exoneration cases, but in the analysis of expert testimony in exonerations performed by Garrett and Neufeld, fingerprint evidence actually excluded the suspect in 19 of the 20 cases that contained fingerprint comparison (Garrett & Neufeld, 2009). The analysis of forensic evidence is not the only area where forensic experts go wrong. Even when analysis of evidence is accurate, the ways in which an expert testifies in court, whether in withholding evidence or overstating evidence, also contributes to their role in wrongful convictions.

Testimony in the Courtroom

The use of scientific evidence in trials was first outlined in *Frye v. United States* in 1923.This landmark case established the *Frye* test which set a standard of "general acceptance" within the scientific community for that evidence to be admissible in court (*Frye v. United States*, 1923). More than fifty years after this standard was established, the Federal Rules of Evidence introduced Rule 702 on testimony of experts to guide federal civil and criminal proceedings and is as follows: "If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience,

training, or education, may testify thereto in the form of an opinion or otherwise" (*28 USC App Fed R Evid Rule 702. Testimony of Experts*, 1975). At first, it was unclear if this rule was intended to incorporate the *Frye* test or if it was intended to replace the *Frye* ruling (*Strengthening Forensic Science in the United States*, 2009). In 1993, the Supreme Court ruled that Rule 702, as opposed to Frye, should apply to the admission of scientific evidence in federal courts, and further clarified that scientific testimony and evidence should be based on valid principles and methodology so as to be reliable (*Daubert v. Marrell Dow Pharmaceuticals, Inc.*, 1993). This ruling left a responsibility for judges to decide if scientific evidence is valid and reliable through proof that the technique had been tested, if research for the technique had been peer reviewed and published, the potential rate of error for a given technique, the standards overseeing a technique, and a degree of acceptance within its scientific community (*Strengthening Forensic Science in the United States*, 2009). The role of judges is to act as a gatekeeper for expert evidence to ensure evidence has valid roots before being placed in front of a jury. It has been shown that juries may place special weight to the presence of forensic evidence (Garrett, 2011). So, while the Daubert criteria strengthened the rules for the admission of evidence in the courtroom, judges are often left to decide credibility of scientific evidence despite having no expertise in the scientific realms.

Furthermore, once evidence is in the courtroom, it needs to be presented in a way that will allow the jury to fully understand the results of the evidence. There has been debate on what is the best way for forensic evidence to be presented in court. The NAS 2009 report criticized forensic experts for conclusions made in court that overstated the strength of evidence without including supporting data (*Strengthening Forensic Science*

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in the United States, 2009). But not only is the overstatement of evidence a concern, the way accurate statistics or observations are phrased plays an impact on how that information is received by members of the jury. For example, DNA analysis is presented using population statistics which is intended to convey how frequently a DNA profile will appear in a population. It would be accurate to describe a DNA match as a percentage or as a probability, such as 0.01% or one in ten thousand. Furthering that, the way the percent or probability is framed can also affect one's understanding of it. One study found that using percentages tended to be more persuasive in the match of a suspect as opposed to probabilities (Koehler, 2000). The same study also found that framing the evidence to a more specific area, such as one in ten thousand people in Houston would also match a DNA profile, as opposed to a more general statement that just targets the suspect is less persuasive (Koehler, 2000). Quantitative evidence is generally more difficult for a person of the jury to comprehend and has been found to be interpreted to mean the opposite of what it actually conveys (Eldridge, 2019). Qualitative explanations or non-numerical explanations are also not immune to misinterpretation. Most notably, qualitative explanations rely on subjective language to make the evidence more understandable, but subjective language may not be able to give an accurate basis for what the evidence means (Eldridge, 2019). This might suggest that a forensic expert should use a balanced amount of both types of explanations to create a greater chance that the jury will understand the evidentiary value properly.

Conclusion

The aim of this research is to further elaborate on how forensic expert testimony may be misleading or inaccurate in a courtroom. Issues in forensic science have been

identified and documented significantly over the past few decades. On the other side of that, improvements in forensic science hopefully mean that the ways in which science-based evidence has failed in the past are not as prevalent. The focus on this research is not on the methods, procedures, or accuracy of forensic analysis at a crime scene or in a lab, but rather on how that evidence is presented during a trial to a jury. The Daubert criteria shows that while a judge can decide whether or not a science has enough credibility to be used in court, it is the responsibility of a forensic scientist to ensure that any analysis of evidence is well established and the presentation of evidence reflects truth. The presence of error in forensic testimony seen in hundreds of exoneration cases is concerning. However, research into the error of forensic science in exonerations is limited to cases that occurred before many of the recent improvements in the science. Garrett and Neufeld's study into forensic expert testimony spanned from 1989, the beginning of DNA analysis in courts, to 2009, just before the NAS report released calling attention to the weaknesses of the science. By focusing on exoneration cases within the last decade, the areas of error seen in older cases, such as the errors observed in explanations of ABO blood-typing, bitemark comparison, or microscopic hair analysis, should not appear as frequently, if at all. The analysis of newer cases can show if forensic practices have improved since 2009, or if the shortcomings in forensic science have shifted to other areas of forensic science

.

CHAPTER III: METHODS

Data

      This study will use a quantitative and qualitative approach to analyze the content of forensic expert testimony. Data will be derived from the testimony of forensic experts during the initial trials of cases that were later exonerated. Expressing the content within a testimony in both a quantitative and qualitative manner will allow for the testimonies to be compared to one another to determine common links between how forensic evidence is presented in exoneration cases. Furthermore, general data about exoneration cases between 2010 and 2022 can be documented to understand the scope of errors in forensic science testimony.

      The National Registry of Exonerations (NRE) provided information on all documented exonerations in the United States since 1989. The NRE search filters were utilized to identify exonerations between 2010 and 2022 that contained false or misleading forensic evidence. There were 314 cases within these parameters. Eighty-two cases, or twenty-six percent, used DNA evidence while the remaining cases used other types of evidence for the exoneration. The NRE provides general details such as exoneration year, conviction year, county and state of conviction, the criminal charges, and summaries of all the cases in the database. This information can be helpful to understand the scope of the cases and track the types of cases seen in exonerations. The details of the 314 cases within the dataset can be seen in Figure 1 through Figure 4.
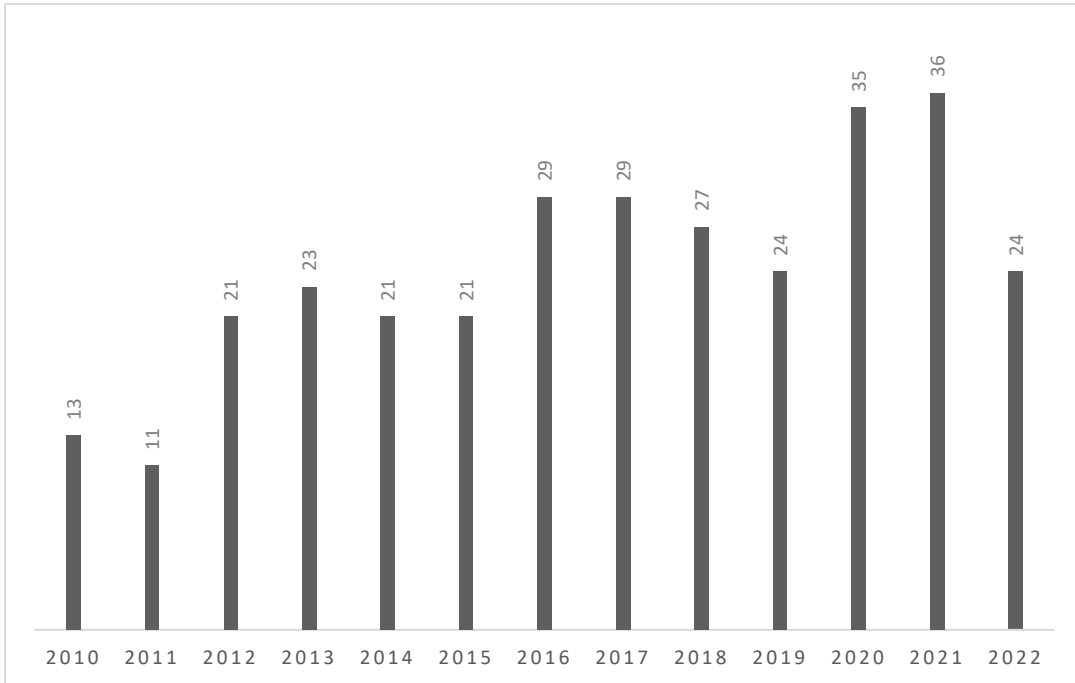
Figure 1: Year of Exoneration
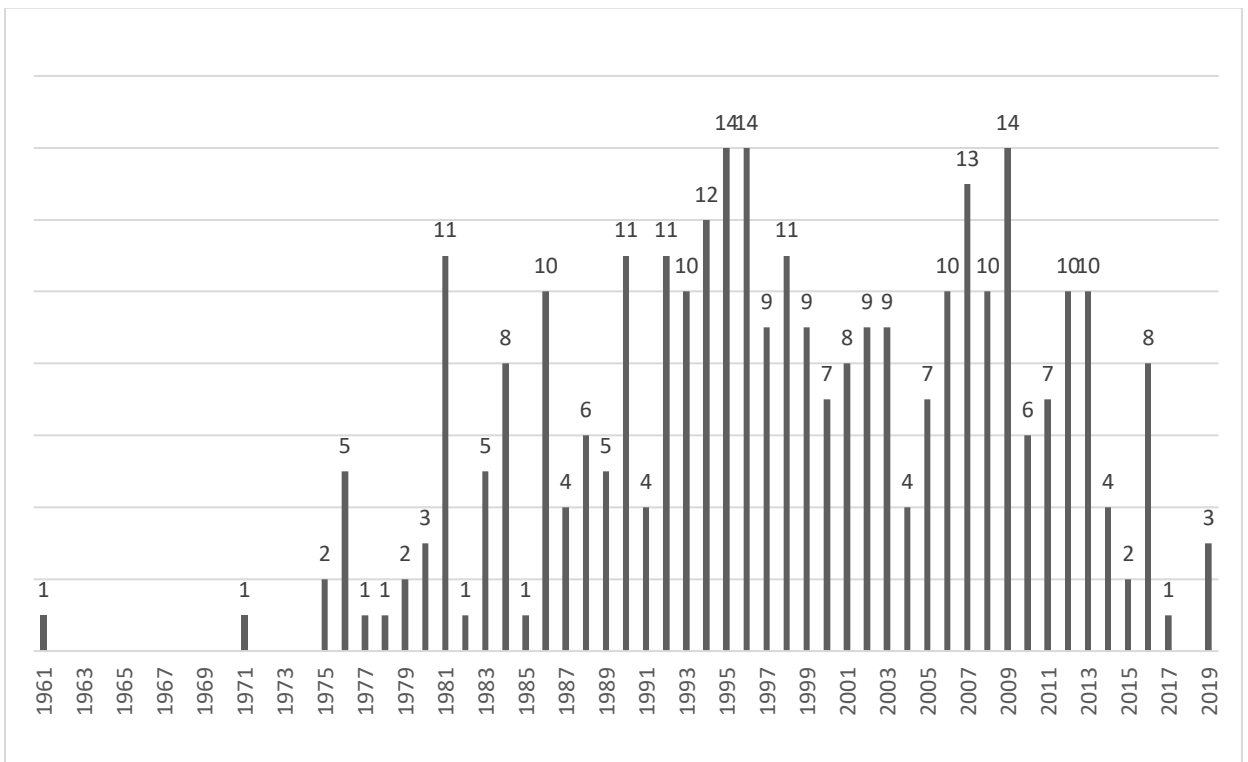

Figure 2: Year of Conviction
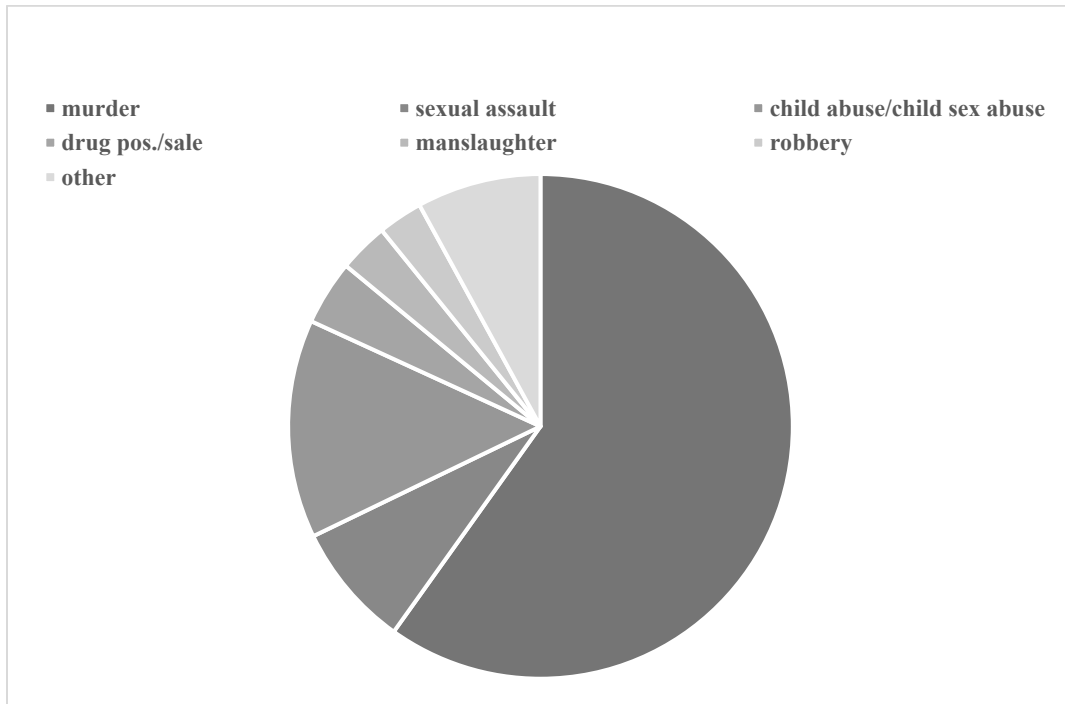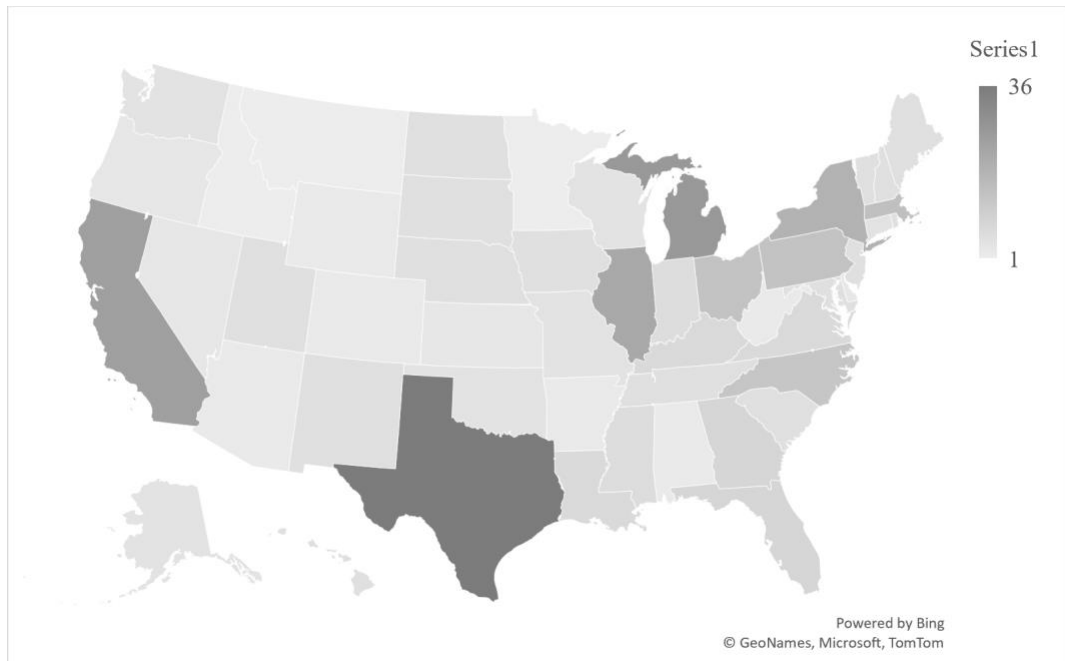
Figure 3: Types of Crime

Figure 4: Exonerations by State

While it would be valuable to analyze testimony of all 314 cases to gather a more

comprehensive idea of the ways forensic evidence appears in exoneration cases between

this time, a smaller sample of these cases can still reflect the commonality in the presentation of forensic evidence in the courtroom. Initially, a random sample was taken of the 314 cases which yielded 30 random cases. This random sample included cases whose initial convictions occurred as far back as 1975 and as recent as 2012. Unfortunately, several courts did not maintain transcripts for cases more than 10 years old. So, while the exonerations took place within the time frame of this research, the initial trials where the individuals were wrongfully convicted spanned across nearly 40 years. For this reason, a new sample was taken to isolate cases where the initial convictions occurred between 2013 and 2022. In that new search, 28 cases fit within these parameters. In those 28 cases, the testimony of three forensic experts could be located and obtained within the time frame of this research. The testimonies of the forensic experts were analyzed to access the ways forensic evidence was described and explained in court to a jury.

Analysis

This analysis consisted of quantifying each answer given by a forensic expert on a scale of 0 to 2 for the following criteria: quantitative explanations and technical terminology, statements of context around statistical support, qualitative explanations, and acknowledgement of potential error or error rates. Quantitative explanations refer to statements given by the expert that focus on numerical explanations regarding the evidence. This can take the form of population statistics, frequency data, or other types of descriptions that focuses on quantifiable measures of comparison when introducing or explaining the evidence. This category further includes scientific descriptions and technical terminology. For areas of forensic science that do not use population statistics

or frequency data, statements that used strictly scientific or technical terminology are frequently used in the presentation of evidence. Statements of context refers to further explanations that frame any numerical statements or technical terminology to be more understandable for a member of the jury. Qualitative explanations refer to non-numerical assertions made by the expert. In other words, statements that intend to relay the evidentiary value of any evidence or analysis that is not presented with statistics or specific scientific data or facts to support the assertion. These statements are typically made in simple layman's terms so that the jury will comprehend the evidence, but they may lack clear indications of scientific support. One way that forensic experts tend to relay information in a qualitative way is describing probative evidence, or evidence that intends to prove a fact of the case, as consistent with or likely to have originated from a suspect. Qualitative explanations for the purpose of this analysis focus on assertions of fact without scientific descriptions. Acknowledgment of error or error rates should appear for any testimony given by an expert. All areas of forensic science cannot produce one-hundred percent certainty. Statements that address the limitation of analysis or results should be given to provide the jury with a relevant basis for what certain forensic sciences are capable of showing. Each testimony was read, and every answer provided by the expert during questioning was accessed based on these four areas. In the quantitative analysis of the expert testimonies, a 0 would indicate that the forensic expert did not include any statements for a particular criterion. This would show that a particular answer did not reference any aspect of that criteria. A score of 1 would indicate some references under a certain criterion. This was categorized by a reference to portions of that criteria while not being the main focus or most prevalent part of that answer. Lastly, a score of 2

would be a full explanation regarding that criterion meaning the answer predominately focused on the aspects of that criteria in a clear and direct manner. Most answers given by an expert would not include all four areas. However, an expert should address each criterion within separate answers during their testimony.

These criteria were selected in order to observe if more numerical and technical or non-numerical statements regarding the evidence as well as context and explanations of error in the specific type of forensic analysis may have played a role in how the jury perceived or understood the evidence presented. If a member of the jury misunderstands the evidence presented, then the testimony explaining the evidence could have been misleading. From a scientist's perspective, a perfect testimony would hypothetically contain significant portions of all four criteria. This would mean that the methods, rationale, and credibility would be fully addressed in answering questions regarding one's analysis of evidence. However, members of the jury may not be as knowledgeable on the statistics or methods surrounding the forensic science field. The lack of scientific knowledge of members of the jury may result in one area of explanation having a greater impact on the way that the jury may interpret the evidence and its value. Because it is the jury's job to determine if a defendant is guilty or not guilty and doing so incorrectly can lead to a person being wrongfully convicted, it is imperative that evidence is presented in a way that will be best understood by a layperson as well as being accurate to the field.

Due to the limited nature of data, a qualitative analysis was also conducted using Grounded Theory. Grounded Theory is a methodological framework which focuses on developing a theory inductively from a data set (Dillon, n.d.; Khan, 2014). Instead of a descriptive analysis of data to support or disprove a theory like some qualitative analyses,

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Grounded Theory employs set procedures and analytical techniques to develop themes

and categories which seek to point out patterns in data which can then be used to develop

a theory (Dillon, n.d.). As the testimonies were assessed quantitatively, general themes in

the answers given by the experts were also documented. Code words were selected based

on the perceived purpose of an expert's answer or general descriptions of what the

answer seemed to convey. After documenting the general themes throughout the

testimony, the most common code words were grouped into categories that were more

focused. This information can be assessed to distinguish common elements between what

experts tend to communicate to a jury. These categories can be used to distinguish

common patterns between testimony given by different experts. Identifying these patterns

between testimonies can be used to further understand the ways that experts present

evidence and help elaborate on any shortcomings in the testimony of experts in court.

CHAPTER IV: FINDINGS

Quantitative Analysis

The testimonies were scaled from 0 to 2 on four criteria for each individual answer. The average for the answers during the entire testimony of each expert can be seen in Table 2.

Table 2: Quantitative Analysis Results

Expert Name	Quantitative Explanations	Statements of Context	Qualitative Explanations	Acknowledgement of Error
Wiles	0.702	0.681	0.702	0.085
Dr. Traylor	0.519	0.457	0.543	0.116
Dr. Thoma	0.325	0.375	0.725	0.075

Qualitative explanations or non-numerical assertions appeared most frequently in the testimony of Dr. Traylor and Dr. Thoma, both of whom testified on evidence relating to forensic pathology. In one such instance, Dr. Traylor testified "Well, it's not – you know, I can answer both ways. It's not inconsistent. I don't want to say it is consistent or inconsistent. It's commonly found in asphyxia forms of death." Statements like this were frequent throughout the testimonies. Dr. Thoma's testimony contained the most significant gap between qualitative and quantitative explanations. Statements of context clarifying scientific data appeared less frequently than quantitative and qualitative explanations during the testimonies. Even so, Dr. Traylor's testimony provides a clear example of this type of explanation in the following answer:

Basically, the same way, like if you got a splinter in your finger, and it turns kind of red and it festers a little bit, and you get like a little area of pus, those little cells

that compose pus are technically referred to as neutrophils; that's what we call

them. 'Pus' is probably an easier word.

Furthermore, all three experts addressed an acknowledgment of error or limitations the

least of all four criteria throughout their testimony. Dr. Traylor acknowledged error at

one point by clarifying "And actually, these three areas that I thought were bruises are not

bruises. They are areas of hyper-pigmentation" It was expected that this criterion would

appear the least during testimony. However, the significant lack of explanations

regarding possible limitations to the evidence or sources of error is concerning. Overall,

the experts' testimonies contained aspects each area that was theorized to be important in

the presentation of evidence to a jury.

Qualitative Analysis

Twelve main categories were identified throughout the testimony of the three

experts which can be seen in Figure 5.

Figure 5: Central Themes of Testimony
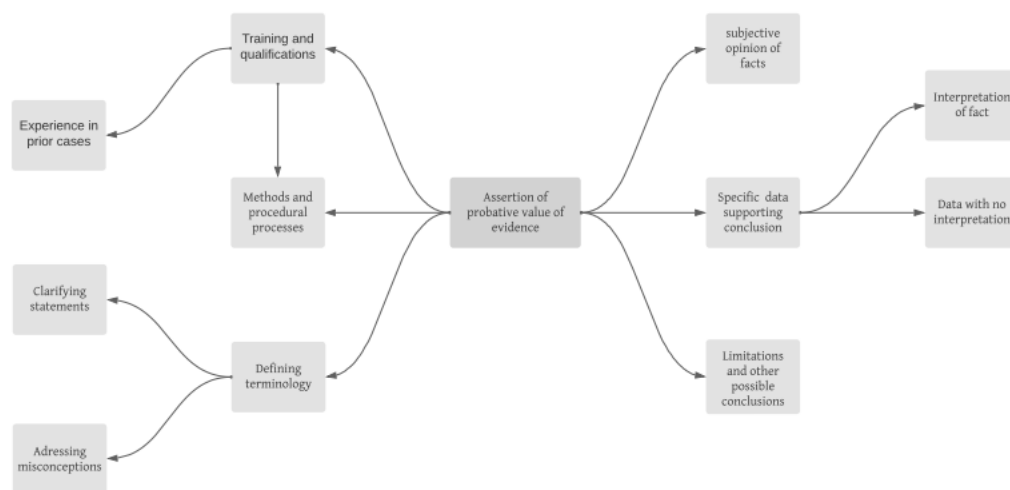
The main purpose of the three testimonies analyzed was to prove facts or circumstances of the cases through forensic evidence. The assertions regarding the probative value of forensic evidence in these cases remained the main focus throughout the entire testimony. These assertions were supported in varying ways. First, the credibility of an expert through education, training, and past professional experience was referenced not only in the introduction of the expert to the court but continued to be addressed throughout the entire time an expert was on the stand. Discussion surrounding their training and experience was frequently accompanied by the specific methods of their work and the procedures they follow during an analysis. Furthermore, a significant portion of the experts' testimonies revolved around defining scientific or procedural processes and words. This resulted in the clarification of their work and gave experts an opportunity to discuss the differences between how the jury may perceive forensic evidence versus what the forensic evidence actually shows. Additionally, assertions of the probative value of evidence lead experts to discuss their opinions regarding the facts of the case, specific data regarding their analysis, and the limitations to their work. The qualitative analysis revealed the flow of an expert's testimony and the specific themes that they convey to a jury.

CHAPTER V: DISCUSSION

Content of Expert Testimony

The quantitative and qualitative analyses reveal important aspects of forensic expert testimony. The presence of both qualitative and quantitative statements from the experts suggests that the forensic expert testimony in these three cases were fairly balanced in how information was presented to the juries. It was theorized that there would be a greater gap between how experts presented evidence to a jury. However, the quantitative analysis indicates that forensic experts attempt to include technical and simplified explanations of evidence. The qualitative analysis also revealed a logical flow of information that focused on the surrounding procedures and methods surrounding their specific field of forensic science. There were no notable answers provided by these experts that appeared significantly misleading throughout the analysis. This might suggest that the testimony of experts has improved which would mean that there needs to be a focus on the analysis of evidence before going to court rather than how evidence is explained to a jury.

The main flaw in the forensic testimony is most clearly the lack of explanation regarding potential error and limitations. It is important to address that the prosecutor's questions during testimony plays a role in how the experts address details about the evidence. The prosecutor's role in how experts testify was not taken into consideration throughout this analysis. Testimony involves the interaction of both the prosecutor and the expert testifying, and so, both can have an impact on how information is conveyed to a jury. Just like each factor that contributes to wrongful convictions cannot be assumed as the sole reason for a wrongful conviction because multiple factors were likely involved in

the outcome, the forensic expert is not working alone while testifying in court, and so, the prosecutor or defense attorney contributes to the way that an expert witness will convey information in court.

Limitations

The most obvious limitation to this research was the low number of expert testimonies obtained for analysis. The three experts testified on two separate areas of forensic science: forensic pathology and forensic mapping. This leaves significant gaps in the knowledge of any potential differences between other fields of forensic science. Previous research identified several specific fields of forensic science, such as microscopic hair comparison and bite mark comparison, that contained significant error, all of which did not appear in the testimony of the three experts in this data set. It was expected that these fields of forensic science would not appear in more recent cases due to the scrutiny to the validity of these fields.

The accuracy of the expert's analysis could also not be determined strictly from their testimony in the initial trials of exonerees. While understanding how forensic experts present information to a jury is relevant to understanding where forensic testimony may be lacking, it does not include the full scope of where error may lie. Even if an expert communicates information to a jury in a way that is understandable through quantitative and qualitative explanations with full contextual statements and acknowledgement of potential errors or limitations, if the expert was erroneous in their analysis of evidence, then the testimony would still be invalid and misleading. This type of error cannot be seen in the testimony of initial trials for exonerees. It is uncertain if the testimony of experts was accurate. In order to consider the accuracy of information

presented to a jury, further information about the cases would be necessary. Furthermore, it is not possible to determine how the jury may have weighed the forensic evidence in a particular case. Additionally, the parameters for the quantitative analysis focused on the aspects of testimony that would affect a juries' comprehension and understanding of evidence, but the actual perception of a jury in these specific cases is unknown.

This research only included exoneration cases classified by the NRE as having false or misleading forensic evidence. It was not known if the error in these cases was due to the inaccuracies in the analysis of evidence or in the presentation of evidence. It is also unknown if there is a difference in the ways testimony was presented in these cases from cases that were not wrongful convictions. Further research that includes cases where there is clear evidence that the conviction was sound and right would help create a better comparison for forensic evidence in court.

Challenges

This type of research presented many difficulties. First and foremost, the court cases are classified as public records. However, locating the records was met with many setbacks. The cases in this study occurred in various states and counties. The specific county court where the cases were held had to be identified. Finding the location of the case was not difficult as the NRE listed the state and county in their database. However, finding information about the case from the specific court did pose some challenges. Different courts had different procedures for public access to records. Some courts provided access to an online case search function while other courts restricted public access online. Case numbers could be found in the online case search for many of the courts that offered that service. The case number was generally required when ordering

transcripts from the courts, and the courts that did not provide online services required a case number for inquiries over the phone. Some court clerks were helpful over the phone in trying to locate a case number based off of the information about the case provided by the NRE, but other courts could not perform case searches for the public without a case number. Additionally, with the assistance of court clerks, the names of the court reporters for a case were located. Transcript requests generally had to go through the court reporters. Unfortunately, only a handful of court reporters could be reached in the time span of the data collection for this research. This caused major setbacks during the data collection process. Furthermore, courts in some states would only accept transcript orders either in person or through mailed requests. Overall, challenges surrounding the access to case numbers, reaching court reporters, and efficiently requesting transcripts prevented the collection of all 28 transcripts that this research hoped for. It would be beneficial for standardized procedures and processing for obtaining public court records or national databases containing public court records to be created. This would allow future research into wrongful conviction, especially research pertaining to testimony of experts, to be more accessible.

CHAPTER VI: CONCLUSION

Wrongful convictions threaten the validity and trust of the criminal justice system. It is evident in the increase of exonerations each year that the factors contributing to wrongful convictions need to be investigated further. Understanding the causes of wrongful convictions pose opportunities to implement strategies and protections to limit and potentially stop the wrongful conviction of innocent individuals. Research into wrongful convictions comes with complications due to the interconnectivity of the factors in each case that contribute to the incorrect outcomes. False or misleading forensic evidence is just one of many factors that result in a wrongful conviction. Cases with false or misleading forensic evidence likely contain other contributing factors which makes it difficult to determine which factors had the greatest impact in a case. The weight a jury places on certain types of evidence, whether that be eyewitness testimony, confessions, etc., is necessary to understanding how wrongful convictions occur. Still, forensic science is an important part of both investigations and trials. Forensic science has improved over the recent decades with DNA analysis and other advancements in the science which should result in more validity and credibility in the field. The testimonies analyzed in this study provide a hopeful outlook on forensic expert testimony as they included a balanced explanation of scientific evidence in technical terminology as well as more simple statements dictating how evidence was analyzed and what it showed.

Further research would need to include a larger set of testimonies to extend the analysis of forensic expert testimony. Analyzing more cases from the recent decade alongside older exonerations would allow researchers to gain a better understanding of the progression of forensic science as a field. As previously addressed, it would also be

beneficial to include cases outside of exoneration cases to further understand the potential

differences between wrongful convictions are convictions that are presumably correct.

Additionally, research would benefit from a more in-depth exploration of these cases on

both the scientific analysis and testimonial aspects in order to gain broader knowledge on

where the current errors or shortcomings of forensic science may be.

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