Serial Killer Connections Through Cold Cases

Cold case investigations have revealed that, in many cases, the offenders are responsible for multiple crimes. Therefore, prioritizing cold case investigations can assist in both resolving crimes and preventing future ones.

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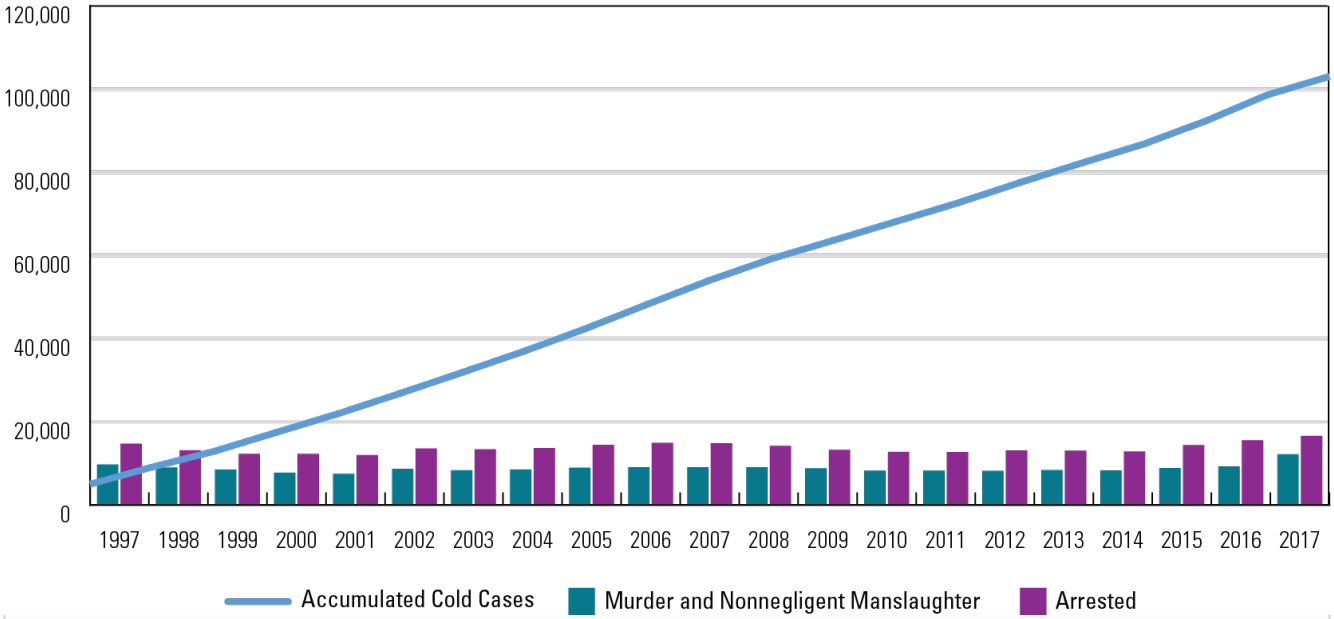
By: Eric Martin
Dawn Elizabeth Schwarting
Ruby J Chase

There is a cold case[1] crisis in the United States. In 1965, approximately 80% of homicide cases were cleared, according to the FBI's Uniform Crime Reports,[2] but in 2017 only about 60% of homicide cases were resolved. An estimated 250,000 unresolved homicides exist in the United States, and more than 100,000 have accumulated in the past 20 years alone (see exhibit 1).[3]



20 Years of Accumulated Cold Cases (View larger image.)

Data table: 20 Years of Cold Cases

In part, limited resources have caused the crisis. Law enforcement agencies are stretched thin and often lack the personnel to adequately work cases as they happen. Cold cases are also difficult investigations, sometimes because of a lack of evidence. If there were easy solutions, resolution would have occurred at the time of the offense. As time passes, the likelihood of losing case file information, evidence, and witnesses increases.

Another likely contributor to the country's current cold case crisis is the number of serial killers operating in the United States. A serial murder is the unlawful killing of two or more victims by the same offender(s) in separate events.[4] Estimates vary, but one estimate of the number of serial killers in the United States who have never been prosecuted for their crimes was as high as 2,000.[5] Another study suggests that up to 15% of homicides are the result of serial killers.[6] Meanwhile, estimates of the number of victims of serial killers, from a research study out of Indiana University-Purdue University Indianapolis, range from fewer than 200 to almost 2,000 each year.[7] The study notes that quantifying the estimated number of victims is difficult, and generalizing and extrapolating data has created a wide range of estimates — but even the low end of the range is alarming.

NIJ had several robust programs that have helped law enforcement agencies solve cold cases over the years. (Recently, nonresearch support for cold case investigations was transferred to one of NIJ's sister agencies, the Bureau of Justice Assistance.) In the process, NIJ-sponsored research has discovered a number of important connections between cold cases and serial offenders, the most alarming of whom are serial killers.

Helping Resolve Cold Cases

NIJ has a long history of supporting the scientific, technical, and capacity needs of the forensic community, particularly as the demand for forensic testing has grown. [8] NIJ recognizes the value of analyzing evidence from older, unresolved cases. From 2005 to 2014, the Institute provided funding for law enforcement agencies to review cold cases and submit their evidence for DNA analyses through its Solving Cold Cases with DNA program. This resulted in the resolution of more than 2,000 cold cases (see exhibit 2).

See "The Costs and Benefits of Cold Cases"

Cases With DNA Program							
f	Number of Cases Reviewed	Number of Cases Where Biological Evidence Remained	Number of Cases Where DNA Was Tested	Number of Cases That Yielded a Profile	CODIS Uploads	CODIS Hits	Number of Cases With Trials, Arrests, Closed
53	7,767	1,305	2,236	677	704	261	206
0	33,897	4,174	1,573	786	530	158	328
05	50,813	7,371	3,691	2,049	1,493	576	353
38	14,087	6,475	2,278	1,369	956	365	333
19	11,885	5,522	1,711	723	598	248	358
3	7,610	3,545	640	378	445	197	176

In 2019, NIJ initiated the Prosecuting Cold Cases using DNA and Other Forensic Technologies program.[9] There was also a need to address the growing accumulation of unidentified remains and missing persons cases. As a result, the Using DNA to Identify the Missing program and the National Missing and Unidentified Persons System (NamUs) evolved.[10] As of February 2019, NamUs reports that foul play is *not* suspected in only 7% (approximately 1,000) of its published missing persons cases (see exhibit 3). The approximately 14,000 remaining cases could have or are suspected to have resulted from foul play, and some fraction of these cases are likely to have serial killer connections. Likewise, some portion of the more than 7,000 unidentified persons cases published in NamUs (comprising more than 2,000 known homicide victims and more than 5,000 unidentified persons whose manner of death remains undetermined) are also likely to be the result of serial killers (see exhibit 4).

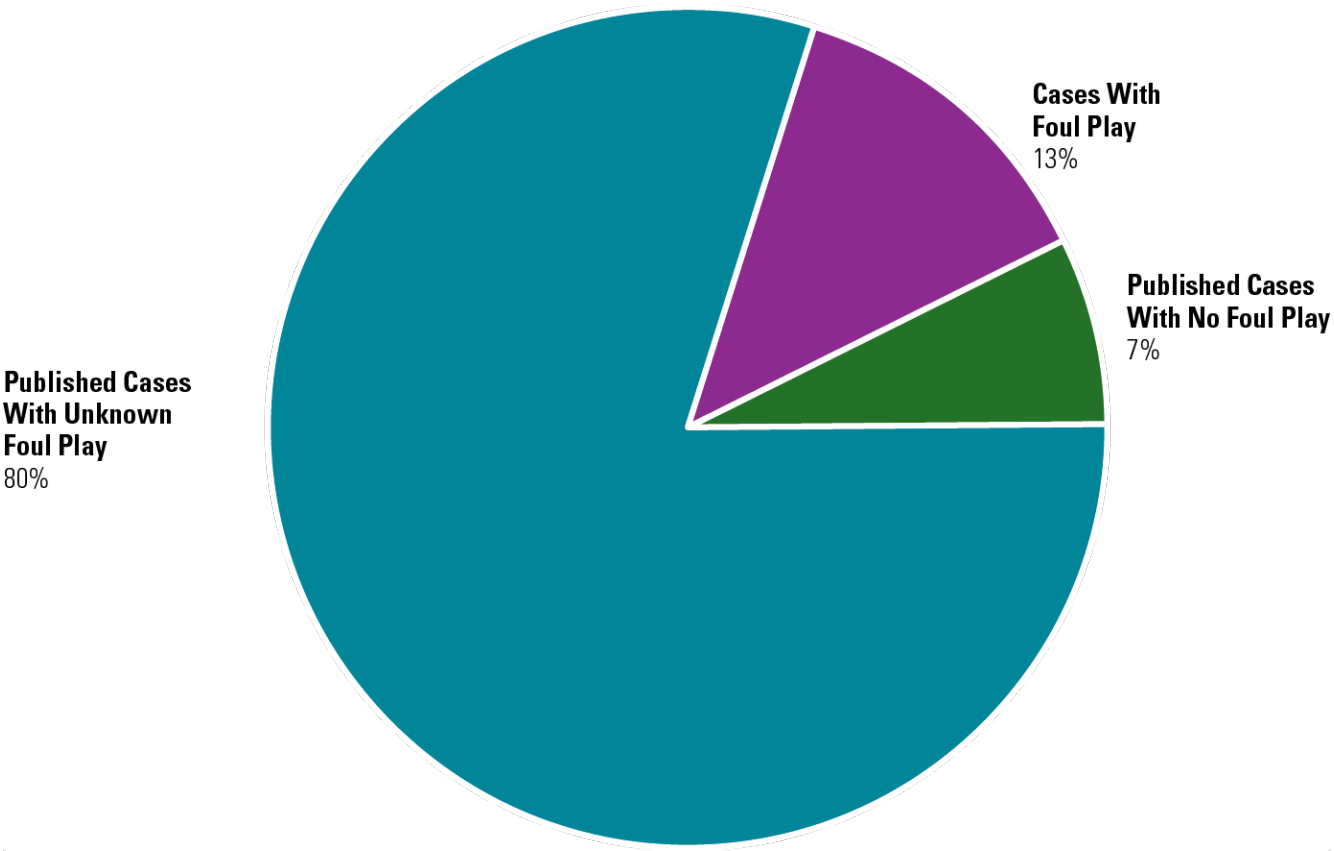


Exhibit 3. Foul Play in Active Missing Persons Cases in NamUs. Note: NamUs publishes cases for which its staff have verified the information and posted the information in the publicly accessible database files. These data were calculated in August 2018.

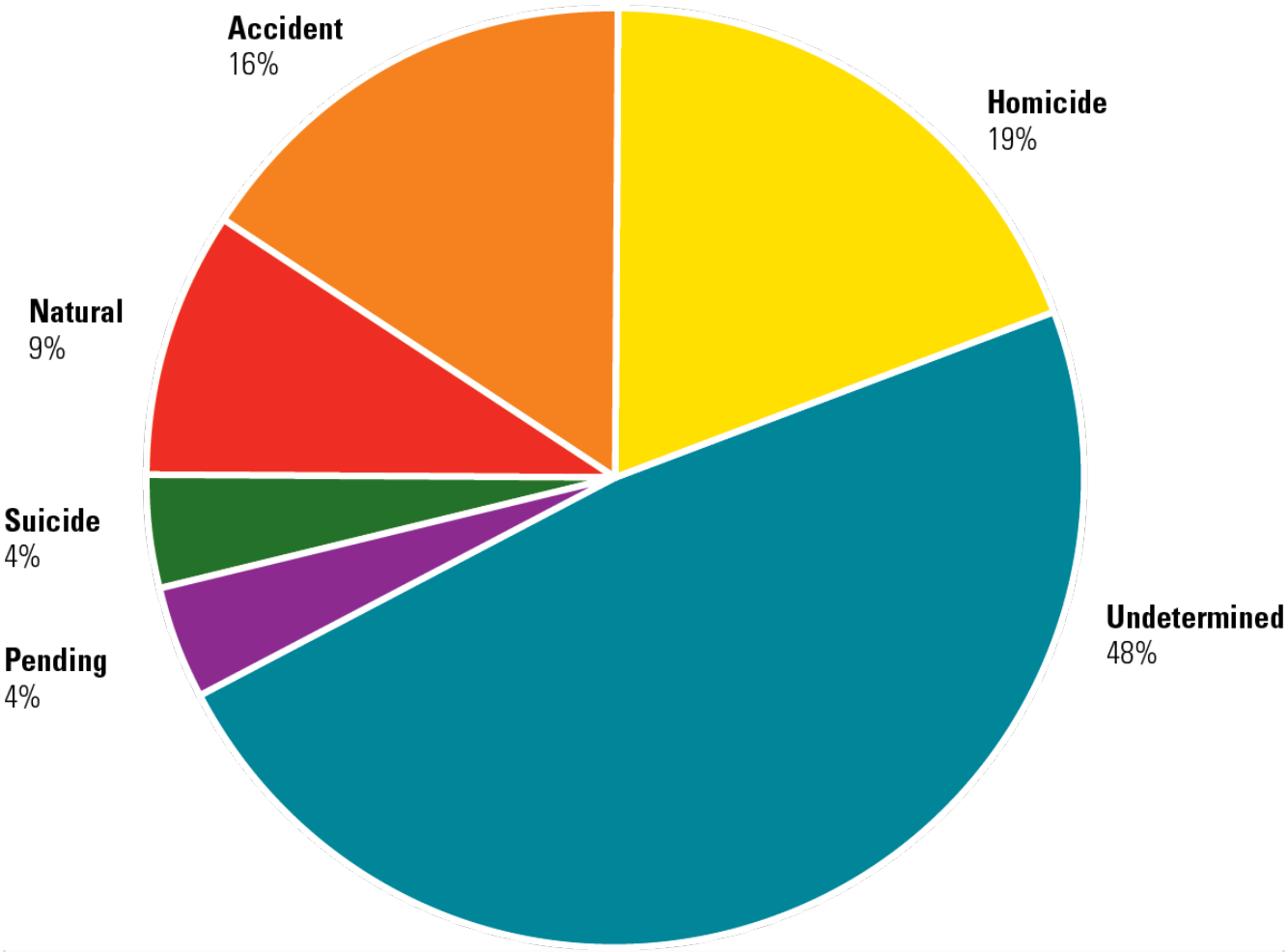


Exhibit 4. Manner of Death in Active Unidentified Persons Cases in NamUs. Note: NamUs publishes cases for which its staff have verified the information and posted the information in the publicly accessible database files. These data were calculated in August 2018.

Potentially more staggering is the number of missing persons who are unaccounted for. These people — often immigrants, foster children, and transient people such as homeless individuals and prostitutes — are not reported missing for a variety of reasons. Even when they are reported missing, law enforcement does not routinely investigate such cases until there is cause to believe that foul play has occurred.[11] In interviews, many serial killers have noted that they preyed on these vulnerable populations and disposed of their victims' bodies in places and manners unlikely to be discovered; thus, their crimes could go unnoticed and they could continue killing.[12]

See "NIJ Programs Help Support Cold Case Investigations"

NIJ's Role in High-Profile Investigations

Through administration of these NIJ programs, several serial killers[13] and their victims have been identified. Below are a few examples of high-profile serial killer cases that were solved with the assistance of NIJ programs.

Boston Strangler

Albert DeSalvo admitted to killing 13 women in the Boston area between 1962 and 1964. Several of the victims were strangled, thus earning DeSalvo the moniker the "Boston Strangler." However, DeSalvo recanted his confession of the murder of Mary Sullivan, and controversy arose over his culpability in that case. DeSalvo — sentenced to life in prison in 1967 — was killed in prison in 1973. In 2013, the Boston Police Department used funds from the Solving Cold Cases with DNA program[14] to confirm that DNA recovered from Mary Sullivan was a statistically relevant match to DNA from DeSalvo's remains, which were exhumed that same year.

Killer Clown

In 1978, 30 bodies were recovered at the Chicago home of John Wayne Gacy, a part-time clown entertainer. As of 2011, 14 victims remained unidentified, but two of those victims have since been identified using forensic technologies. Facial reconstructions performed on the unidentified victims and DNA profiles obtained through NIJ's Using DNA to Identify the Missing program led to the identification of William Bundy in 2011.[15] In 2017, NamUs assisted in identifying Jimmy Haakenson.[16]

Green River Killer

During the 1980s, Gary Ridgway killed numerous women along the Green River in Washington state. In 2003, Ridgway — called the "Green River Killer" — was convicted of killing 49 women; he is suspected in as many as 90 homicides. In 2001, the King County Sheriff's Office used DNA laboratory equipment purchased with NIJ funds from the Crime Laboratory Improvement Program to link evidence found on four of the victims to Ridgway.[17]

In addition to not knowing the actual number of Ridgway's victims, the identities of

some victims remain unknown. In 2012, through two separate awards from NIJ's Using DNA to Identify the Missing program, Bode Cellmark Forensics and the University of North Texas Health Science Center used reference DNA provided by siblings to confirm that the victim once known as "Jane Doe B16" was Sandra Major.[18]

Long Island Killer

In the 1990s, 11 sets of human remains were recovered along a beach in Long Island, New York. Several of the victims were dismembered and only partially recovered. Through NIJ's Using DNA to Identify the Missing program, New York City's Office of Chief Medical Examiner helped determine the identities of six victims. It also matched two sets of remains recovered from separate locations to one victim, who remains unidentified.

The medical examiner's office also obtained a partial familial DNA match between DNA samples collected from two of the victims and the brother of John Bittrolff. Bittrolff was confirmed as an exact match to the DNA from the victims and was subsequently convicted. His case was the first homicide conviction in New York based on a partial DNA match — although it still remains unclear whether Bittrolff is the "Long Island Killer" or only one of perhaps multiple killers who disposed of their victims in that area.[19]

Grim Sleeper

A single source of DNA connected several homicide victims from the 1980s and 2000s, but no suspect was identified in the FBI's Combined DNA Index System (CODIS). The lag between the associated killings led to the moniker the "Grim Sleeper."

NIJ's Solving Cold Cases with DNA program enabled detectives to review and analyze DNA evidence in several of the unsolved homicides. A familial DNA search in CODIS led investigators to the son of Lonnie David Franklin Jr. NIJ funding assisted in analyzing DNA from Franklin, which was confirmed as a match to DNA recovered from the murders.

In 2016, Franklin was convicted of killing 10 women, and he is suspected of killing an additional 25 women. More than 100 photographs of unknown women were found among Franklin's possessions, leading to speculation that he may have been responsible for many more killings.[20]

Golden State Killer/East Area Rapist

In the 1970s and 1980s, at least two separate serial offenders were thought to be operating in California: the "Golden State Killer" and the "East Area Rapist." These unknown offenders were also known as the "Original Night Stalker," the "Visalia Ransacker," the "East Bay Rapist," and the "Diamond Knot Killer."

Funding through NIJ's Solving Cold Cases with DNA program helped link a double homicide in Ventura to a common suspect in 10 homicides and three sexual assaults throughout California — including in Orange County, where a separate NIJ award allowed investigators to work on unsolved sexual assaults and homicides attributed to the Golden State Killer and the East Area Rapist.[21] Once investigators from multiple counties realized that the separate offenders were in fact the same person, they calculated that the suspect had possibly committed more than 50 sexual assaults. Armed with the case-to-case connections, investigators tried a new DNA investigative approach: forensic genetic genealogy, which is the identification of suspects through DNA matches to family members. In 2018, Joseph James DeAngelo was identified as a suspect, and a confirmatory DNA match led to 13 rape charges and 13 murder charges against him.

Truck Drivers and Other Cases

Truck drivers travel great distances regularly, which provides ideal opportunities to commit crimes that are difficult to resolve.[22] With funding from NIJ's Using DNA to Identify the Missing program, the University of North Texas was able to connect truck driver William Reece to the deaths of one girl in Oklahoma and two young women in Texas.

In addition to the high-profile cases listed above, NIJ grantees have reported other serial killers who were identified as a result of their projects.

See a more comprehensive list of serial killer investigations aided by NIJ funds in appendix A.

Catching Serial Offenders Early

Understanding patterns of behavior along with criminal and psychological profiles can help identify and catch prolific serial killers — and perhaps even prevent some before they start. For example, studies have shown that compared to other criminals, serial violent offenders start committing crimes earlier; offend over a longer period of time; and have more employment, interpersonal, and substance abuse problems.[23] Moreover, research suggests that offenders who engage early on in a diverse criminal career are likely to commit more violent offenses later.[24]

Armed burglary in particular is associated with further increases in violent crime, such as armed robbery, armed rape, kidnapping, assault with intent to murder, and even first-degree murder. Researchers have found that sex offenders were most likely to transition quickly from conventional profit-motivated burglaries to sexual assaults in homes without engaging in fetish-motivated burglaries or voyeurism.[25]

Some serial killers exhibit a three-part progression from burglary to sexual assault to murder. Sexual assault does not necessarily predict further escalation to violent crime or serial killing,[26] but some examples of this pattern include the following cases:

- Albert DeSalvo (the Boston Strangler) began with shoplifting and stealing. He progressed to burglary and eventually to sexual assault and murder.[27]
- Joseph DeAngelo (the Golden State Killer) committed a string of burglaries from April 1974 to December 1975. He then progressed to a series of sexual assaults between June 1976 and July 1979 and was dubbed the “East Area Rapist.” He progressed to murder in October 1979 and was called the “Original Night Stalker” before investigators finally linked him to the burglaries, sexual assaults, and homicides.[28]
- John Wayne Gacy (the Killer Clown) engaged in petty theft as a child,

> graduated to sexual assault in his 20s, and then began to murder in his 30s, preying on a vulnerable population of teenage boys.[29]

These findings are important because they suggest that the seriousness of any one offense should not drive where law enforcement directs resources for investigating and clearing cases. Such strategies are understandable, but they can lead to the perception that there are classes of offenders based on specialty. This belief, in turn, may lead law enforcement to prioritize cases related to "violent" offenders over cases involving "property" offenders.

It would be worthwhile to reconsider the way agencies investigate cold cases — that is, it would be beneficial to include a wider range of offenses when seeking investigative leads for homicides. Indeed, research on the careers of serial killers justifies paying increased attention to burglaries when investigating violent criminal careers and cold cases.

To help law enforcement understand the nexus of property crimes and more violent offenses, NIJ funded the Urban Institute to conduct a randomized controlled trial examining the impact of using DNA testing to investigate burglary cases in five separate jurisdictions. Researchers found that in 67% of cases in which a DNA sample was obtained, the sample was entered into CODIS; 41% of these cases yielded a match.[30] Overall, this led to twice as many suspects identified when using DNA than through conventional burglary investigations.[31]

Of particular interest, suspects identified through DNA evidence from burglaries had double the number of felony arrests and convictions than suspects identified using conventional methods.[32] This finding does not guarantee that using DNA methods to investigate burglaries will lead law enforcement to serial violent offenders (known or unknown), but it does show that these investigative methods help police discover and apprehend more prolific offenders.

Addressing the Crisis

Focusing investigative efforts on cold cases and apprehending repeat offenders

can prevent future crimes and protect possible victims, thus saving the community the immense cost of these crimes. Clearing cases also frees agency resources, and resolved crimes equate to a sense of a safer community, lessening the need for "boots on the ground" and reactive policing.

The future looks bleak when seeing numbers like a quarter of a million unresolved homicides and 2,000 serial killers. But today's agencies have numerous tools on their side, including research on best investigative practices, advancements in science and technology, and increased information exchange. As evidenced by the serial killer case examples reported through NIJ's programs — and the knowledge that criminals tend to be repeat offenders — many unresolved homicides are likely to lead to perpetrators responsible for multiple killings. Thus, solving one case is likely to solve multiple cases. For example, one detective seeking to identify the remaining victims of John Wayne Gacy resolved 11 other missing persons cases in the process, several of which were homicides.[33]

Investigative Practices

One NIJ-funded study examined effective investigation practices for cold cases. Researchers found that cold cases were usually opened because new witnesses came forward or DNA tests were conducted on retained physical evidence (some of which was collected before the most current DNA technologies became available).[34]

They also found that the amount of resources dedicated to cold case investigations, particularly the level of funding, significantly affected the cold case clearance rate.[35] More recent cases were more likely to be solved than older ones. Also, if the victim was found inside his or her own home, chances of solvability increased. The justification for opening the cold case investigation mattered as well: Cold cases were most likely to be cleared if the cases were initiated by investigators through new evidentiary leads.[36] In sexual assault cases, victim cooperation was found to be related to a successful conviction rate.[37]

Science and Technology

Advancements in science and technology have helped solve cases that were once unsolvable. DNA — an unknown evidence source in the 1980s — can now be analyzed with a fraction of the sample size needed merely five years ago. Meanwhile, upgraded computer search algorithms[38] are realizing connections between friction ridge impressions[39] that were not identifiable during previous searches.

See “NamUs-FBI Fingerprint Collaboration Partnership”

Tapping into technology can propel a stalled cold case investigation forward. For example, innovations in DNA databases’ search capabilities are connecting crimes to other crimes and to offenders.[40] The Golden State Killer alone was connected to 12 homicides, more than 50 sexual assaults, and hundreds of incidents of burglaries, peeping, stalking, and prowling[41] through DNA database connections.

In conventional practice, DNA database searching consists of seeking an exact match at 20 DNA loci between evidence and samples in the CODIS database from other crime scenes or convicted offenders or arrestees. Some jurisdictions are finding success through less precise (lower stringency) searching, giving them the ability to find individuals related to the suspect. This can be done by simply noting partial matches, or through specific software algorithms designed to identify family members (i.e., familial searching).[42]

ICF International, in an NIJ-funded study, found that 11 states allowed familial DNA searching and that 24 states and Puerto Rico disclosed DNA hits based on partial matches. The labs that engaged in familial DNA searching were starting to see arrests leading to convictions, albeit in a small number of cases. ICF also found that key stakeholders who championed the use of familial searching along with establishing clear policies led to greater use of this technique.[43] As use of this technique becomes more familiar, and as more cases are cleared through partial-match and familial searching, it is foreseeable that this practice may expand or lead to other innovative DNA searching methods.

In addition, information is more accessible today. Investigators can connect suspects to crimes using the vast amount of information available through the

internet and electronic records, as illustrated by recent news stories of cold cases that were resolved through genealogy databases.

See “DNA and Cold Case Investigations”

Auditing the Evidence

Cold case investigators and laboratories across the country have realized that auditing cold cases may help clear them. As with any process, there can be gaps and oversights, and many investigators have learned that these may exist in evidence databases.

For example, capturing DNA from criminals, according to the locality’s defined offense criteria, is a common practice and has been occurring for decades, but many offenders have managed to avoid it. Investigators routinely submit evidence to labs, hoping that their unknown DNA profile matches an entry from a known person in CODIS. This is possible if the suspect was previously convicted (and, in some states, arrested). But what if the suspect was arrested or convicted prior to DNA collection laws? What if the suspect was committed for mental observation and the DNA collection process was circumvented? What if the suspect died without DNA being collected? Investigators may identify a suspect in a cold case merely by auditing the evidence, case files, and associated databases and recognizing a gap or oversight.[44]

Cold cases also have the benefit of time. Situations change, relationships change, and barriers — such as the previously uncooperative spouse who is now an ex-spouse, willing to share his or her knowledge — can help resolve cold cases. Scientific processes also evolve with time. Having the ability to patiently and thoroughly investigate a cold case, rather than acting reactively or responding only to recent situations, affords investigators the ability to research and apply all available tools for resolving today’s cold cases, preventing future crimes, and potentially catching a serial killer. Agencies need only apply resources to capitalize on these assets.

There has never been a better time to address cold cases. With the advantages of

research, technology, and time, agencies can greatly benefit from addressing the cold case crisis in the United States and, as a consequence, serial killings can be identified, solved, and prevented.

For More Information

- Read NIJ's *National Best Practices for Implementing and Sustaining a Cold Case Investigation Unit*.
- Learn more about NamUs.
- Watch a video on the impact of NIJ's Solving Cold Cases with DNA program.
- Read the related *NIJ Journal* article "Cold Cases: Resources for Agencies, Resolution for Families."
- Watch a video on the importance and impact of cold case units.

Sidebar: The Costs and Benefits of Cold Cases

In numerous ways, investigating and resolving cold cases benefits law enforcement agencies, the communities they serve, and society as a whole. First and foremost is the safety of the community. When offenders are incarcerated, the community is spared their crimes and residents feel safer. Safety is both real and perceived. With respect to the latter, unresolved crimes can lead to mental health and financial costs — for example, businesses might suffer when customers avoid particular times and locations because they are afraid. Serial offenders contribute to these fears — their crimes are compounded by notoriety, and with each unsolved case there is a growing sense of prevalent danger in the community.

Secondly, and no less important, is the sense of justice that survivors feel when perpetrators are apprehended.[44] Survivors often feel that law enforcement has given up on them and that the lives of their loved ones are no longer a priority.[45] Law enforcement has a moral obligation to fulfill its mission; because cold cases capture public interest, resolving them inspires public confidence in law enforcement.

In addition to promoting safety and justice, preventing future crime and clearing active cases result in enormous financial savings. Although very difficult to calculate, the costs of crime are generally believed to be extremely high, ranging from $690 billion to $3.41 trillion annually.[46] Many variables determine the costs of crime: crime prevention efforts, direct consequences of crimes such as medical and funeral costs for victims, crime responses, and investigations, as well as the costs of moving suspects through the legal system and incarcerating them. Even harder to quantify are the intangible costs to victims and the community. Fear and post-traumatic responses may be somewhat quantifiable if psychological help and physical security enhancements could be calculated; however, the emotional costs can never be measured.

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Sidebar: NIJ Programs Help Support Cold Case Investigations

The Postconviction DNA Testing Assistance program (Postconviction DNA Testing to Exonerate the Innocent) is designed to review evidence in cases where DNA analysis may substantiate claims of a potential wrongful conviction.[47] Grantees have reported that, in some cases, not only were those convicted not responsible, but also the true culprits appeared to be serial killers. For example, in North Carolina, Leon Brown and Henry Lee McCollum were convicted for the murder of Sabrina Buie, but subsequent DNA testing exonerated them and revealed that Roscoe Artis, a convicted rapist and killer, was Buie's likely killer.[48]

NIJ also tracks the outcomes of criminal justice programs, including those related to cold cases and repeat violent offenders, and supports behavioral and social science research through its Social Science Research on Forensic Science (SSRFS) portfolio. SSRFS was born out of a need to understand both the potential and the limits of forensic science in bringing offenders to justice. Its diverse topics have included studying the effectiveness of an innovative forensic method,[49] understanding the perception of forensics in the courtroom,[50] and assessing the

benefits of expanding the use of DNA testing beyond serious violent crime.[51] SSRFS's research has identified effective practices for the apprehension of serious violent criminals,[52] which include pursuing cold cases, employing alternative DNA searching technologies, and investigating property crimes. This program gives agencies an understanding of the full spectrum of investigative opportunities open to them through the use of forensic methods.

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Sidebar: NamUs–FBI Fingerprint Collaboration Partnership

In 2017, the FBI and the National Missing and Unidentified Persons System (NamUs) entered into a partnership in which the friction ridge impression records for missing and unidentified persons that NamUs collected were searched against the FBI's Next Generation biometric database. As of September 30, 2019, 259 identifications of unidentified persons have been made through this partnership. Most notably, 28 of those identified are confirmed homicide victims.

A significant number of the unidentified human remains in NamUs have a cause of death that is undetermined or unlisted. The probability that at least some of these NamUs cases are homicide victims means that the partnership with the FBI is likely to turn up many additional homicide leads. Recognizing a homicide and identifying a victim is a major first step in resolving cold cases and identifying serial killers.

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Sidebar: DNA and Cold Case Investigations

Emerging DNA analysis applications that may assist in cold case investigations include DNA phenotyping, forensic genetic genealogy (FGG), and DNA mixture

interpretation. DNA phenotyping is the use of DNA information to predict the physical features of a person (their phenotype), such as eye, skin, and hair color. A sketch of a person's appearance can be generated by combining the information from several phenotypically important genes. NIJ research has included projects such as identifying genetic markers in DNA that contribute to skin pigmentation. [53]

FGG is a process whereby DNA profiles are used in conjunction with genealogy investigations to identify relatives of an unknown donor of a DNA sample. It should be noted that the DNA profiles used in law enforcement databases differ from the DNA profiles obtained through the commercial DNA genealogy sites that FGG relies on. The U.S. Department of Justice published an interim policy on the use of FGG in September 2019 to ensure that law enforcement practices continue to protect the rights of people who use public genealogy resources while also incorporating FGG to identify potential investigative leads.[54] The use of FGG led to the identification of the Golden State Killer.

Because violent crimes involve the interaction of two or more people, multiple DNA profiles may be mixed together in evidence. Using probabilistic software in DNA analyses has allowed analysts to separate or interpret individual DNA profiles from such mixtures where previous analyses provided inconclusive results. In addition, NIJ-funded research is applying machine learning to DNA mixture interpretation, improving results by incorporating data from previous analyses.[55]

NIJ continues to fund research and development for advancing new DNA technologies. Many of these technologies, however, are still evolving and may not provide solutions in the near future. But in cold cases, where there may be little evidence and few to no investigative leads, new technologies may, in time, provide just enough information to propel a cold case investigation toward its next steps.

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Appendix A: Serial Killer Cold Cases Assisted by NIJ Funding

Albert DeSalvo ***Boston Strangler***

Lonnie Franklin Jr. Grim Sleeper, Southside Slayer

Joseph James DeAngelo, ***Golden State Killer, East Area Rapist, Original Night Stalker, Visalia Ransacker, East Bay Rapist, Diamond Knot Killer***

John Wayne Gacy ***Killer Clown***

Ottis Toole

Henry Lee Lucas ***Confession Killer, Highway Stalker***

Gary Ridgway ***Green River Killer***

Zodiac Killer

Vincent Groves

Jose Manuel Martinez, ***Mexican Hitman, El Mano Negra (The Black Hand)***

Roscoe Artis

Douglas Thames Jr.

David Wayne Nelson

Bryan Miller, ***Canal Killer, Zombie Hunter***

John Floyd Thomas Jr. *Westside Rapist*

John Bittrolff, Suspect in the Long Island Killer case

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Notes

[note 1] "Cold case" is a term used by the media to describe a criminal case that has remained unresolved for an extended period of time. It is not clearly defined, and definitions vary between agencies. For example, the state of Arizona defines a cold case as one that remains unsolved after one year, while Los Angeles, California, uses five years as its homicide cold case threshold. NIJ uses "cold case" because of the term's prevalence and acceptance in most agencies, even though it realizes that this term can be perceived as insensitive; it is not NIJ's intention to diminish the seriousness of any crimes nor the resolve of law enforcement to provide justice for all crimes. Arizona Cold Case Task Force, "A Report to the Governor and the Arizona State Legislature," 2007; and Los Angeles Police Department [LAPD], "Robbery-Homicide Divison," Los Angeles: LAPD.

[note 2] A Bureau of Justice Statistics report notes that 72% of homicides were cleared in 1980. Alexia Cooper and Erica L. Smith, *Homicide Trends in the United States, 1980-2008*, Washington, DC: U.S. Department of Justice, Bureau of Justice Statistics, November 2011, NCJ 236018.

[note 3] Information surmised by calculating the number of homicides reported to the FBI since 1980 minus the total number of homicide cases reported to have been cleared.

[note 4] Federal Bureau of Investigation, *Serial Murder: Multi-Disciplinary Perspectives for Investigators*, Washington, DC: U.S. Department of Justice,

Federal Bureau of Investigation, Behavioral Analysis Unit, 2005.

[note 5] A 2018 article in *Live Science* notes that the number of serial killers who have not been captured can be determined by calculating the number of cases linked through evidence connections in evidence databases that have not been adjudicated. Stephanie Pappas, "How Many Uncaptured Serial Killers Are Out There?" *Live Science,* April 28, 2018. Mike Aamodt of Radford University collected serial killer data from 1992 to 2016 and calculated that 54 serial killers were operating during the years 2010 to 2015. Aamodt's research was the basis for the data reported in the *Live Science* article. Mike Aamodt, *Serial Killer Statistics,* Radford, VA: Radford University, Serial Killer Information Center, September 4, 2016. One former investigator for the FBI stated that he believed that at any one time there are between 25 and 50 active serial killers in the United States. John E. Douglas, *Mind Hunter: Inside the FBI's Elite Serial Crime Unit* (New York: Pocket Books, 1995).

[note 6] The authors of a study from Indiana University-Purdue University Indianapolis apply a formula based on data analyzed through a study from Washington state to estimate that serial killers are responsible for approximately 15% of all homicides. The study further describes how this estimate may be conservative, since there are many unknown cases. Kenna Quinet, "The Missing Missing: Toward a Quantification of Serial Murder Victimization in the United States," *Homicide Studies* 11 no. 4 (2007): 319-339, doi:10.1177/1088767907307467.

[note 7] Quinet, "The Missing Missing."

[note 8] Gerald LaPorte, Heather Waltke, Charles Heurich, and Ruby J Chase, *Fiscal Year 2017 Funding for DNA Analysis, Capacity Enhancement, and Other Forensic Activities,* Washington, DC: U.S. Department of Justice, National Institute of Justice, April 2018, NCJ 251445.

[note 9] Section 2 of the Justice Served Act of 2018 provides funding for prosecutors to increase the capacity of state and local prosecution offices to address cold cases involving violent crime where suspects have been

identified through DNA evidence. In 2020, this program moved to the Bureau of Justice Assistance, Office of Justice Programs.

[note 10] NamUs is a national, central repository and resource center for the records of missing and unidentified persons. It consists of three primary databases: the Missing Persons Database, the Unidentified Persons Database, and the Unclaimed Persons Database, a database of people whose identities are known but who remain in the custody of a medical examiner or coroner until next of kin are identified. For more information, go to www.namus.gov.

[note 11] Connecticut, Michigan, New Jersey, New York, and Tennessee require law enforcement agencies to enter missing persons into NamUs, and Oklahoma has proposed Francine's Law, whereby all missing and unidentified persons must be entered into NamUs within 30 days of the initial report. Office of the Oklahoma Attorney General, "Attorney General Hunter, Local, State Leaders Announce Initiative to Help Solve Cold, Missing and Unidentified Person Cases," press release, Oklahoma City: Office of the Oklahoma Attorney General, August 16, 2018.

[note 12] "I picked prostitutes as victims because they were easy to pick up without being noticed. … I knew they would not be reported missing. I picked prostitutes because I thought I could kill as many of them as I wanted without getting caught," Gary Ridgway explained. James Allen Fox, "Serial Killers Find Prostitutes Easy Prey," *USA Today,* October 23, 2014.

[note 13] 28 U.S.C. § 540B defines serial killing as a "series of three or more killings, not less than one of which was committed within the United States, having common characteristics such as to suggest the reasonable possibility that the crimes were committed by the same actor or actors."

[note 14] Phil Bulman, "Solving Cold Cases with DNA: The Boston Strangler Case," *NIJ Journal* 273, April 2014.

[note 15] National Institute of Justice, "The University of North Texas Center

for Human Identification Project: Using DNA Technology to Identify the Missing, FY 2010," award to University of North Texas Health Science Center at Fort Worth, grant number 2010-DN-BX-K206.

[note 16] Aamer Madhani, "DNA Test Confirms Teen Missing Since 1976 Was John Wayne Gacy Victim," *USA Today,* July 19, 2017.

[note 17] National Institute of Justice, "Crime Laboratory Improvement Program (CLIP)," award to King County Sheriff's Office, grant number 2004-RG-CX-K011.

[note 18] National Institute of Justice, "Using DNA Technology to Identify the Missing," award to Bode Cellmark Forensics, Inc., grant number 2010-DN-BX-K257; and National Institute of Justice, "The University of North Texas Center for Human Identification Project: Using DNA Technology to Identify the Missing, FY 2010."

[note 19] National Institute of Justice, "Using DNA Technology to Identify the Missing," award to City of New York, Office of Chief Medical Examiner, grant number 2010-DN-BX-K131.

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[note 29] Terry Sullivan and Peter T. Maiken, *Killer Clown: The John Wayne Gacy Murders* (New York: Pinnacle, 2000).

[note 30] John K. Roman et al., *The DNA Field Experiment: Cost-Effectiveness Analysis of the Use of DNA in the Investigation of High-Volume Crime*, Washington, DC: Urban Institute, Justice Policy Center, April 2008, NCJ 222318.

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[note 33] Sharon Cohen, "Unintended Result: Gacy Probe Clears 11 Unrelated

Cold Cases," *Chicago Tribune,* December 27, 2015.

[note 34] Robert C. Davis, Carl Jensen, and Karin E. Kitchens, *Cold-Case Investigations: An Analysis of Current Practices and Factors Associated with Successful Outcomes*, Arlington, VA: RAND Corporation, Center on Quality Policing, 2011, NCJ 237558, 10.

[note 35] Davis, Jensen, and Kitchens, *Cold-Case Investigations*, 15.

[note 36] Davis, Jensen, and Kitchens, *Cold-Case Investigations*, 33-36.

[note 37] Davis, Jensen, and Kitchens, *Cold-Case Investigations*, 39. It is important to note that the research team had access only to sexual assault cold cases where a DNA match was present.

[note 38] Starting in 2011, the FBI began upgrading its Automated Fingerprint Identification System by replacing it with Advanced Fingerprint Identification Technology and adding additional biometric databases to form its Next Generation Identification system. Palm prints and other friction ridge impressions can now be analyzed and compared. Federal Bureau of Investigation, "Next Generation Identification (NGI)," Washington, DC: U.S. Department of Justice, Federal Bureau of Investigation.

[note 39] Friction ridge impressions are often referred to as fingerprints or finger marks, even though a mark may or may not be visible to the unaided eye, and they may also be created by the palms of the hands or the feet in addition to the fingers. Friction ridge impressions are sometimes called latent prints as well, although that term is imprecise. The definition of "latent" means "not visible." Once a friction ridge impression is enhanced, it is no longer invisible, thus no longer "latent."

[note 40] A pilot project in the United Kingdom noted that some cold cases can be resolved and some serial offenders can be identified through small investments in upgrading DNA analyses and the use of DNA databases. The same study notes the prevalence of repeat offenders, justifying the

resources expended to resolve the cases. Cheryl Allsop, "Motivations, Money and Modern Policing: Accounting for Cold Case Reviews in an Age of Austerity," *Policing and Society* 23 no. 3 (2013): 362-375, doi:10.1080/10439463.2013.782211. One innovative DNA tool is the use of familial DNA. The DNA of a serial killer's relative may be in a DNA database, and law enforcement can search DNA databases to seek potential DNA relationships. A recent NIJ study notes that 11 states (California, Colorado, Florida, Michigan, Minnesota, Pennsylvania, Texas, Utah, Virginia, Washington, and Wyoming) use familial DNA searches. Several Solving Cold Cases with DNA grantees reported familial DNA successes, such as in the case of the Grim Sleeper. Sara Debus-Sherrill and Michael B. Field, "Familial DNA Searching- An Emerging Forensic Investigative Tool," *Science & Justice* 59 no. 1 (2019): 20-28, doi:10.1016/j.scijus.2018.07.006.

[note 41] Laurel Wamsley, "After Arrest Of Suspected Golden State Killer, Details Of His Life Emerge," *NPR,* April 26, 2018.

[note 42] Sara Debus-Sherrill and Michael B. Field, *Understanding Familial DNA Searching: Policies, Procedures, and Potential Impact, Summary Overview*, Washington, DC: U.S. Department of Justice, National Institute of Justice, August 2017, NCJ 251043, 3.

[note 43] Debus-Sherrill and Field, *Understanding Familial DNA Searching*, 12-14.

[note 44] In 2017, Nevada identified approximately 8,000 missing DNA profiles from inmates in CODIS. As a result, the state is auditing DNA profiles and working to collect and upload all of the lawfully owed DNA sample profiles into CODIS. Several other states — such as Delaware, Georgia, Montana, Nebraska, Rhode Island, and Tennessee — have identified similar issues. Cold case investigators are encouraged to review DNA evidence, suspects, and the appropriate DNA databases to ensure that all potential DNA evidence leads have, in fact, been exhausted. Seth Augenstein, "Hidden in Prison: 7 States Have Thousands of Inmates Not in DNA Databases,"

Forensic Magazine, July 17, 2017.

[note 44] The term "survivors" refers to victims and their circle of family and friends who are also affected by the victimization from the crime (e.g., family members are affected by the loss of a murdered loved one). These people are considered to be survivors of the crime, just as the victims of nonhomicides are considered to be survivors.

[note 45] The Office for Victims of Crime, in coordination with the National Sheriffs' Association and the National Organization of Parents of Murdered Children, created a guide to assist law enforcement in understanding survivors and to provide strategies for working with survivors. National Sheriffs' Association, Justice Solutions, and National Organization of Parents of Murdered Children, *Serving Survivors of Homicide Victims During Cold Case Investigations: A Guide for Developing a Law Enforcement Protocol*, Washington, DC: Justice Solutions, August 2011, NCJ 236082.

[note 46] U.S. Government Accountability Office, "How Much Does Crime Cost?" *WatchBlog*, November 29, 2017.

[note 47] In 2020, the Postconviction DNA Testing to Exonerate the Innocent program was moved from NIJ to the Bureau of Justice Assistance, Office of Justice Programs, along with other capacity enhancement programs.

[note 48] The National Registry of Exonerations, "Henry McCollum," Newkirk Center for Science & Society at the University of California Irvine, University of Michigan Law School, and Michigan State University College of Law, updated September 2, 2015.

[note 49] Sara Debus-Sherrill and Michael B. Field, *Understanding Familial DNA Searching: Policies, Procedures, and Potential Impact, Summary Overview*, Washington, DC: U.S. Department of Justice, National Institute of Justice, August 2017, NCJ 251043.

[note 50] N.J. Schweitzer, *Communicating Forensic Science*, Washington, DC:

U.S. Department of Justice, National Institute of Justice, May 2016, NCJ 249804.

[note 51] John K. Roman et al., *The DNA Field Experiment: Cost-Effectiveness Analysis of the Use of DNA in the Investigation of High-Volume Crimes*, Washington, DC: U.S. Department of Justice, National Institute of Justice, April 2008, NCJ 222318.

[note 52] National Institute of Justice, *Social Science Research on Forensic Science Topical Working Group Meeting*, Washington, DC: U.S. Department of Justice, National Institute of Justice, January 2013, NCJ 244261.

[note 53] National Institute of Justice, "Genomewide Association of Quantitative Pigmentary Traits in Admixed US Populations," award to the University of Cincinnati, grant number 2013-DN-BX-K011.

[note 54] U.S. Department of Justice, "Department of Justice Announces Interim Policy on Emerging Method to Generate Leads for Unsolved Violent Crimes," press release, September 24, 2019.

[note 55] Michael A. Marciano and Kevin S. Sweder, "Hybrid Machine Learning Approach for DNA Mixture Interpretation," report to the National Institute of Justice, grant number 2014-DN-BX-K029, June 2016, NCJ 251804; and Forensic Technology Center of Excellence and RTI International, "Success Story: Improving DNA Mixture Interpretation With the Help of Machine Learning," Research Triangle Park, NC: Forensic Technology Center of Excellence, March 2019, NCJ 252783.

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