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DNA Analysis: The Answer for Unsolved Cases?

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Abstract

DNA analysis has become a crucial part of solving cases. It has developed significantly since its creation in the mid-1980s. The longing for answers within unsolved cases is historically lengthy, leaving traces of distrust and injustice. Criminologists offer a potential solution to the mess created by connecting DNA analysis to protect victims and communities. DNA evidence and analysis can assist in solving cases and provide answers for exonerees. Like public genealogy websites, law enforcement agencies must acknowledge new methods to solve issues. Not only could law enforcement agencies solve and arrest suspects through DNA analysis, but DNA could also provide answers for those wrongfully imprisoned. Thus, the ethical and moral issues with unsolved cases and DNA analysis create a unique and challenging outlook. Public distrust and image of law enforcement agencies suffer from the failure of non-modern DNA technology. Therefore, law enforcement agencies must be aware and conscious of their decisions regarding evidence at a crime scene and submission. However, due to the advancements in DNA testing, scientists and criminologists argue that solving cases has significantly increased. Decision-makers and lawmakers are questioned regarding the increase in unsolved cases, and the need for new resources and dedication has risen. But with the lack of knowledge and resources, many cases still need to be solved. Many law enforcement and criminal justice agencies must recognize the importance of understanding the mistakes and techniques in older and present ecases. Researching and investigating unsolved files and DNA analysis can provide answers to many current and future circumstances.

Keywords: DNA analysis, exonerations, unsolved cases, Combined DNA Index System

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Introduction

Criminologists have witnessed a spike in unsolved cases regardless of the assistance of DNA analysis and technology. They started conducting experiments to create a solution to the growing problem to determine if law enforcement agencies are lacking adequate training and technology. Psychologists have suggested that law enforcement agencies have grown weary of assigning an entire department to solely investigate cold cases despite DNA analysis because of increased substance abuse and lack of motivation and satisfaction.

The ethical and moral issues within the criminal justice system, particularly surrounding the topic of unsolved cases and DNA analysis, have increased. The United States has experienced a spike in unsolved cases, and most of those files are homicides. The answers are yet to be determined regarding the increase in cold cases; however, many criminologists determined that today's standards within criminal justice as changed. The clearance rates from the early 1980s to the mid-2010s have significantly decreased. Many homicides committed in the 1980s were solved, but in today's criminal justice system, they have gone cold, the reasonings are not determined. Unfortunately, criminologists have suggested that the clearance rates will continue to decrease rapidly. There is a significant risk of offenders and public safety concerns. Many violent defendants who are released are rearrested in less than five years, causing the probability of serial offenders to increase.

Further, the number of untested DNA analyses has increased alarmingly, causing immediate attention from the National Institute of Justice to create new programs to assist law enforcement agencies. There has been a rise in non-suspect cases because of the failure of law enforcement agencies to submit evidence to laboratories or the massive backlog and scientists unable to achieve realistic clearance rates. However, criminologists have discovered that DNA

evidence and analysis that are older and newer can be combined to create solutions for unsolved cases. For example, on April 24, 2018, in Orange County, California, the Golden State Killer was identified as Joseph James DeAngelo. Criminologists have discovered that there is an informal method to solve cases. Investigators on the Golden State Killer case utilized DNA evidence from a crime scene to match with results found on GEDMatch, a genealogy website. They found the Golden State Killer's distant cousin to connect the offenses to Joseph James DeAngelo.

Criminologists suggest several reasons to reopen cases due to new technological advancements and techniques to increase the algorithm. Through the improvements in DNA analysis, technology as developed a new experiment to assist law enforcement agencies and federal investigators. The National DNA Index System and the National Institute of Justice have discovered that law enforcement agencies need assistance with modern technology and training.

Besides, it is challenging to predict the total cost of DNA testing when available nationwide because there are no moral and ethical rights. Criminologists and attorneys argue that DNA technology creates no significant threats to privacy rights than fingerprinting, photographs, and blood samples. The issue with DNA analysis is it can appear more invasive because it provides a substantial amount of information about a person. Scientists argue that DNA analysis can also be less intrusive because it does not involve bringing in multiple suspects for one case. Some scientists warn that DNA analysis can produce false positives, and a result does not guarantee a suspect.

The backlog of evidence caused by increased DNA case analysis is a growing problem, creating a rising number of pardons granted to those falsely accused of crimes they did not commit. The backlog, combined with law enforcement’s failure to collect crime scene evidence,

has led to several post-conviction relief requests and exonerations. For example, on August 14, 1989, Gary Dotson was the first person in the United States to be exonerated through DNA evidence and analysis. Cathleen Crowell falsely accused Dotson of sexual assault and physically harming her. When Dotson was released from jail, he created a precedent for future defendants who were also acquitted – substance abuse and follow-up charges. Criminal psychologists diagnose defendants with various mental health issues that could be eliminated if law enforcement agencies and investigators accurately submitted DNA evidence to laboratories.

So, exonerations and public genealogy websites have become a trending topic for criminologists to discuss ways to conduct DNA analysis. Criminal psychologists must discover new ways to assist those exonerated through the challenges of life outside of prison. The use of genealogy websites has led to solving cases. It has also become a significant issue because users feel like their privacy rights have been violated. However, no known law prevents law enforcement agencies from using open websites to connect offenders to heinous crimes.

Despite creating prominent solutions, such as advanced technologies, which are designed to equip law enforcement agencies better, communities continue to feel unheard and unsupported. Law enforcement agencies generate statements explaining their plans to solve cases quicker and more efficiently; however, the crisis of distrust and disrespect remains. The hauntings of unsolved cases create new and severe trauma for victims and their families. The ongoing rise in unsolved cases, even with DNA analysis, has prompted law enforcement agencies and criminologists to develop new technologies and approaches. Technology is ever-changing; however, the controversy over recent advancements has made a new sense of crisis to train individuals with the regulations and equipment. Criminologists must secure grants for

evidence training and testing to allow more law enforcement agencies to decrease this controversy.

DNA Analysis: The Answer for Unsolved Cases?

In 1985, Sir Alec Jeffreys discovered forensic DNA typing and patterns from unknown biological samples. Deoxyribonucleic "DNA" acid contains the genetic makeup of all living things. It is unique to each person and found in many cells. Eventually, Peter Gill created the Forensic Science Service to compare DNA patterns from crime scenes to develop suspects. "DNA can be used to identify criminals with incredible accuracy when biological evidence exists" (Advancing Justice Through DNA Technology, 2003). DNA can establish indisputable evidence to incriminate or exonerate individuals. It can assure accuracy and fairness in trials. DNA can solve cases in two ways: when the suspect is identified, a sample of DNA can be gathered and compared to the DNA found at the crime scene. When the suspect is not specified, the crime scene evidence can be compared to the DNA profiles in databases to create a direct connection. Between the 1980s and the 1990s, many States began passing laws requiring offenders convicted of serious crimes to provide DNA samples.

In 1965, approximately eighty percent of homicide cases were solved and cleared. Thus, more than 250,000 cases are left unsolved every year. However, the clearance rate significantly decreased in 2017, and less than sixty percent of murder cases were solved. The drastic downgrade over time has created immense stress on society, victims, families, and law enforcement agencies. Despite the decrease in clearance rates, there has been an increase in 100,000 homicide cases in the past twenty years. Homicides disrupt and cause significant stress to many individuals. Several thousand of the files are cold cases. "Cold cases are also difficult investigations, sometimes because of a lack of evidence" (Martin et al., 2020). If solving cases were easy, the resolution would be immediate. Due to the age of some unsolved cases, the

solution is lost because of destroyed evidence, information, and witnesses. Valuable evidence is lost, making it extremely challenging to gather clear evidence.

In the past, homicides were typically committed by a person whom the victim knew. Recently, murderers committed stranger-to-stranger killings, which are incredibly difficult to solve. Investigators are challenged to discover the motive of murderers through gang violence, drugs, and lack of cooperation of witnesses due to fear of retaliation or indifference.

In the 1980s and the 1990s, the National Institute of Justice desired to understand how DNA can convict and exonerate defendants. Thus, scientists developed the Combined DNA Index System to connect DNA analysis and national, state, and local labs. When a piece of sample DNA enters the Combined DNA Index System, it searches for potential matches. It compares crime scene evidence and DNA profiles of convicted defendants. There are two sections: the Combined DNA Index System uses the convicted offender index, DNA from those convicted, and the forensic index, DNA gathered from a crime scene (Davis & Wells, 2019). For example, law enforcement agencies have begun to issue "John Doe Warrants" (Using DNA to solve crimes, 2017), which are filed based on the suspect's DNA profile and physical description.

Nonetheless, the Combined DNA Index System aids in the missing person index to help identify the person's remains and locate suspects. When the Combined DNA Index System was first created, laws began to pass to require offenders to provide DNA samples in a small group of States. Today, all fifty States require offenders to provide DNA samples. For example, on January 15, 1947, a mother and her young daughter went for a morning walk in Las Angeles, California, and they came across a naked woman's body sliced at the waist in a ditch. No blood was found at the crime scene, making authorities believe the young woman was murdered elsewhere. The Los Angeles Police Department received blurred fingerprints from the woman

and sent them to the Federal Bureau of Investigation to help identify the individual. The fingerprints identified the woman as twenty-two-year-old Elizabeth "Black Dahlia" Short. Short was arrested for underage drinking a few months before her murder (FBI, 2016). Thus, by gathering the DNA and fingerprints of Short, the Las Angeles Police Department could quickly identify her body and use her mugshot for the paper.

Furthermore, the DNA Identification Act of 1994 created the National DNA Index System, which changed the DNA analysis and profiles world. Investigators who gathered DNA found at crime scenes could utilize the National DNA Index System to find genetic similarities with the originating DNA. "NDIS is the acronym used to refer to the criminal justice DNA database program administered by the FBI" (Wickenheiser, 2019). It established strict requirements, confidentiality, privacy, penalties, testing, qualifications, and quality for the use of data. Shortly after that same year, the Federal Bureau of Investigation developed the Combined DNA Index System, which is the software that generates the DNA profiles found at crime scenes and is used to compare against existing offenders. However, detectives and scientists discovered that DNA could be analyzed outside the Combined DNA Index System realms using 850,000 single nucleotide polymorphisms due to direct genealogy, like public forums.

In comparison, in 1994, the Federal Bureau of Investigations established the DNA Identification Act to create the Combined DNA Index System to collect DNA samples to analyze from arrestees and cases. In 2018, 13 to 15 million profiles were uploaded into the Combined DNA Index System (Ethical Concerns of DNA Databases Used for Crime Control. Bill of Health, 2019). The Combined DNA Index System regulated the use of DNA samples by requiring the samples to be processed for quality assurance, achieve standards, and acquire accreditation. Some issues discovered within the process include human error and bias, innocent

people being found guilty, infringement on privacy rights, and racial disparities. Those falsely accused of crimes experience severe reputational damages and increased emotional stress. In 2006, more than forty percent of the Combined DNA Index System comprised African Americans.

However, from 1997 to 2000, DNA laboratories experienced a seventy-three percent increase in casework and a 135 percent increase in the DNA analysis backlog (Advancing Justice Through DNA Technology, 2003). This caused a drastic rise in 'no suspect' cases due to unanalyzed samples and the lack of a known suspect and offender.

The untested DNA samples ranged from 200,000 to 300,000, and the samples not collected grew from 500,000 to 1,000,000. In 2000, the Department of Justice created the Convicted Offender DNA Backlog Reduction Program to assist with the significant increase. The Convicted Offender DNA Backlog Reduction Program was administrated by analyzing approximately 495,000 DNA samples in the first year. In 2001, the No Suspect Casework DNA Backlog Reduction Program helped to support the Convicted Offender DNA Backlog Reduction Program by sampling and analyzing more than 24,800 cases. A year later, former President George Bush signed a bill granting $70.8 million to fund the DNA backlog reduction programs and an additional $95 million dependent on the programs' success rates (Advancing Justice Through DNA Technology, 2003).

Moreover, in 2004, former President George Bush passed another bill funding DNA analysis procedures and improving the retention and storage of DNA samples. It creates and provides infrastructure support for organizations that need adequate equipment and materials to conduct DNA analysis. Some organizations began building infrastructure through laboratory information management systems designed to automate evidence by handling management to

increase the speed of DNA analysis. For example, the fund allowed companies to improve their laboratory tools and purchase robots to reduce contamination (Advancing Justice Through DNA Technology, 2003). It also helped agencies build storage for forensic evidence to ensure its integrity and availability for judicial proceedings.

Since the creation of the Combined DNA Index System, several improvements have been needed, such as the criminal laboratory backlog of unanalyzed DNA and laboratories not being up to date with the latest technology. The largest backlog groups are sexual assault files and murder cases. Due to the tremendous number of no-suspect cases, scientists and criminologists are searching for a quicker process to analyze DNA samples due to the possibility of criminals reoffending. Thus, many cases are going cold, and the chain of custody of evidence is a significant risk factor. Several people are handling evidence from older cases and have been moved to accommodate new cases. Lawmakers also need clarification on the statute of limitations and how long prosecutors can wait to press charges. State legislatures are passing laws regarding expanding the statute of limitations or eliminating the regulations. States have questioned potential post-conviction appeals when DNA analysis points to a different suspect.

Likewise, criminal justice agencies have begun training their employees in the importance and usage of DNA analysis. Law enforcement agents must be able to identify and collect DNA samples from crime scenes to submit to laboratories for further testing. They must understand quick decision-making skills in DNA collection and the importance of leads on cold cases. Similarly, correction and probation officers must be trained to gather and submit DNA samples. Whereas prosecutors must obtain skills to solve cold cases using DNA evidence and post-conviction relief, defense attorneys must be prepared to argue the limitations of DNA

evidence. Thus, judges should fully understand the technical knowledge of DNA analysis and evidence for rulings and sentencings.

Nevertheless, data has concluded that between 1980 and 2016, more than 240,000 unsolved cases remained open, equating to approximately forty percent of all unsolved files in the United States being homicides. For example, in 1965, eighty percent of all homicides were cleared, and in 2017, sixty percent of murders were solved (Martin et al., 2020). In 2020, approximately 250,000 unsolved homicide cases existed; over 100,000 have accumulated in 20 years. The clearance rates between 1973 and 2016 have drastically decreased from seventy-eight percent to fifty-nine percent (Heurich & Haskins, 2019). Criminologists have predicted this number to decline rapidly, causing much anxiety for several law enforcement agents, the Federal Bureau of Investigations, the Bureau of Criminal Apprehension, and the judicial system. However, less than half of all violent crimes are solved each year.

> But there is hope. Even as the volume of unsolved crimes continues to soar, formidable new forensic technologies that can help crack cold cases keep emerging. Thus, there is great need, as well as great opportunity, for a commitment to refocusing attention to unsolved homicides and other violent crimes. Now is the time to address the cold case crisis. Cases once considered unsolvable can be solved today. (Hurich & Haskins, 2019)

Criminologists have recommended that law enforcement agents and various criminal justice agents need more robust cold case units, implement new technologically advanced techniques, train employees to operate units, and identify the needs of existing units. So, criminal justice agencies must focus their energy on DNA databases and investigators to continue researching and solving cold cases.

One in five law enforcement agencies has cold case units and investigation protocols. One study found that out of one hundred law enforcement agencies, only seven percent of them had a cold case unit; eighteen percent had dedicated teams with more than seventy-five officers working; one percent had less than fifty employees working; ten percent had investigators on call and no dedicated cold case units; and twenty percent have formal protocols for investigations (Heurich & Haskins, 2019). "Cold case investigations have revealed that, in many cases, those responsible for multiple crimes. Therefore, prioritizing cold case investigations can assist in both resolving crimes and preventing future ones" (Martin et al., 2020). There are high-level justifications for cold case units, specifically within the criminal justice units, public safety and trust, clearance rates, and cost savings. Thus, these justifications create moral and ethical safety concerns. Unsolved cases stress the criminal justice system because the victims lose trust and faith in the design, and their attitudes toward law enforcement agencies decline. Criminologists suggest that agencies ensure victims are heard, not forgotten, and the criminal will be held accountable.

Another study conducted in Florida of three-hundred and ten law enforcement agencies questioning their cold cases and training found that fifty-one did not have cold case units, and nine had a dedicated investigative team (Gilson, 2022). However, those agencies had two or fewer detectives for the cold case units. Approximately eighty-five percent of the law enforcement agencies had collaborated with other agencies with unsolved files. Less than fifty used the Florida Department of Law Enforcement for forensic laboratory analysis. However, six agencies that used the Federal Bureau of Investigations sent forensic samples for laboratory analysis. At the same time, twenty-nine of them used local or private laboratories. Finally, the study also found that thirty percent of law enforcement agents agree that staffing and personnel

were inhibiting factors in resolving cases. Another thirty-eight percent stated that evidence and witnesses were factors that highly impaired clearance rates. Then, approximately forty-two percent of law enforcement agencies had access to DNA laboratories, which was not a leading factor in the immense number of cold cases.

In 2011, Detective Lieutenant Jason Moran of Cook County Sheriff's Office argued that evidence be submitted to forensic laboratories like fingerprints, blood, and clothing to compare the results with those in the database. Detective Lieutenant Jason Moran explained that fingerprints from 1990 should be resubmitted using modern-day technology due to the expansion of laboratory analysis. The initial evidence found must be tested, and retesting the evidence should be considered due to the sensitivity of the evolution of scientific advancements. "Cold case units should deploy modern investigative methods and new scientific technology whenever possible" (Moran, 2022). By bringing resolution to cold cases, it provides a sense of security and reassurance to victims to rely on law enforcement agencies to continue to search for answers.

Detective Lieutenant Jason Moran (2022) points out that there is an unknown time frame between the initial testing and additional testing of evidence. It may be dependent on what the results are the first time. If the evidence discovered must be retested, the case may be filed at "contemporary status" to ensure local law enforcement and victim advocacies that there are new changes, or the case may remain cold. Detective Lieutenant Jason Moran concludes that the challenge with cold cases is persuading decision-makers and lawmakers of the importance of dedication to continue to improve resources. Many agencies assign detectives a specific number of caseloads to examine when they have spare time; however, cold cases heavily rely on active cold case units with detectives trained in these investigations.

There has been a significant issue regarding prioritizing sexual assault DNA submissions. Approximately a third of all sexual assault kits are submitted, and five percent were examined. "While DNA evidence may be key to making a prosecutable case, it is not sufficient for conviction. Other factors come into play, including the crime context, victim accountability, credibility, victim willingness to cooperate, and the ability of the defendant to mount a consensual sex defense" (Davis & Wells, 2019). For example, in 2010, the Dallas Police Department created a program to notify and question sexual assault victims whose cases went cold if they wanted their files reopened and their DNA evidence retested. The Dallas Police Department did not receive any responses from the victims. It is challenging to determine why the rate is detrimentally low. Some experts state that DNA testing can cost more than $1,000 per submission, and victims are not adequately educated on how DNA can assist in their cases. In September 2016, the Bureau of Justice Assistance National Sexual Assault Kit Initiative awarded $38 million to States to test and investigate sexual assault kits. The program continues to grant States more technology and money to help with the backlog of sexual assault cases.

Further, one study examined one-hundred-and-eleven Combined DNA Index System offender profiles in San Francisco, California. The report found eleven sexual assault perpetrators connected to two or more sexual assault offenses. Approximately one in three cases were convicted, possibly due to the lack of court resolution and the prosecutor's and victim's unwillingness to pursue charges (Davis & Wells, 2019). Another study concluded that forty-four percent of DNA submissions were expired due to the statute of limitations. Less than half of criminal complaints filed were dismissed due to the lack of evidence; however, slightly less than half of the sexual assault cases led to an arrest of the suspect.

In contrast, in the 1960s, more than 200,000 homicides remained unsolved. Thus, more than ninety percent of all homicide cases were solved. Between the 1970s and the 1980s, the success rate drastically dropped due to gun violence, the rise of cocaine usage, and organized crime. Throughout the 2000s, the momentum decreased significantly, with more than half of homicide cases being unsolved. Due to the fallout of clearance rates, criminologists have begun teaming up with law enforcement agencies to collaborate on research and provide new procedures, such as handwriting analysis. Law enforcement agencies benefit by becoming a force that multiplies and gains invocate approaches by evidence-based research. It allows criminologists to understand translational criminology, which is the application of research to the policy and practice of the criminal justice system. Translational criminology aims to develop a mutually beneficial connection between criminologists and practitioners. For example, in the spring of 2018, the Pasco Sheriff's Office and the University of South Florida collaborated to explore the policies and procedures for investigating cold cases. "Cold cases are generally defined as an open case where significant investigative efforts were exhausted, and the case has gone inactive for any period of time" (Bryanna Fox et al., 2020). The pair discovered that cold cases could be considered unsolved after an unknown period, such as a few weeks to several years. They also found that cold case detectives have an incredibly challenging career because of the age of the case, lack of substantial evidence, and insufficient documentation.

The study reported three specific ways investigators obtain new leads for unsolved cases, which can be highly beneficial but only sometimes successful due to the lack of sufficient and credible information. The first is testing old evidence with advanced technology and, if possible, obtaining new evidence. The second way is renewed attraction from the media, law enforcement agencies, and families included in the case. The last concept occurs when suspects and witnesses

report new information that assists with solving the case. This significantly impacts law enforcement agencies, detectives, victims, families, and communities because it allows various individuals to trust and hope that their cases may be solved. However, the Pasco Sheriff's Office and the University of South Florida study indicated that testing cold cases can cost up to $100,000 per year due to the specialized training needed for professionals, travel costs, and laboratory expenses.

The University of South Florida incorporated explicit instructions for the Pasco Sheriff's Office regarding the differences and importance of an interview and interrogation. Criminologists explained that discussions are held informally, and the purpose is to develop background information. There are some reasons for an individual to withhold information or feel threatened. Investigators typically use open-ended questions that provide a wide variety of answers. At the same time, an interrogation is formally and more structured to establish criminal liability and gain incriminating information. Miranda Rights must be read for the individual, and they must voluntarily and freely waive their rights. Interrogations use both open- and closed-ended questions to establish a factual basis. Investigators must be aware of bias when interviewing and interrogating individuals because it could harm the case.

Similarly, the Pasco Sheriff's Office and the University of South Florida examined false confessions, which are made against an innocent person charged and imprisoned for a crime they did not commit. The collaboration specifically read false confessions that were a part of the Innocent Project. In 2019, more than twenty-five percent of wrongly accused defendants were exonerated through DNA evidence (Bryanna Fox et al., 2020). They discovered there are three types of false confessions. The first is a voluntary statement when a person experiences no external pressure to accuse another falsely. The other type is coerced-compliant, which occurs

when an individual attempts to escape the stress of the interrogation or interview. Thus, investigators and detectives must remain calm and collected during interrogations and discussions due to the negative, unintended consequences. The last type of false confession is coerced-internalized when a person strongly believes they are held responsible or should be held accountable for a crime. When these interrogations are often reviewed by other professional personnel, they may dismiss the case, or an Alford plea may be sufficient.

On the other hand, the Pasco Sheriff's Office and the University of South Florida examined sexual assault and murder offenders to determine similarities and differences. They found that many of the criminals were either psychopaths or suffered from psychosis. Psychopaths commit crimes ritualistically, and they are premeditated and meditated offenses. The victim is used to meet the offender's end goal, like financial, sexual, pleasure, or power. The sexual assault offender or murderer makes impulsive decisions, causing the crime scene to appear more threatening and calculated. Psychopaths are typically mentally stable and connected to reality; however, they seem more narcissistic, remorseless, charming, manipulative, and aggressive.

In contrast, a psychotic sexual assault offender or murderer convicts' violence in response to a command to resolve an internal conflict, such as hallucinations and delusions. Hallucinations are false sensory perceptions can lead these individuals to believe they are receiving external commands. For example, a person experiencing a hallucination may hear a false voice telling them to commit a murder. However, delusions are the false distortions of reality. Unlike psychopaths, psychosis causes individuals to inflict minimal violence to offend. Several times, sexual assault offenders or murderers transport their victims to a new location to prevent any

traces of evidence, leaving no clues. These individuals may be experiencing hallucinations or delusions.

Due to unsolved cases, there is a higher risk for public safety and trust concerns because of the probability. Approximately seventy-one percent of violent offenders are rearrested within five years of release, causing the likelihood of serial killers to be more prevalent (Heurich & Haskins, 2019). "Resolving cold cases is an important contributor to preventing crime, increasing public safety, and increasing the favorable image of law enforcement – that is, fulfilling law enforcement's mission and maintaining public trust" (Heurich & Haskins, 2019). Thus, solving cases can prevent repeat defendants and re-victimization. However, clearance rates are not a significant indicator for unsolved crimes or an instrument to measure success rates.

Criminologists suggest there are several reasons to reopen cases, such as advancements within forensic technology and techniques have rapidly increased to create firmer algorithms. For example, DNA database improvements have created a new technique to solve cold cases. Thus, there has been an increase in DNA records every year. In December 2019, the National DNA Index System contained more than 13.6 million and 3 million arrestee profiles. Two years prior, the National DNA Index System indicated that more than one million sexual assault kits were analyzed, and 400,000 forensic crime scenes' DNA profiles uploaded.

> Databases hits often occur long after an investigation is imitated. Without proper protocol to address hit notifications, agencies face confusion about what is needed and who should respond. Leaving a notification unaddressed equates to ignoring a suspect who is likely a perpetrator. (Heurich & Haskins, 2019)

The National Institute of Justice has recently developed several programs and systems that have assisted in solving cold cases. For instance, the National Missing and Unidentified Persons

Systems were designed to help identify missing persons and their remains. The National Integrated Ballistic Information Network is a cartridge for cashing evidence. The National Institute of Justice has also created methods for forensic DNA testing, advancements in fingerprinting, and fiber, hair, and physical analysis.

The National Institute of Justice's Solving Cold Case with DNA program awarded multiple law enforcement agencies to help fund the need to investigate open and cold cases. In 2005, the National Institute of Justice granted thirty-eight awards and financed over $14,245,153 by reviewing 7,767 cases. The program discovered 261 hits within the Combined DNA Index System and closed 206. But in 2014, the National Institute of Justice granted twenty-five agencies $4,742,222 for funding to review 5,498 files (Martin et al., 2020). This year, the system found 118 hits in the Combined DNA Index System and closed eighty-six cases.

Through this study, the National Institute of Justice's Solving Cold Case with DNA program also concluded that 2000 serial killers in the United States have never been prosecuted, and fifteen percent bare serial murderers. "A serial murder is the unlawful killing of two or more victims by the same person(s) in separate events" (Martin et al., 2020). The National Institute of Justice announced that serial murders kill 200 to 2,000 victims yearly. But in February 2019, the National Missing and Unidentified Persons and System, a program regarding unidentified and missing persons, concluded that foul play is not suspected in seven percent of missing person cases. Approximately 14,000 cases were alleged to have resulted in foul play and could have been serial killers. Thus, more than 7,000 unidentified persons are caused by serial murderers (Martin et al., 2020).

Regardless, the cost of equipment, training, supplies, and personnel are significant factors regarding DNA technical advances and developing cold case units. For example, three proposed

laboratories would cost more than $1.4 million per year in New York. "The forensic use of DNA technology will have various economic impacts. The proliferation of DNA evidence in investigations and trials requires a fairly rapid expansion in the number of reliable experts and laboratories" (DNA Typing and Society – DNA Technology in Forensic Science, 1992). The costs can be associated with upgrading and changing databases with new procedures. However, the prices can affect budgets for law enforcement agents, prosecutors, and courts. The courts must be supplied with reliable assistance for DNA material, and the government must bear the cost.

Nonetheless, it is challenging to predict the total cost of DNA testing when available nationwide because there are no moral rights, and a specific class of people may be affected. DNA technology poses no more significant threats to privacy rights than fingerprinting, photographs, and blood samples. But DNA technology is no different than other techniques; it is more robust because it allows for a definitive identification. The primary issue of DNA analysis is it is more invasive because it provides more information about a person. DNA analysis can also be less intrusive and dramatic because it does not involve bringing in multiple suspects for one case. "Therefore, DNA identification is not only a way of securing convictions; it is also a way of excluding suspects who might otherwise be falsely charged with and convicted of serious crimes" (DNA Typing and Society – DNA Technology in Forensic Science, 1992). DNA tests can also yield false positives and not always guarantee a suspect every time. For example, approximately thirty-five percent of cases had suspects that were guaranteed. However, DNA samples must be protected and held at a high level of confidentiality and should be released only when the defendant has signed a waiver or knows the access. DNA profile storage has raised

some concerns if the defendant's case has been dismissed, so there is some uncertainty about what to do with the information gathered.

Case Study: JonBenet Ramsey

The cause of JonBenet's death was officially reported as strangulation and head trauma. The tragedy sent shockwaves across the United States leading to widespread public concern of safety and media attention. The case was substantial due to the lack of clear suspects and evidence to develop the potential circumstances surrounding the young girl's demise. At 5:52 AM, JonBenet's mother, Patricia "Patsy" Ramsey, made a frantic and hysterical 911 call reporting that her daughter had been kidnapped and a ransom note had been left. Patsy rushed to wake her husband, John Ramsey, to alert him of the tragic news. The pair examined the horrific letter, noting that it was two and a half pages long and signed by an unknown individual. The kidnappers were requesting $118,000 and threatened to kill JonBenet if anyone was contacted, and they would call the house between 8:00 AM and 10:00 AM for further direction (Behm, 2015, p. 5). As the Boulder Police Department searched the home around 1:00 PM, they discovered JonBenet's limp body in the family basement. Years later, the cause remains unsolved, and no one has been convicted for the kidnapping and murder of Ramsey. Several theories have swirled regarding why the case was never solved, precisely due to the lack of control and authority from the Boulder Police Department regarding failure of evidence collection and advanced testing.

Moreover, several mistakes caused detrimental loose ends in the case. When the Boulder Police Department received the 911 call from Patsy, there was a shift change in officers, causing miscommunication of details and information about the emergency. When Officer Rick French arrived at the Ramsey home, he arrived in a customary police vehicle. However, detectives state

this was a fatal mistake because Officer Rick French should have been driving an unmarked or uncovered police car due to the potential risk of the kidnappers spying on the home. They would have known immediately that the police had been in contact, thus breaking the ransom note's demands. Once Sergeant Paul Reichenbach arrived at the crime scene, he ordered the responding officers to eliminate the usage of their radios and use only their cell phones for communication. Sergeant Paul Reichenberg ordered the squad not to search the house or gather witness statements immediately (Behm, 2015). Again, detectives state this was a mistake because it limits multiple officers from hearing information and is a slower communication method. If the officers had gathered statements promptly, they would not have gained more precise stories due to the fresh memory of the witnesses. Also, if the officers had conducted a walk-through, they could collect substantial evidence without contamination.

Nevertheless, the Boulder Police Department failed to secure Ramsey's house and treat it like a crime scene. They should have established authority over the family and those surrounding the home. For instance, Patsy called four of her closest friends, Fleet and Priscilla White and John and Barbara Fernie, to discuss what happened. When the two couples arrived on the scene, officers allowed them to enter the home. One critic stated that a suitable police procedure during the investigation should have been to empty the house immediately and take those in the home to the police station for questioning (Behm, 2015, p. 10). The Boulder Police Department should have posted a police officer inside the home and on the property and only allowed authorized personnel into the sealed area. However, the officers allowed Fleet White to walk through the home unsupervised because he believed JonBenet was most likely hiding in a closet. When White entered the basement, he found a piece of broken glass and searched for additional details. Thus, White altered potential evidence that could have benefited the case.

Detective Linda Arndt told John and Fleet to conduct their individual, unsupervised walk-through to search for anything that belonged to JonBenet. She advised the pair to start their investigation on the top floor and end up in the basement. Notably, John made a direct line toward the basement, specifically the wine cellar, where he found JonBenet lying on her back on the floor, wrapped in a white blanket. "In an interview afterwards, John Ramsey was quoted as saying, 'As I was walking through the basement, I opened the door to a room and knew immediately that I'd found her…Her eyes were closed; I feared the worst, but yet – I'd found her'" (Behm, 2015, p. 12). John ripped the duct tape off JonBenet's mouth and loosened the ties on her wrists. He picked his daughter up and brought her body to the upstairs living room, causing alterations to the evidence. Detective Arndt told John to put the body down; then, she moved it to a rug. John removed the blanket from JonBenet's body, grabbed one nearby, and placed it over her. The evidence was compromised due to the continuous movement and destruction of fibers. It was not in a contained area to allow experts to obtain fingerprints or DNA analysis.

Meanwhile, days after the tragic death of JonBenet, the media and the Boulder Police Department began to develop their lists of potential suspects. Statistically, they assumed John and Patsy had collaboratively murdered their daughter. Family members commit approximately fifty-four percent of all child murders ((Behm, 2015, p. 7). The pair were the last ones to see JonBenet alive making her parents suspects. However, the spotlight turned directly and solely to Patsy. Individuals close to the Ramsey family stated that JonBenet and Patsy had several arguments and disagreements in the months leading up to JonBenet's death. Patsy appeared to be highly controlling, specifically during pageant events. Patsy desired her daughter to appear perfect in the eyes of the judges and society.

When Detective Jeff Kithcart examined the ransom note utilizing handwriting analysis to those of John and Patsy, John provided Detective Kithcart with sample paper, specifically his notepad from work and Patsy's notepad in the kitchen. He concluded that the handwriting was like Patsy's and that John was cleared of being a suspect. While Detective Kithcart was investigating Patsy's notepad, he discovered rough drafts of the ransom note. Detective Kithcart explained that the ransom note handwriting appeared nervous and attempted to disguise their writing. Another handwriting expert, Chet Ubowski, also concluded that Patsy wrote the ransom letter. He thought it was puzzling that the suspect wrote the exact amount of money, $118,000, which John received as his Christmas bonus. Thus, Ubowski concluded it had to be Patsy because of the inside knowledge. Despite the expert knowledge, in 2008, touch DNA evidence was performed on the long johns JonBenet was wearing when her body was found, and it concluded that neither John nor Patsy killed JonBenet (Behm, 2015). It was an unidentified male suspect; however, there was no match in the Combined DNA Index System to charge the killer. The murder of JonBenet Ramsey remains unsolved.

Genealogy Websites

In contrast to traditional investigative methods, which often focus on limited data, like a suspect’s sex, age, and proximity of the crime scene. Genealogical investigations provide a substantial shift in perspective by creating a holistic view of a suspect’s family history. Both techniques provide investigators to create a unique tapestry of a suspect’s family history regarding their DNA on their maternal and paternal sides. Thus, databases and genetic data expose specific personal information about a defendant. "Investigators turn to forensic genealogy when DNA has been obtained at a crime scene, a suspect match has not been obtained in the National DNA Index System (NDIS), and investigative leads have not identified viable suspects"

(Wickenheiser, 2019, p. 3). Traditional investigations must acquire ethical and legal concepts, specifically the requirement of reasonable suspicion and the presumption of innocence to avoid legal and procedural violations of discrimination and protection of privacy rights. Law enforcement agencies must respect defendants' freedom from unreasonable searches and seizures.

Peter Gill, a forensic scientist, determined that DNA patterns are developed from crime scenes to create samples from individuals to solve a case. For example, the first DNA typing case assisted in exonerating Richard Buckland. Buckland confessed to killing one of two young girls in Leicestershire; however, he was convicted of killing both. After investigators found DNA patterns from the two murder crime scenes, it was a single defendant. Colin Pitchfork's DNA matched the victims' samples at the crime scene. Pitchfork later admitted to sexually assaulting and murdering the girls (Wickenheiser, 2019, p. 3).

Subsequently, serological comparisons, that are blood tests, still need to gain the level of specificity and stability that DNA can provide for cases. DNA from crime scenes can be obtained without a warrant because the defendant waived their privacy rights. Laboratories that utilize the National DNA Index System have a Local DNA Index System discretionally used for DNA profiles to detect contamination. The Local DNA Index System is used to compare cases to discover suspects. All laboratories must abide by the DNA Identification Act to protect privacy and compliance rights with assurance procedures. The National DNA Index System created the Act in 1994 to establish requirements for the use of data, confidentiality, penalties, qualifications, and quality assurance. Thus, the Aristotelian concept argues that investigators must discover the balance between competing interests, such as state privilege, public safety, individual rights, and parens patriae.

In May 2019, the FBI National DNA Index System contained approximately 944,750 DNA profiles and persons of interest, 486,156 hits to the profiles, and more than 476,000 cases solved derived from serological tests. (Wickenheiser, 2019, p. 4). The ethical concept of proportionality suggests that there must be a balance between individual and public rights. There are choices and consequences investigators and the public face when cases remain cold; however, it is dependent on the choices made to favor the outcome. The concept is applicable when two competing interests overlap to measure the balance for optimal results.

But no special privacy rights protect one's genetic information. "There is no additional US Federal genetic privacy legislation beyond GINA and HIPPA" (Wickenheiser, 2019, p. 3). Regardless, the Fourth Amendment protects the right against unreasonable searches and seizures; however, it does explicitly apply to genetic information. For instance, in Maryland v. King, the Supreme Court ruled that a defendant's DNA profile can be included in the National DNA Index System despite the Fourth Amendment.

Criminologists reopen cases for various reasons to attempt to resolve them to provide ethical and moral virtues back to the community and victims. For instance, Albert "Boston Strangler" DeSalvo confessed to killing thirteen women in Boston between 1962 and 1964. The Boston Strangler recanted his confession of killing Mary Sullivan. However, the Boston Strangler was sentenced to life in 1967 and murdered in prison in 1973. Eventually, in 2013, the Boston Police Department assisted with the National Institute of Justice's Solving Cold Cases with DNA program, confirming that Sullivan's DNA matched the crime scene. In 1978, the Killer Clown killed more than thirty people who recovered in John Wayne Gacy's home, a part-time clown entertainer. In 2011, fourteen victims remained unidentified. A few years later, two victims were identified using the National Institute of Justice's program, the Using DNA to

Identify the Missing Persons program, to help reconstruct the victim's facial reconstruction from DNA profiles. The victims were William Bundy and Jimmy Haakenson, whereas, in the 1980s, Gary "Green River Killer" Ridgway murdered multiple women along the Green River in Washington (Martin et al., 2020). In 2003, the Green River Killer was convicted of killing forty-nine women and suspected of an additional ninety homicides. Eight years later, the King County Sheriff's Office, funded by the National Institute of Justice's Crime Laboratory Improvement Program, found four victims and linked them to the Green River Killer (Martin et al., 2020).

In comparison, on April 24, 2018, in Orange County, California, the Golden State Killer was identified as Joseph James DeAngelo. He was charged and arrested for stalking, raping, murdering, and burglary from 1984 to 1986. The Golden State Killer had twelve known murder victims and approximately fifty sexual assault victims. The Golden State Killer is one of the most significant examples of recidivism, demonstrating repeated offenses and graduating to more severe crimes. The Golden State Killer's experience with law enforcement might have increased his knowledge and pleasure to commit more violent crimes. "A note sent to the Sacramento newspaper and media outlets provides a view into the psychology of the criminal, including building impulsive desire, uncontrollable urges, excitement seeking, feelings of superiority combined with self-esteem issues, and a need for dominance, achievement, and recognition not fulfilled within societally accepted norms" (Wickenheiser, 2019, p. 2). Thus, the older investigators assumed that the Golden State Killer crimes were unconnected. Unlike modern-day detectives who discovered the Golden State Killer was one individual committing all the crimes, no DNA profiles were found in the National DNA Index Systems.

Recently, there was a massive break in the Golden State Killer case. The DNA from a crime scene was compared to that from a public source genealogical website – GEDMatch

(Wickenheiser, 2019). When GEDMatch was first created, users agreed that their information would be entirely private and that law enforcement agencies could not access their data. But over the years, GEDMatch changed its privacy statement after the Golden State Killer case was kept unsolved for several years. Thus, law enforcement agents could legally search and utilize an individual's genetic information. Investigators discovered a potential match for the Golden State Killer's fourth cousin. It took the detectives four months to construct the family tree to match likely comparisons based on gender, age, and geography of the crimes.

The investigators narrowed the search to Joseph James DeAngelo. They traced DeAngelo's recent steps to gather DNA samples. The DNA was analyzed, and it was an exact match to the Golden State Killer's crimes. DeAngelo's attorneys challenged the concept that law enforcement agents had breached the defendant's Fourth Amendment rights against unreasonable searches and seizures. However, DNA discarded at crime scenes has no right to privacy, and there is no ethical or legal issue.

Supreme Court

DNA analysis has been an ongoing legal issue within the criminal justice system. In Maryland v. King, 569 U.S. 435, 2013, the Maryland DNA Collection Act allows State and local law enforcement agencies to collect DNA samples from individuals held in custody for targeted crimes waiting for bail hearings (Maryland v. King). Alonzo Jay King, Jr. was arrested for first- and second-degree assault. Before King was convicted, while being held, King's DNA was collected and logged into Maryland's DNA database correlating to the Act. During the trial, the district judge denied King's motion to suppress the DNA evidence, arguing that it infringed his Fourth Amendment rights. Thus, King was found guilty by a jury of first-degree criminal sexual assault and sentenced to life in prison. King appealed his conviction, stating that the Maryland

DNA Collection Act was unconstitutional and had infringed his Fourth Amendment right against warrantless searches and seizures. The Maryland Court of Appeals reversed King's motion, arguing that the Maryland DNA Collection Act was unconstitutional and King's privacy rights were more significant than the Maryland DNA Collection Act identification purpose.

King appealed his case to the United States Supreme Court. The case was argued on February 26, 2013. The issue of Maryland v. King was whether the Fourth Amendment grants States the right to collect and gather DNA samples from defendants in custody but not convicted of targeted crimes (Maryland v. King). The United States Supreme Court held that the Fourth Amendment allows States to analyze DNA samples from people in custody. Supreme Court Justice Anthony M. Kennedy wrote the opinion of the five-to-four majority of Maryland v. King. Justice Kennedy explained that conducting DNA samples as part of the arrest procedure does violate an individual's Fourth Amendment rights. It serves as a legitimate interest and is considered not invasive enough for a warrant to be issued. Justice Kennedy further explained that discovering a defendant's identity and criminal history is fundamental to the arrest procedure and court knowledge. DNA testing is an informative process. It assists in finding the level of risk a defendant poses to officers, the public, the court, and other individuals to help set conditions in court when released from custody.

Besides, Supreme Court Justice Antonin Scalia wrote the dissenting opinion and joined Justice Ruth Bader Ginsburg, Justice Sonia Sotomayor, and Justice Elena Kagan. Justice Scalia argues that the Fourth Amendment prevents unlawful searches and seizures of a person without probable cause or reasonable suspicion. Thus, the Supreme Court alludes to gathering DNA samples of a person before they are convicted of a crime is held unconstitutional and infringes on their Fourth Amendment right. Justice Scalia explains that the Supreme Court's opinion grants

DNA tests to be conducted without evidence of a DNA-related crime; however, the Fourth Amendment was designed to prohibit this because it is like Great Britain's general warrants. Justice Scalia finishes by stating that the procedural safeguards of DNA evidence are an ineffective identification tool.

Similarly, in Andrews v. State of Florida of 1988, Tommie Lee Andrews allegedly sexually assaulted more than twenty people in Orlando, Florida (Longmire, 2004). In February of 1987, Andrews left his semen at a crime scene, where scientists at Lifecodes Corporation in Valhalla, New York, used DNA analysis to charge and arrest Andrews. This would be the first DNA analysis and testing used in a United States criminal case. The district court judge in Andrews v. State of Florida agreed that prosecutors could not use the DNA evidence without having an evidentiary hearing. The case first ended in a hung jury due to the reliability of DNA analysis. A new trial was granted, and the DNA samples were readmitted without fingerprints and verified identification of Tommie Andrews. Ultimately, the jury found Andrews guilty. On October 20, 1988, the Circuit Court of Orange County charged Andrews with aggravated battery, criminal sexual conduct, and armed burglary of a dwelling place, making Andrews the first person ever to be convicted of a crime based on DNA evidence. Andrews was sentenced to over one hundred years of prison (Longmire, 2004).

Likewise, People of the State of New York v. Joseph Castro argued in 1989 after Joseph Castro allegedly murdered his neighbors, a pregnant twenty-two-year-old woman, Vilma Pone, and her two-year-old daughter. In July of 1987, Lifecodes Corporation in Valhalla, New York, analyzed a bloodstain found on Castro's watch. Ponce's DNA was gathered, and it matched the blood found on Castro. After twelve weeks, the New York Supreme Court investigated the admissibility of the DNA tests after some disagreements between four expert witnesses. The

team wrote a two-page paper regarding the inadequacies and flaws of the DNA evidence and legal procedure. In August of 1989, Judge Gerald Sheindlin established the three-prong test to determine if DNA evidence should be admitted:

> Is there a generally accepted theory in the scientific community which supports the conclusion that DNA forensic testing can produce reliable results? Are there techniques or experiments that currently exist that are capable of producing reliable results in DNA identification, and which are generally accepted in the scientific community? Did the testing laboratory perform the accepted scientific techniques in analyzing the forensic samples in this particular case? (Longmire, 2004)

On August 14, 1989, the Court found justification for prongs one and two in People of the State of New York v. Joseph Castro arguments due to the acceptance of forensic DNA evidence and identification techniques. The Court ruled that the third prong did not meet evidentiary standards, and any DNA that fell under the category would be deemed inadmissible (Longmire, 2004). It made People of the State of New York v. Joseph Castro the first case in the United States to question DNA evidence and provide a greater understanding of analysis in criminal justice.

Exonerations

The criminal justice system has challenged previous investigations because of the improvements in fast-paced exonerations. The first exoneration through DNA evidence and analysis occurred in 1989. In 2020, there were over 375 exonerations in the United States. Many of the individuals falsely accused were African Americans. The average number of years an exonerated person has served is fourteen, and the total number of years served is approximately 5,284. The average age of an exoneree is twenty-six, and the median age of exoneration is forty-

three. Out of 375 exonerees, approximately twenty-one defendants were sentenced to death (DNA Exonerations in the United States, 2020). However, forty-four individuals accepted a plea deal to the offenses. Victims and eyewitnesses misidentified more than sixty-five percent of the exonerations—approximately forty percent of cases experienced misapplication by investigators and forensic scientists. Almost thirty percent of all exoneration cases were false confessions, with forty-nine percent of the files having victims younger than twenty-one. Over 265 falsely accused individuals were compensated for damages, and 190 worked with the Innocence Project (*DNA Exonerations in the United States*, 2020).

Nevertheless, on August 14, 1989, a twenty-two-year-old, Gary Dotson, was the first person in the United States to be exonerated through DNA evidence and analysis. On July 19, 1977, the victim, Cathleen Crowell, was allegedly raped by three men when they dragged her into their car, sexually assaulted her, and cut her stomach with a broken beer bottle. The deputies on scene transported Crowell to the nearby hospital, and a sexual assault kit was performed on her where evidence was obtained (First DNA Exoneration). Three days after the alleged sexual assault, Crowell reported to the law enforcement agency to work with a sketch artist to describe the suspect. Crowell explained that the man had shoulder-length hair and no facial hair. A couple of hours later, law enforcement agents provided a mugshot book for Crowell to identify the perpetrator. After examining the book, Crowell pointed to Gary Dotson as the alleged rapist. Crowell would later declare that she felt pressured to choose an individual out of the book, which the law enforcement agency denied the statements. The following morning, Dotson was arrested at his mother's country club hills home, and Crowell positively identified him as her rapist.

In May of 1979, Dotson's jury trial began, and the prosecutor called two witnesses – the victim who positively identified Dotson under oath and Timothy Dixon, a state police forensic

scientist. Dixon was sworn in and took the witness stand. Dixon explained that Crowell's sexual assault kit contained type B blood antigens, and Dotson was type B blood. Ironically, more than ten percent of white males have type B blood (First DNA Exoneration). If Crowell had falsely accused Dotson, she had a ten-to-one odds. However, Crowell had type B Blood, too. Dixon continued stating that the loose hairs gathered from Crowell's underpants were like Dotson. Thus, Assistant Cook County State's Attorney Raymond Garza exaggerated Dixon's hair conclusions in his closing arguments. But it was unlikely the hair could have been Dotson's because DNA technology in the late 1970s and early 1980s could not identify hair sources. Attorney Garza argued Crowell was indeed a virgin when the sexual assault occurred but did not provide explicit, direct evidence. He called the defense's witnesses liars despite their testimonies lined up with Dotson's claims that they were watching cartoons and attending a small gathering that evening (First DNA Exoneration).

Assistant Cook County Public Defender Paul T. Foxgrover failed to challenge Attorney Garza's arguments and allegations. However, Attorney Foxgrover objected to several prejudicial statements and evidence, like the hair gathered from Crowell. Judge Richard L. Samuels overruled most of Attorney Foxgrover's objections. Despite Attorney Foxgrover's few objections, he did fail to exploit the inconsistencies within the trial and evidence. Crowell had described the perpetrator as a clean-shaven man, scratched at him, and drew blood from his chest (First DNA Exoneration). She explained the suspect's car in considerable detail. But Dotson had an outgrown mustache, no scratches or dry blood on his chest, and did not own a vehicle that matched Crowell's description. Attorney Foxgrover did not summon an independent forensic analysis to challenge Attorney Garza's witness, likely due to lack of funding and desire. The jury found Dotson guilty beyond a reasonable doubt. Judge Samuels sentenced Dotson to twenty-five to

fifty years in prison for sexual assault charges and twenty-five to fifty years for aggravated kidnapping. Dotson appealed his conviction, and the Court of Appeals upheld the sentence.

Later, in 1982, Crowell married David Webb, moved to Jaffrey, New Hampshire, and became a member of the Pilgrim Baptist Church. Crowell-Webb told Pastor Nannini that she was horribly and painfully guilt-ridden because of the false sexual assault accusations of sending an innocent man to prison. Crowll-Webb stated that she needed a cover story in case her boyfriend had gotten her pregnant. Crowell-Webb and her boyfriend had consensual sexual encounters the day before her alleged story. Crowell-Webb was not pregnant. Pastor Nannini contacted Attorney John McLario to represent Crowell-Webb. Attorney McLario wrote to the Cook County State's Attorney Office to explain Crowell-Webb's situation and false accusations; however, the prosecutor was unresponsive. Thus, Attorney McLario called a friend, Jim Gibbons, an on-air reporter for WLS-TV on ABC. On March 22, 1985, Gibbons aired the story and Crowell-Webb's recantation and had the story printed on the cover of the Chicago Sun-Times (First DNA Exoneration). By public demand on April 4, 1985, Judge Samuels ordered Dotson to be released from prison on a $100,000 bond.

On April 11, 1985, a new hearing was scheduled due to Defense Attorney Warren Lupel's petition under the Illinois Civil Practice Act, requesting the original sentencing judge to hear the trial. Attorney Lupel called his first witness, Edward T. Black, a forensic serologist that stated that Crowell was indeed not raped at the time.

> What Black discovered was that the concentration of spermatozoa in the stain on Crowell’s underpants was two or three times greater than the concentration of spermatozoa on the vaginal swab made at the hospital only a couple of hours, at most, after the presumed rape. Spermatozoa are metabolized in the vagina,

> reducing their concentration. In a stain on a garment, although the sperm die, the concentration is not reduced. Thus, had Crowell been raped at the time she claimed, the concentrations in the stain and on the swab should have been roughly equal. (*First DNA Exoneration*)

Blake's findings were confirmed by the second witness, Henry C. Lee, a Connecticut State Police scientist. Crowell had not been sexually assaulted due to the inconsistencies found in the sexual assault kit, and the evidence found could have been her boyfriend the day before. Attorney Lupel also called Bill Julian, who was Dotson's old friend at the time of the original allegations; however, Julian had contradicted the prior statements from the witnesses. Assistant Cook County State's Attorney J. Scott Arthur located Crowell-Webb's former boyfriend, David Bierne, and desired to conduct new forensic tests for blood types. "Lupel was surprised when J. Scott Arthur declared in his closing arguments at the April 11 hearing that the inconsistency proved the adage, 'If you give a guilty man enough rope, he'll hang himself'" (First DNA Exoneration). Judge Samuels found that Crowell-Webb's trial testimony was more credible than her recantation. Judge Samuels ordered Dotson's bond revoked, and Dotson returned to prison (First DNA Exoneration).

Governor Thompson held a hearing with the Prisoner Review Board from May 10 to May 12 by petitioning the Illinois Supreme Court to reinstate Dotson's bond to allow him to appear in person for the conference. The Prisoner Review Board unanimously voted against full clemency. Governor Thompson declared that Dotson's trial was fair and just, and Dotson's guilt of the crime grew over time. Governor Thompson commuted Dotson's sentence as time served and held he was guilty of sexually assaulting Crowell-Webb.

After being released from prison, Dotson became dependent on alcohol and various substances. He got married, and the couple had a daughter. On August 2, 1987, the Dotson family was driving home from hanging out with friends when the couple got into an argument, and Dotson told his wife to get out of the car. Dotson's wife called the police and was arrested for domestic assault. Dotson was held without bond and was sentenced to sixteen years, one month, and five days in prison. However, on Christmas Eve in 1987, Governor Thompson ordered Dotson to be released from jail. Two days later, Dotson heavily drank with his friends and was charged with disorderly conduct. Judge Martin McDonough called Dotson's bond to be set at $1,000.

A year later, in August 1988, Edward T. Black contacted Governor Thompson, the Cook County State's Attorney Office, and Thomas Breen that the DNA test had been Bierne's, Crowell-Webbs's ex-boyfriend. Judge Fitzpatrick granted the petition, stating that if the evidence had been identified twelve years before, it would have changed the case's outcome. However, after Dotson was acquitted, he continued to experience substance abuse and criminal-like behavior. He had graduated from several chemical dependency treatments, but they were all unsuccessful. Thus, Dotson's criminogenic needs would have been higher for substance use and abuse, criminal companions, and a pro-criminal attitude. This could be caused by the number of years and no direction after release.

Wrongful Imprisonment

In 2021, a study (Brooks & Greenberg, 2021) found that approximately six percent of all criminal convictions lead to unlawful imprisonment. "Wrongful imprisonment is traumatizing and disorienting because imprisonment itself is traumatizing and disorienting" (Kregg, 2016). A comparable peer review discovered that more than fifteen percent of criminal sentences were

wrongful. The study concluded that there would be a drastic increase in exonerations due to DNA technologies and political developments. There is an evident racial and class bias regarding wrongful accusations. Regardless, false allegations and wrongful imprisonments create a unique form of post-traumatic stress disorder surrounding the challenges of employment experience, finding, and the stigmas of such offenses.

Additionally, a study located 2,921 citations to evaluate the psychological effects of wrongful accusations and imprisonments; out of the citations pulled, thirty defendants agreed to the research. There were eight distinct themes discovered among the participants. First, nineteen out of thirty individuals experienced permanent personality and self-identity changes. The offenders tested positive for paranoia, anxiety, depression, low self-esteem, hostility, mistrust, self-isolation, and personality disorders. For example, twenty-three people suffered from depressive episodes, and eight were suicidal and experienced previous attempts. Eighteen of the individuals were diagnosed with anxiety and panic-related disorders. Over half of the defendants experienced post-traumatic stress disorder and night terrors (Brooks & Greenberg, 2021). They explained the feeling of being lost – loss of time, hope, self, purpose, dignity, and future. However, fewer than five participants showed positive changes because they desired to help others who had experienced similar situations.

Consequently, many falsely accused explained their reputation and image were severely damaged and felt labeled. For example, the offenders began to feel incredibly guilty due to society and the community believing they were guilty. The participants felt they could not clear their names and blamed themselves for the accusations, causing strained relationships with friends, family, and strangers due to self-isolation and convictions. For instance, twenty-six participants became socially withdrawn and isolated due to feeling burdensome and having to

readjust around others (Brooks & Greenberg, 2021). Many of them lost several friends and family members. After being released from custody, over half of the individuals experienced strained inmate relationships, divorce, custody battles, and break-ups. It was causing many children of those falsely accused to feel abandoned. It is sporadic for a family's culture and relationship to be stronger. Regardless, those falsely accused and their family members reported losing hope in the criminal justice system. Many participants explained that the lack of apology or responsibility for their innocence from the court caused more negative feelings, shame, and fear of repeat allegations.

Another study utilized eleven violent crime cases, like sexual assault, homicide, burglary, theft, and drug possession. Eyewitness misidentification, improper forensic evidence, false testimonies and confessions, and ineffective legal counsel caused most falsely accused victims (Irazola et al., 2014). In nine of the eleven cases, law enforcement identifies the actual offender through concrete confession, DNA testing, analysis, or new evidence discovered at the crime scene. Three of the offenders were prosecuted and convicted. Another three cases were eliminated due to the statute of limitations passing. The final three files were never fully charged because the offender was incarcerated for other, more severe charges (Irazola et al., 2014). More than half of the victims on the files were shocked when they heard of the pardon and experienced intense guilt and fear of revictimization (Irazola et al., 2014). They reported that they feared the exonerees and the actual offenders of the crime.

Conclusion

Over the years, DNA evidence and research have become a booming industry due to the DNA evidence evolution across the United States and pressing concern of open cold cases awaiting DNA testing. DNA analysis in cold cases is consequentially necessary because of the development of technology and the Combined DNA Index System. The effects of unsolved cases reach past the victims, families, and detectives by taking on another role worldwide. Criminologists and forensic scientists have been challenged by the complexity of DNA analysis and lingering questions surrounding cold files. The advancements in DNA analysis and technology have encouraged and strengthened the limits of investigations to provide unique answers regardless of the age of the evidence. Thus, scientists may have ample room to continue understanding DNA analysis and its long-term effects on cases.

Historically, the advancements in DNA analysis have created new strengths to allow victims and law enforcement agencies to gain mutual respect regarding DNA, ethical, and legal advancements to provide complex answers for cases. When DNA was not utilized as an evidentiary factor, it became apparent that something had to change due to the number of cold cases. However, the clearance rate was significantly higher when DNA analysis and evidence started than today than twenty years ago.

Recent advancements in the criminal justice system have also challenged previous investigations because of fast-paced exoneration and the victims of wrongful convictions. This helps in aiding several individuals to be exonerated from falsely accused crimes and convict suitable offenders. Victims of wrongful imprisonments and sentencings have become a well-known study for criminal psychologists. The mental effects have vicarious effects on a defendant, and the risk of recidivism increases significantly.

Moreover, DNA analysis has been an ongoing legal issue due to the need for more research and precedent court decisions. Lawmakers have witnessed a trend of defendants and attorneys arguing that DNA analysis infringes upon one's constitutional rights. Throughout the criminal justice history of the United States, DNA analysis has become required for several trials regarding convictions and exonerations. It has become one of the leading factors and reasonings to convict defendants. Thus, DNA analysis provides a road map for several investigations and victims to ensure their case is treated to a higher standard. The public and society may begin to trust and respect law enforcement agencies if they view cases being investigated and taken seriously.

DNA analysis only sometimes offers answers in rare cases. Due to the age or lack of evidence, in some cases, many of them turn cold because of lack of evidence collected and inhibited testing and analysis. Some law enforcement agencies are dedicated to assisting with unsolved cases, like the Golden State Killer file. If law enforcement agencies had adequate funding and resources from decision-makers and lawmakers, the number of cold cases might be solved through DNA analysis given evidence was collected and analyzed at the time of the crime.

Despite the need for lawmakers to make a change, criminal justice administrators must understand the mistakes and unanswered questions from DNA analysis and genealogical testing. Lawmakers initiate reform change that criminal justice agencies should also acknowledge the errors and uncertainties stemming from DNA analysis and genealogical testing. For example, recent cases have revealed instances where DNA evidence and genealogical data were mishandled and led to false accusations. Through older cases and DNA findings, administrators can better equip their agencies regarding ethical considerations and expectations. In several cold

cases, ethical expectations must be prioritized to ensure the trust between criminal justice agencies and communities remains. By examining older cases and DNA findings, administrators can enhance their organizations' understanding of ethical considerations and expectations. In several cold cases, these ethical expectations must take precedence to preserve the trust between criminal justice agencies and society. Administrators must promote moral accountability by providing victims that their well-being is held to higher standards and that the offenders will be prosecuted. Unsolved cases and DNA analysis are essential to understand to allow trust and ethical standards to be maintained higher for communities and victims.

Criminologists and law enforcement agencies have witnessed the unique ways to incriminate suspects from older cases, like the Golden State Killer. This investigation proved that law enforcement agencies must become flexible within their manageable techniques to create a more profound analysis; yet testing protocols in place that do not afford much flexibility are held to a higher ethical standard. Using genealogy websites has offered a new way for law enforcement agencies to develop a familial link for potential suspects. For example, in the case of the Golden State Killer, using genealogy websites was pivotal in identifying the defendant and developing the balance between privacy concerns and solving cases through innovative ways. However, many individuals argue that utilizing genealogy websites infringes upon one's privacy and constitutional rights. Criminologists and lawmakers discovered that there is no violation upon users because the genealogy websites offer an agreement that states that an individual's information is public for anyone to search and utilize.

Overall, DNA analysis has become a fascinating trend in the world of criminal justice regarding its use for solving cases – old and new. It creates unique ways and opportunities for criminologists and forensic scientists to promote technological advancements and growth. The

ongoing issue and trend for DNA analysis within unsolved cases will continue to grow due to the need for answers from victims, detectives, and society. So, DNA analysis within cold cases will remain unsolved.

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