

Beyond the Cold Hit: Measuring the Impact of the National DNA Data Bank on Public Safety at the City and County Level

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Criminalistics laboratories routinely provide “cold hits” in police investigations by comparing DNA profiles from crime scenes to offenders residing in the Combined DNA Index System (CODIS). Forensic DNA analysis is often glamorized in popular culture, where the perpetrators are identified and crimes solved within a single television episode. In reality forensic DNA hits can identify perpetrators of violent offenses, link multiple crimes committed by the same individual, or exclude suspects and exonerate the falsely accused. Unlike the media portrayals, downstream activities after a DNA identification or cold hit are often more complex. While the Federal Bureau of Investigation (FBI) cites a national DNA Data Bank of more than 7.2 million DNA profiles and 94,000 identifications nationwide,¹ an in-depth analysis of public safety improvements made with CODIS is currently unavailable to forensic practitioners and public policy analysts. A review of case resolutions for 198 DNA database hits in San Francisco created performance metrics to provide a concrete measure of the effectiveness of DNA databasing efforts at the city and county level. Our findings indicate that the impact of DNA identifications achieved using CODIS is complicated by societal issues and systemic challenges in the administration of criminal justice. When the performance metrics presented here are applied to other jurisdictions, they have the ability to drive public policy as part of a clear strategy to future success of a unified national public safety endeavor.

General Background

The DNA Identification Act of 1994 authorized the FBI to administer the National DNA Index System (NDIS). Despite state and local law enforcement efforts to solve violent crimes through NDIS over more than a decade, full implementation of the DNA databasing program remains incomplete. Some laboratories still contend with significant case backlogs while others attempt to gather limited resources for inter-agency Cold Case Units designed to promote case resolutions. Still other police agencies, sheriffs’ departments, and district attorneys’ offices nationwide may not even be aware of the true number of probative DNA hits that exist in their respective jurisdictions, and thus do not fully realize the resources necessary to move these cases toward legal resolution. For agencies fortunate enough to have Cold Case Units in place to address these caseloads, team members are faced with the new challenge of managing cold hit cases, while the number of crime scene DNA profiles entered into CODIS steadily increases and DNA database legislation continues to expand.

Critics have questioned the effectiveness of CODIS, citing overburdened police investigators and understaffed DNA laboratories, unable to address caseload increases, as primary factors that lessen the impact of CODIS on public safety. Police investigators in California, Virginia, Oregon, and other states have been criticized for inadequate efforts following notification of database hits; efficient use of federal funds to address backlogged DNA casework has also been

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questioned.² Others calling for an assessment of DNA databasing efforts within the U.S. suggest that lack of timely investigative work poses grave risk of potential harm (to society) when particularly violent and/or prolific criminal offenders are concerned.³ In order to consider what critical factors promote or diminish CODIS' impact on public safety, a thorough analysis

Sexual Assault Evidence Program (ASAP).⁵ Analysis of case outcomes resulted in the following three Performance Metrics: Performance Metric I — Significance of a Database Hit; Performance Metric II — Case Progression & Judicial Resolution; and Performance Metric III — Potential Reduction of Future Criminal Activity.

Our findings indicate that the impact of DNA identifications achieved using CODIS is complicated by societal issues and systemic challenges in the administration of criminal justice. When the performance metrics presented here are applied to other jurisdictions, they have the ability to drive public policy as part of a clear strategy to future success of a unified national public safety endeavor.

would focus not only on laboratories and police investigators but also on the critical efforts of all criminal justice partners. As CODIS operates within the criminal justice system, the successes obtained through DNA testing of unsolved crimes are affected by the following: (1) state and national DNA database legislation; (2) convicted offender and arrestee DNA sample collection; (3) crime scene and sexual assault evidence collection; (4) cold case review and DNA testing strategies; (5) charging decisions in criminal complaint and John Doe warrant filing; (6) case dismissals, plea bargain agreements, and prosecution of cold hit cases; (7) court hearings and rulings on forensic DNA evidence; (8) application of probation and parole as a criminal penalty; and (9) offender rehabilitation and supervision at re-entry in society.

Methods

Defining Meaningful Performance Metrics

The current statistics used by the FBI to assess the progress of DNA databasing efforts — “total number of hits obtained” and “investigations aided” — are limited in their ability to measure CODIS' effectiveness.⁴ For this study, the San Francisco Police Department (SFPD) Forensic Biology Unit categorized and measured DNA hit outcomes between 2001 and 2006 to identify CODIS performance metrics and public safety implications.⁵ Cold cases are defined here as incidents that have not developed a named suspect(s) through traditional methods of police investigation. Cold cases often are years or decades-old but may also be more recent. The surveyed DNA hits primarily arose from the following SFPD Forensic Services Division initiatives: (1) California DNA Cold Hit Grant Program, (2) DNA Analysis in Property Crimes, and (3) Additional

PERFORMANCE METRIC I — SIGNIFICANCE OF A DATABASE HIT

The 198 database hits were categorized based on their investigative value for each of the SFPD investigative details as follows:

1. Probative Offender Hit: Perpetrator is identified via CODIS search of DNA from evidence sample(s).
2. Non-Probative Offender Hit: Known third party not associated with the crime has the same DNA profile as the crime scene evidence.
3. Forensic Hit (or Case-to-Case Hit): Two or more crime scene DNA profiles from separate incidents are the same. Perpetrator/suspect may be known in one or more incidents or may be unknown at the time of testing.
4. Warm Hit: Individual who crime scene DNA evidence matches is developed as a suspect through police investigation or other forensic match (e.g., fingerprint identification, etc.) prior to the CODIS search output.
5. Conviction Match: An individual's CODIS DNA profile is the same as the crime scene DNA evidence, but the crime has already been solved.
6. Benchmark Match: DNA laboratory staff associates two or more cases based on review of DNA profiles prior to CODIS upload.

PERFORMANCE METRIC II — CASE PROGRESSION & JUDICIAL RESOLUTION

Case outcomes for SFPD incidents with probative database hits (i.e., probative offender, forensic, and warm hit categories) were categorized as follows:

1. Inactive: Investigator is no longer working to follow investigative lead(s).
2. Victim Declines Prosecution: Victim chooses not to proceed with police and prosecution efforts.
3. District Attorney's Office Declines or Dismisses Case: District Attorney's Office does not proceed with case due to charging threshold or other factor(s).
4. Open & Active: Investigator is following lead(s), in the process of locating suspect or victim, etc.
5. Arrest, Case Charged & Awaiting Prosecution: District Attorney's Office files charges against cold hit offender.
6. Judicial Resolution: Perpetrator is incarcerated following conviction or guilty plea OR parole revocation and/or probation is applied.
7. Not Guilty Verdict: Legal proceedings result in a 'not guilty' verdict and the suspect is acquitted for crime.

PERFORMANCE METRIC III — POTENTIAL REDUCTION OF FUTURE CRIMINAL ACTIVITY

California criminal history records for two offender groups identified through database hits were analyzed in this study. Information related to past criminal offenses was tallied for arrests on record (e.g., date of arrest, location, offense types, case disposition and sentencing where applicable) and grouped into major offense categories (e.g., assault with a deadly weapon, assault/battery, burglary/robbery, etc.) for the data in the Tables and Figures. For example, sodomy, rape by force, forced oral copulation, etc., were categorized as sexual offenses; likewise, theft, possession of stolen goods or burglary tools, receiving stolen property, etc., were identified as burglary offenses and so on for the remaining categories. Relatively minor offenses such as vandalism, disobeying court orders, motor vehicle, obstruction of a peace officer, etc., were measured but not reported herein except as "other" offenses.

Categorizing past offenses helped to identify the range of criminal activity for the offender groups and their interaction with law enforcement over time. Each of the felons in the first offender group (Felons #1-12) described in this text was linked to multiple SFPD incidents through DNA cold hits and serve as the primary focus of Performance Metric III. All of the felons in this group (except Felon #3) were associated with two or more sexual assaults; Felon #3 was linked to two homicide cases. The repeated and violent criminal output against California citizens in the San Francisco Bay Area prompted us to study these individuals further. The criminal activities for a group of ten randomly chosen burglars represent a second

type of local criminal offender identified through recent DNA testing in property crimes and are presented herein.

Trends in California Criminal Case Resolutions

The analysis of California criminal history records of Felons #1-12 (and ten burglars) led to five noteworthy case resolution trends. The trends offer meaningful insight into CODIS' potential for solving crimes, recidivist propensity to commit crimes, and the potential to reach legal remedy. The criminal case resolution trends are as follows: Trend #1: Wide Range in Offense Types; Trend #2: Minimal Interruption of Criminal Activity Following Felony Arrests; Trend #3: Case Dismissals, (Early) Release, and Rapid Re-Offense; Trend #4: Probation as a Deterrent of Future Criminal Activity; and Trend #5: More Prolific Activity, Less Versatility in Burglaries.

Practical Questions

When DNA testing of unsolved crimes is considered, one main objective for jurisdictions must be to achieve high percentages of perpetrator arrests and legal remedies after cold hits. Therefore, the data presented in this study attempt to offer some insight for the following practical questions: (1) What critical factors promote or diminish CODIS' ability to significantly interrupt criminal activity? (2) Do past experiences with CODIS inform future public safety improvements? and (3) How can the effectiveness of probative DNA cold hits be maximized?

Results

Measurable Outcomes for SFPD Database Hits

PERFORMANCE METRIC I — SIGNIFICANCE OF A DATABASE HIT

The "value" or significance of each database hit as an investigative lead differs. Categorizing significance of CODIS search results is beneficial to understand the role DNA testing plays within the context of a criminal investigation. Database hits that provide true investigative leads and may result in perpetrator arrests are probative for the value they provide to an investigator. These hits identify unknown perpetrators and drive inactive or "cold cases" forward, while others such as warm hits and conviction matches support traditional police investigations (and verify that the developed suspect/defendant is the same as the offender identified through CODIS). Table 1 summarizes the database hits analyzed for this study. Cold hits were made to offenders, and to other unsolved cases, in eight different SFPD investigative details.⁷ Ninety percent of the cold hits were probative in nature and provided investigators with substantive leads. DNA profiles

Table 1

198 Offender and Case-to-Case CODIS Hits

	Offender Hits	Case-to-Case Hits
Sex Crimes	85	25
Homicide	22	2
Burglary [†]	40	2
Juvenile	4	3
Robbery	4	1
General Work	4	0
Gang Task Force	3	1
Night Investigations ^{††}	2	0
Total Number of Cold Hits	164	34

[†] The majority of burglary DNA cold hits resulted from the January 2008 implementation of DNA testing in property crimes.

^{††} Investigative Detail is now disbanded.

matching to a known witness, victim, or other third party — who possess no culpability for the instant crime but reside on a state database due to prior qualifying offense — are termed non-probative offender hits. Two or more crime scene DNA evidence profiles that hit to each other describe forensic or case-to-case hits. In such circumstances, the perpetrator may be (1) unknown in both of the cases (no named suspect) or (2) known in one or both cases but does not reside on the DNA data bank. If the perpetrator is unknown, then DNA testing and upload of profiles in these cases assures investigators that the same unknown individual is linked to both crimes. If the perpetrator is known in one of the cases (suspect named), and DNA testing establishes the suspect and perpetrator have the same DNA profile, then upload of the crime scene profiles in both cases allows investigators to associate the crime scene DNA profiles of the two incidents with the named suspect/perpetrator.

Sexual Assaults

The majority of the database hits involved sexual assaults where 110 cases associated a crime scene DNA profile to a known convicted offender or to an evidence sample(s) in another sexual assault.⁸ For police investigators, all 85 felon offender hits represent cases solved primarily, if not solely, through DNA evidence. For the 25 sex crimes case-to-case hits (or forensic hits), the perpetrator had been identified through traditional investigative means in at least one case for each pair (or group when three or more cases were linked) in the majority of instances. In less than one-third of the case-to-case hits the perpetrator was unidentified for

the associated cases at the time of the CODIS search results.

Homicides

Cold hits were made in 24 homicides that had occurred between 1968 and 2005; many contained a sexual component⁹ and 22 of these cold hits were probative (~92%). For the offender hits obtained, several individuals were out of custody at the time of the cold hits; one offender was scheduled for jail release less than two months after the DNA identification. Interstate CODIS hits with Oregon and Arizona were obtained for two rape/murder cases; the remaining probative homicide hits were made within California's state CODIS.

Burglaries

For DNA testing in property crimes, "best evidence" items left at residential and commercial burglaries in San Francisco¹⁰ are subjected to streamlined DNA testing. To date, nearly 75 cases have been analyzed, resulting in 58 CODIS eligible DNA profiles and 42 cold hits (a 72% hit rate).

Other Investigative Details

Comprehensive DNA testing services were not available to all SFPD investigative details until recently. Therefore, fewer cases were analyzed from 2001-2006 among these groups.¹¹ Currently, unsolved cases are prioritized based on case circumstances and impact on public safety, irrespective of the investigative detail.

PERFORMANCE METRIC II — CASE PROGRESSION & JUDICIAL RESOLUTION

The CODIS link established between crime scene DNA profile and known offender imparts a responsibility upon police investigators, legal counsel, and criminal courts to determine the value of DNA associations. When a probative DNA cold hit (offender hit) results in arrest of a perpetrator, an investigator may achieve the success of a case solved. This valuable investigative lead marks the initial potential for reaching legal remedy. Mitigating factors can reduce the potential and frequency of reaching judicial outcome. As with any criminal case, sustained investigative and legal efforts after a DNA hit require the willingness and dedication

to rebuild these often challenging cases, especially those that are decades old.

Figure 1 shows the current case status and judicial resolution for the cold hits surveyed in this study.¹² Probative hits have led to judicial resolution via conviction, guilty plea, or parole revocation in nearly 40% of the 198 cases surveyed at the time of this writing. Another 28% of the cases are awaiting jury trial or investigations are ongoing. As pending cases move forward (i.e., those listed in Figure 1 as awaiting jury trial plus open and active), approximately 70% of the probative and warm hits have the potential to result in legal remedy and criminal interruption (refer to dotted bars in Figure 1 for maximum potential case resolution). District Attorney and victim declinations are most pronounced in sexual assaults (~50%) but significantly lower (<10%) in burglaries and absent in homicides to date.¹³

Sexual Assaults

Roughly 30% of the 110 cold hits in sexual assault cases resulted in some form of legal remedy (e.g., guilty plea or conviction by jury trial). As the remainder of the CODIS identifications reach investigative and legal conclusion, nearly 50% of the probative cold hits in sex crimes can reach some form of resolution (refer to dotted bars in Figure 1). In one recent cold hit conviction, SFPD investigators worked with authorities in Mexico to locate, detain, and transport the named offender to

San Francisco for prosecution efforts; the individual was sentenced to 15 years to life in prison.

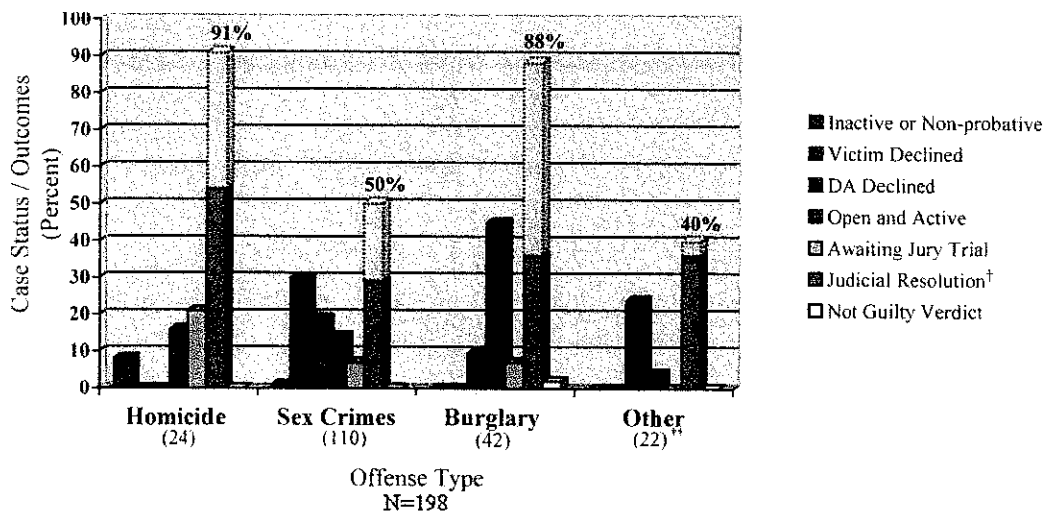
By definition, all offenders in the cases surveyed are recidivists as each had a prior arrest and conviction that qualified for compulsory DNA sample collection and entry into CODIS. Of the 85 sexual perpetrators identified through forensic DNA testing, 11 offenders were linked to two or more unsolved sexual assaults. One offender was implicated in five different SFPD sex crimes; two others were linked through DNA to three cases each. The criminal activities of the 11 serial sex offenders, and of one individual linked to two homicides, were further measured (and referred to as Felons #1-12) under Performance Metric III. The 11 sex offenders were responsible for a total of 29 detected sex crimes as of this writing. Case resolutions for these 29 incidents are shown in Table 2. The prosecutor or victim declined to move cases forward in 17% and 31% of the incidents, respectively; however, the offenders were held to answer in 41% of the cases and sentenced to incarceration periods.

Homicides

A greater percentage (75%) of homicide cold hits resulted in perpetrator arrests, as shown in Figure 1 (i.e., those listed as awaiting jury trial plus judicial resolution). While a number of the 22 murder suspects were already incarcerated for unrelated offenses, several individuals were out of police custody at the time of the DNA hits. Prosecution efforts moved forward in the

Figure 1

Case Outcomes for SFPD Cold Hits



† Guilty pleas, convictions, and parole revocations

** Robbery, Juvenile, General Work, Gang Task Force, Night Investigations

Note: Dotted bars indicate maximum potential for judicial resolution (i.e., 'judicial resolution' achieved plus cases currently 'awaiting jury trial' plus 'open and active' cases).

Table 2

Case Resolutions for Twelve Repeat Violent Offenders

Felon	Cold Hit Case Outcome	Sentence
1.	a. ADA declined prosecution b. Victim declined prosecution c. Guilty plea to 261(A)(2)PC (rape by force)	N/A N/A Six years in prison
2.	a. Victim declined prosecution b. Victim declined prosecution	N/A N/A
3.	a. Convicted of 664/187PC (attempted murder) b. Convicted of 187PC (murder)	77 years to life in prison for a. and b.
4.	a. ADA declined prosecution b. ADA declined prosecution	Convicted in another jurisdiction (18 years to life) SFPD cases not prosecuted;
5.	a. Victim unable to be located b. Victim unable to be located c. Guilty plea to 261(A)(2)PC (rape by force) d. Open and active e. Guilty plea to 261(A)(2)PC (rape by force)	16 years in prison for c. and e.
6.	a. Guilty plea to PC207 (kidnapping) b. Guilty plea to PC273.5 (corporal injury)	Time served for a. and b.
7.	a. Convicted of 212.5PC and 220PC (robbery & assault to commit rape) b. ADA declined prosecution	Four years in prison N/A
8*	a. Convicted of 288A(C)PC and 288(B)PC (lewd acts w/ child & forced oral copulation with child) b. ADA declined prosecution (beyond statute of limitations)	16 years in prison N/A
9.	a. Victim declined prosecution b. Victim declined prosecution	N/A N/A
10.	a. Convicted of 261A(2)PC (rape by force) b. Convicted of 261A(2)PC (rape by force) c. Convicted of 261A(2)PC (rape by force)	21 years in prison for a., b. and c.
11.	a. ADA declined prosecution b. ADA declined prosecution	N/A N/A
12.	a. ADA declined prosecution b. ADA declined prosecution	N/A N/A

Eleven of the twelve offenders listed below were implicated in two or more sex crimes; Felon #3 was linked to two homicides.

* = both cases involved sexual assaults of juveniles

majority of homicide cases with a probative offender hit, and some cases are now reaching the final stages of police investigation. As these homicide cases progress, 91% have the potential for a legal remedy (refer to dotted bars in Figure 1). To date, 10 of the 22 homicide cases with probative or warm hits have reached jury trials or guilty pleas for years to life prison sentences.

Burglaries

In 43% of the 42 burglary cold hits, the offenders are awaiting jury trial or pled guilty (i.e., those listed in Figure 1 as awaiting jury trial plus judicial resolution). One offender has a warrant for his arrest and three offenders were either sentenced to San Francisco Drug Court (Track II) or given probation for the instant crimes.¹⁴ When all the pending burglary cold hits are measured, nearly 88% of the cases may result in legal remedy (refer to dotted bars in Figure 1). The one burglary case

Figure 2

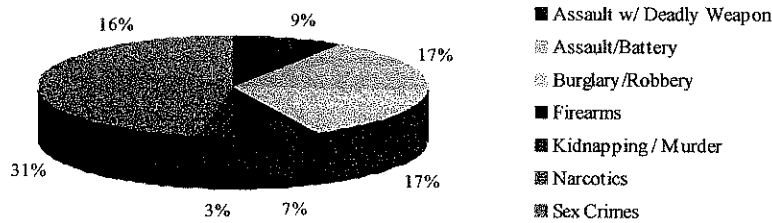
Detected Criminal Behavior Prior to CODIS Hits: Twelve Violent Offenders

Figure 2A: Range of Offenses for Felons #1-12

Arrest Category	Felon Identifier											
	1	2	3	4	5	6	7	8	9	10	11	12
Ten or more arrests	■	■	■	■	■	■	■	■	■	■	■	■
Multiple narcotics arrests	■	■	■	■	■	■	■	■	■	■	■	■
Two or more burglary/robbery arrests	■	■	■	■	■	■	■	■	■	■	■	■
At least one burglary/robbery prior to first sexual assault	■	■	■	■	■	■	■	■	■	■	■	■
Two or more sexual assaults	■	■	■	■	■	■	■	■	■	■	■	■
At least one arrest for (a) sexual assault, (b) assault and battery, (c) burglary/robbery, and (d) narcotics	■	■	■	■	■	■	■	■	■	■	■	■

A total of 199 offenses and their corresponding arrests were analyzed for Felons #1-12 to demonstrate overall criminal activity. The darkened areas indicate that a felon offender has achieved the metric shown in the arrest category.

Figure 2B: Major Offense Types for Felons #1-12



The 199 offenses were grouped into the major categories above (percentages shown). Conspiracy, motor vehicle-related offenses, obstruction of a peace officer, vandalism, failure to register as a sex offender, and disobeying court orders were not included in the above graph.

which led to a not guilty verdict proceeded to jury trial prior to the DNA cold hit (the acquitted individual was the offender later identified through CODIS).¹⁵

Other Investigative Details

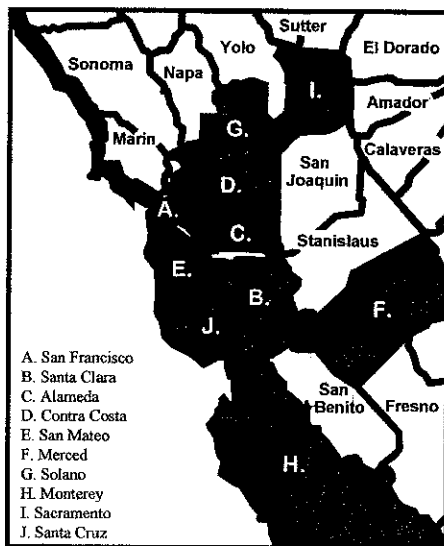
Approximately 40% of the remaining 22 cold hit cases have the potential to result in some form of judicial resolution (refer to dotted bars in Figure 1). Currently DNA associations in Robbery, Juvenile, General Work, Night Investigations, and Gang Task Force represent <15% of the CODIS hits and demonstrate a commitment by police investigators to provide follow-up investigation.

PERFORMANCE METRIC III — POTENTIAL REDUCTION OF FUTURE CRIMINAL ACTIVITY

Criminal history data reveal behavioral patterns of offenders over time. More importantly, case resolutions for prior arrests may signify a change in an offender's conduct or provide an opportunity to re-offend. While empirical analysis of an offender's criminal history may not reliably predict the number and/or specific types of future criminal activity,¹⁶ these data offer information about CODIS' potential to prevent or curtail future crimes. As summarized in Figure 2, adult criminal history records of Felons #1-12 demonstrate significant contact with law enforcement. The offenders amassed considerable felony offenses throughout their criminal careers and diminished public safety for many years.

Figure 3

San Francisco Repeat Offender Arrests in Neighboring Bay Area Counties



SF Bay Area counties (A-J) highlight areas where SF repeat offenders (Felons #1-12 and 10 burglars) had prior arrests. Arrest totals are represented in descending order (A = highest / J = lowest) for this group.

Citizens living in 20 California cities — covering 10 Bay Area counties — were adversely affected by the violent acts of this offender group (Refer to Figure 3).¹⁷ At the time of the sexual assault DNA cold hits, the average number of sex offenses detected for Felons #1-12 was roughly four per offender. As published data indicate that each sex offender commits on average eight assaults during his criminal career,¹⁸ CODIS may be capable of preventing (or delaying) the commission of more than 40 sexual assaults for this relatively small group of offenders (or less, if one assumes that some sexual assaults were already committed but undetected by law enforcement).

Despite CODIS' potential to stem criminal behavior of the violent and/or prolific repeat offender, data for Felons #1-12 demonstrate that the criminal justice system was unsuccessful in interrupting behavioral patterns over time. In fact, the percentage of the total number of offenses committed before the introduction of the U.S. Data Bank and after its availability to California forensic practitioners was strikingly similar (51% vs. 49%; See Figure 4) for Felons #1-12. These offenses are described below in greater detail.

California Criminal Case Resolution Trends

Application of Performance Metric III to a representative cross-section of criminal offenders (Felons #1-12

and a group of 10 burglars) led to five noteworthy criminal case resolution trends. These trends highlight some of the challenges faced by the criminal justice system to resolve cold hit cases.

TREND #1: WIDE RANGE IN OFFENSE TYPES

Major offense types in Figures 2A and 2B illustrate the range and frequency of criminal activity committed by Felons #1-12 as adults within California.¹⁹ In total, the 12 offenders committed greater than 300 felony offenses with an average number of 25 offenses per individual. At the time of this study, all 12 individuals were arrested for 10 or more offenses as adults. Narcotics offenses were most prevalent with the next most frequent offense types being assault or battery, burglary or robbery and sexual related crimes.

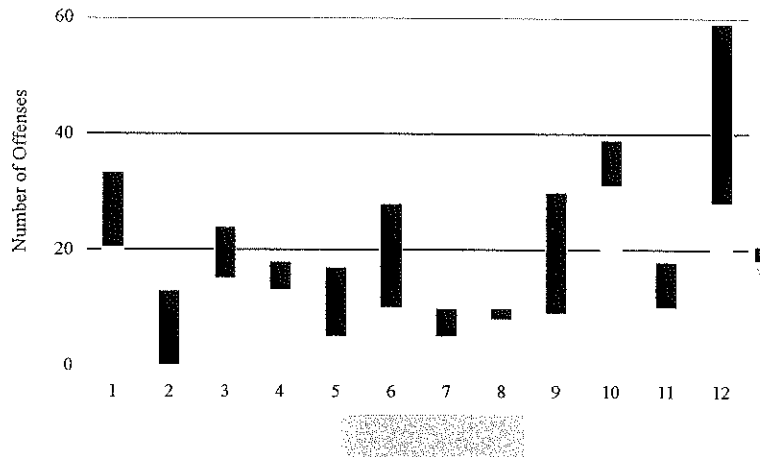
Eleven of 12 offenders had two or more sexual assaults (the 12th individual was linked to two homicide cases through warm hits). All but two of the 11 sexual perpetrators committed at least one prior felony offense for something other than a sex crime (e.g., assault, robbery, or burglary) before the first recorded sexual assault. For nearly all 12 individuals, arrests began in the late teenage years or early 20s (dating as early as 1979) and continued without significant periods of interruption. While a considerable number of these crimes occurred within the City and County of San Francisco, no less than 50 arrests took place in neighboring Bay Area counties.²⁰ Eight of the 12 individuals had at least one arrest in each of the four most frequently occurring categories (i.e., assault/battery, burglary/robbery, narcotics, and sexual assault). Many of the offenders had numerous narcotics arrests — one individual with 19.

TREND #2: MINIMAL INTERRUPTION OF CRIMINAL ACTIVITY FOLLOWING FELONY ARRESTS

In order for these 12 offenders to amass more than 300 offenses, long-term interruption of criminal activity through rehabilitation and/or incarceration was obviously not successful. Prison sentences for convictions prior to the DNA cold hits did not exceed five years in any incidents. For most, several felony convictions occurred before the offenders were sentenced to prison terms greater than one year. Numerous narcotics arrests and other non-violent offenses carried little or no incarceration (data not shown). The years to life sentences shown in Table 2 emerged after DNA cold hits were made in grave crimes against the person (e.g., murder, attempted murder, rape of juvenile), or when multiple sexual assault cases were "joined" in filing the criminal complaint(s).²¹

Figure 4

Criminal Offenses for Twelve Repeat Offenders (Felons #1-12) Before and After 1998 CODIS Implementation in the United States



Each of the felons committed crimes prior to 1998 with exception of Felon #2. All felons continued their criminal activity after CODIS was made available to forensic laboratories.

EXAMPLE: FELON #12

The criminal career of Felon #12 spans over 25 years of his life. Born in 1958, he was first arrested as an adult at the age of 21 for a narcotics DUI offense with a quick advance to sexual assault and a range of other violent offenses including assault/battery, kidnapping, lewd acts with child, rape of an incompetent female, robbery, assault with a deadly weapon, burglary, exhibiting a firearm in public, and so on. This criminal activity culminated in 20 separate arrests in a 25

criminal activity after the inception of CODIS, the majority of which did not carry significant prison terms (data not shown). Criminal histories show that <26% of the total arrests on record had some legal remedy to interrupt future acts or prolong an individual's release from prison (through conviction, parole revocation, or release to another jurisdiction for criminal prosecution); <32% of the convictions resulted in prison terms of two years or more.

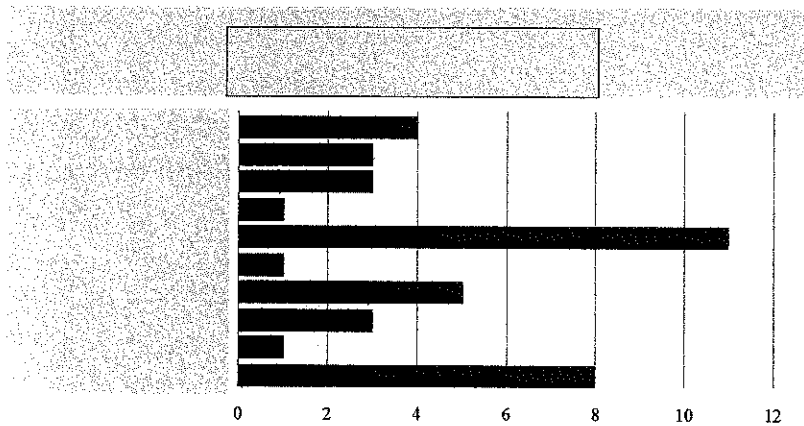
year period. The December 2004 guilty convictions, for three SFPD cold hit sexual assaults from July 2000 to June 2001, carried a 21-year prison term.

TREND #3: CASE DISMISSALS, (EARLY) RELEASE, AND RAPID RE-OFFENSE

Felons #1-12 (except for Felon #2) began committing crimes prior to the passage of the DNA Identification Act of 1994 and continued well beyond the 1998 introduction of CODIS. As previously stated, Figure 4 highlights a significant amount of

Figure 5

Summary of Offenses for Felon #1



EXAMPLE: FELON #1

The first decade of Felon #1's criminal activity was primarily comprised of burglary, assault, and narcotics offenses. The second decade of offenses included indecent exposure, hit and run, and two arrests for prostitution in San Francisco. The second of these prostitution arrests resulted in the offender's entry into a San Francisco diversionary program. Eight months following the successful completion of this program, Felon #1 was arrested in Oakland, California in March 1999 for narcotics possession and unlawful sex with a minor.

In fall 2005, Felon #1 was linked by CODIS to three sexual assaults in San Francisco (which occurred in April 2000, June 2000, and June 2001) and two additional

sexual assaults in Oakland, California. Of note, all three of the SFPD incidents were committed while the offender was on probation. At the time of the cold hits, the individual was out of police custody and residing in Oakland. Figure 5 outlines the number and types of offenses recorded for this individual. Felon #1 pled guilty to two of the SFPD incidents and received six years in state prison; the third incident was dismissed as the victim was unwilling to proceed with prosecution.²²

TREND #4: PROBATION AS A DETERRENT OF FUTURE CRIMINAL ACTIVITY

For Felons #1-12, the majority of prison sentences prior to the DNA cold hits also included several years of probation. When measured over the course of their careers, several individuals accrued significantly longer probationary periods than jail sentences. In some arrests, probation was the only form of judicial resolution on record. A significant percentage of the total criminal activity occurred during the probationary periods for all offenders (data not shown). Of note, ~46% of the sexual offenses in the SFPD cold hit cases occurred while these individuals served a probationary period for prior convictions.

EXAMPLE: FELON #4

CODIS linked Felon #4 to a total of five sexual assaults in the San Francisco Bay Area. Fourteen arrests beginning at the age of 20 occurred prior to the first DNA cold hit. For Felon #4's 22 arrest total, greater than one-third of these crimes were committed while serving a probationary period; both of the SFPD cold hit incidents were committed while on probation. Outside of one felony hit and run incident in Santa Cruz, California, Felon #4 committed all of his crimes in the Northern California cities of San Francisco, Oakland, Alameda, and Hayward, a geographic area spanning roughly 30 miles. The DNA cold hits resulted in guilty convictions in Alameda County Criminal Court for multiple rape charges and a jail sentence of 18 years to life in 2005 to interrupt 22 years of criminal behavior.

TREND #5: MORE PROLIFIC ACTIVITY, LESS VERSATILITY IN BURGLARIES

Criminal history records for a random group of 10 burglars identified through CODIS showed previous arrests for nearly three times as many offenses as Felons #1-12. No less than 40 arrests took place in Bay Area counties outside of San Francisco (included in Figure 3). In contrast to Felons #1-12, the individuals identified in burglaries committed fewer types of crimes overall. Burglary and narcotics offenses made

up over 53% of the offenses tallied. Motor vehicle-related charges (e.g., DUI, driving with suspended license, reckless driving, etc.), vandalism, obstruction of peace officer, and conspiracy were prevalent among these individuals. Arrests for sexual acts accounted for less than 2% of the total.

Homicides Solved with CODIS: Offender Overview

Under the California DNA Cold Hit Grant Program, the Forensic Biology Unit worked closely with the San Francisco Medical Examiner to identify decades-old rape/homicide cases with probative biological material recovered during autopsy. In many of the cases, the only evidence that remained to support the criminal investigation was semen recovered from the victims, deposited on microscope slides and stored for many years. Several of the rape/homicide cases that resulted in CODIS associations are described below.

People v. Speer

On March 29, 1968, 14-year-old Linda Harmon was brutally raped and murdered while babysitting a neighbor's children. A suspect at the time of the incident, William Speer was not charged with the crime. In 2003, DNA profiles for semen recovered from the victim's body at autopsy and bloodstains left at the scene were determined to be the same as Mr. Speer's DNA profile, who at the time of the DNA database hit, was housed in an Arizona psychiatric hospital.

Mr. Speer's recorded criminal history began at age 19 and continued for over a decade in the San Francisco Bay Area. Misdemeanor and felony convictions flanked the rape/murder of Linda Harmon. Five years prior to the Harmon murder, William Speer was convicted of a rape/assault of another 14-year-old who managed to flee from her attacker. Mr. Speer was sentenced to eight months in jail for this prior crime.

Arrests for burglary, rape by force, failure to register as a sex offender, prostitution, and narcotics possession occurred in the years leading up to the murder. Following Linda Harmon's death, Speer relocated to Colorado where he was jailed and later successfully escaped from a Colorado state prison. Speer was apprehended and released to the custody of SFPD to stand trial for outstanding charges of kidnapping, oral copulation/rape of an incompetent female, vehicle theft, and carrying a concealed weapon. These proceedings were ultimately suspended when Speer was deemed mentally incompetent to stand trial. Following the 2003 interstate hit, Mr. Speer was convicted of first degree murder of Linda Harmon and sentenced

in San Francisco criminal courts in 2005, nearly 37 years after the incident.²³

People v. Laudenberg

At the time that a database hit implicated Adolph Laudenberg in a 1975 San Francisco rape/homicide, he was also being investigated for a series of unsolved murders that occurred in the 1970s in San Pedro, California, a small town outside of Los Angeles.²⁴ The semen donor DNA profile developed in the San Francisco homicide was the same as a DNA profile in one

Proactive Use of CODIS: *Rapid Analysis of Unsolved Crimes*

The California State Bureau of Forensic Services (BFS) Laboratory recently administered the Additional Sexual Assault Evidence Program (ASAP) consortium grant that focused on rapid DNA analysis and perpetrator identification in sexual assault cases to curtail recidivism. Several jurisdictions including San Francisco participated in this pilot program. For the majority of cases, DNA profiles from potential perpetrators were generated by the BFS within 72 hours

In San Francisco, sustained policing efforts and the Forensic Biology Unit's commitment to review and conduct testing on more than 700 unsolved cases (for incidents ranging from 1966 to the present) allowed SFPD investigators to close the gap on the activities of a fraction of the more than 150 Bay Area criminal offenders detected by our CODIS uploads. After more than five years of police investigations, forensic DNA testing, and prosecutorial efforts, long-lasting criminal interruption was achieved for only a few violent offenders, who received years to life sentences.

of the San Pedro murders. Mr. Laudenberg was tried and found guilty of murder in Los Angeles Criminal Court; a California Court of Appeals recently upheld this murder conviction.

People v. Puckett

John Puckett was found guilty in 2008 for the 1972 rape/homicide of Diane Sylvester. Prior to this murder, Mr. Puckett's criminal history included multiple sexual assaults and impersonating a police officer in order to stop passing motorists and engage in sexual acts with force.²⁵ His sexual assault convictions in Long Beach, San Rafael, and San Francisco occurred as early as 1957.

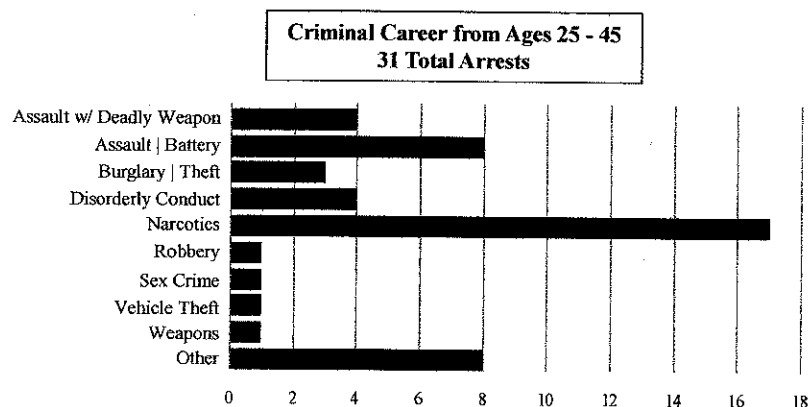
A six marker DNA profile, obtained from sperm cells collected from Ms. Sylvester's oral cavity, resulted in the CODIS hit to Mr. Puckett. Among the more than 300,000 offender DNA profiles residing on the California State DNA Index System (SDIS), only Mr. Puckett was a possible source of the semen donor profile from the crime scene. The profile generated a random match probability of roughly 1 in 1 million,²⁶ reinforcing the highly discriminating nature of current DNA analysis methods and the strength of CODIS output.

post-assault with prioritized sample processing and a streamlined analytical testing method.²⁷

The results of this program were overwhelmingly positive. A total of 179 SFPD incidents qualified for ASAP and were initially analyzed by California BFS Criminalists. In nearly one-third of the cases a suitable CODIS profile was developed. Over 50% of the DNA profiles either identified a known convicted offender or were linked to another SFPD incident.²⁸ One example of the program's effectiveness is demonstrated in a case that involved a sexual assault of a 20-year-old female by three males. At the time of the incident, the victim described her attackers as a Hispanic male riding a BMX bicycle and two African-American males, one of whom appeared to be blind in one eye. The timeline for investigative efforts follows:

- Day 1:** Victim assaulted; SART nurse begins sexual assault evidence collection in less than three hours.
- Day 2:** Post-coital swab is received by the California BFS Laboratory for immediate analysis/DNA profile upload.
- Day 4:** Semen donor DNA profile is searched at the state level (SDIS) and hits to an offender. Cold hit verification is initiated.

Figure 6

Summary of Offenses for ASAP Felon

Individual offenses are shown above for this felon's 31 total arrests. "Other" offenses include obstruction of a peace officer, probation violation, criminal conspiracy and violation of parole.

Day 10: SFPD DNA Technical Leader is notified of the offender hit; immediate notification of the individual's identifying information is made to SFPD Inspector.

Day 11: SFPD Inspector locates assailant and makes arrest.

Figure 6 demonstrates the significant criminal history of one of the perpetrators linked by CODIS in the above incident. Comprised of numerous narcotics offenses, assault and battery, burglary, robbery, vehicle theft, and others, the individual was arrested for acts over a period of two decades. This offender also had four consecutive disorderly conduct offenses for prostitution prior to the sexual assault incident described above. In November 2004, the offender faced second-degree burglary, battery, and two charges of assault with a deadly weapon in San Francisco courts in an unrelated crime. A conviction for one of the assault charges resulted in a two year prison term. Released from prison in spring 2005, the sexual assault above occurred in January 2006, roughly eight months after the offender's release. The cold hit perpetrator pled guilty to a sexual battery charge for the ASAP incident.

Discussion

In San Francisco, sustained policing efforts and the Forensic Biology Unit's commitment to review and conduct testing on more than 700 unsolved cases (for incidents ranging from 1966 to the present) allowed SFPD investigators to close the gap on the activities of a fraction of the more than 150 Bay Area crimi-

nal offenders detected by our CODIS uploads. After more than five years of police investigations, forensic DNA testing, and prosecutorial efforts, long-lasting criminal interruption was achieved for only a few violent offenders, who received years to life sentences. As a whole, legal remedies were imposed on just over 50 Bay Area repeat offenders for the crimes solved through CODIS. Therefore, in the interest of public safety we ask, "What critical factors promote or diminish CODIS' ability to significantly interrupt criminal activity?"

The perceived success of "total number of hits" and "investigations aided" through CODIS associations is complicated by societal issues and systemic challenges in the administration of criminal justice.²⁹ Our findings demonstrate that <40% of surveyed probative DNA hits reached legal remedy at the time of this writing. Criminal history patterns detected beyond these database hits (see Trends #3 and #4 in Performance Metric III) suggest that, even when incarceration is the penalty, the criminal justice system often faces an uphill struggle to improve public safety. Indeed, the percentage of offenses for Felons #1-12 committed before the introduction of the U.S. Data Bank and after its availability to California forensic practitioners was strikingly similar (51% vs. 49%; see Figure 4). These data show that offender propensity for rapid and frequent re-offense may prevent major improvements in public safety through CODIS and other policing efforts. Past studies estimate that approximately one-third of violent crimes are committed by those under supervised release.³⁰ As noted in Trend #4 of Performance Metric III, ~45% (13 of 29) of Felons #1-12's sexual offenses solved with CODIS occurred while the individuals served probationary periods for prior convictions. And, two-thirds of the felons committed at least one or more of their sexual assaults while on probation.³¹ Thus, an attempt to describe CODIS' impact on public safety leads to the uncertain proposition of how to assess the risk of an offender's release and when probation or parole is a prudent choice.

Forensic DNA analysis and CODIS searches are extremely effective in achieving numerous links between crime scene DNA profiles and known offenders (and associations among unrelated crime scenes) but cannot minimize downstream obstacles in the lay-

ers of criminal justice, especially when recidivist propensity to commit crimes continues. Thus, CODIS on its own may be no more effective in reducing crime and victimization than the Automated Fingerprint Identification System (AFIS) or other methods of human identification. While advanced uses of CODIS to identify putative perpetrators through partial matches and familial searching may be beneficial in limited circumstances,³² true improvements to the national DNA Data Bank effort must be realized at the public policy level.

Beyond the small percentage of San Francisco cases resulting in years to life sentencing of some murderers and serial sex offenders, CODIS was generally able to trigger the interruption of criminal activity for only a short duration in violent crimes. Case resolutions further indicate that a single CODIS association in non-violent offenses may impede criminal activity for an even shorter period of time. The importance of targeting serial burglars and robbers with CODIS is, however, solidified when one considers the number of San Francisco sexual predators who committed one or more prior burglaries. Of the offenses tallied for recidivist Felons #1-12, 17% of the 199 (>30 offenses) were related to burglary or robbery. Six of the 11 sexual predators also had two or more burglary/robbery arrests; five of the six offenders committed at least one burglary/robbery prior to the first sexual assault. Further, every one of the 10 randomly chosen burglars identified through CODIS had multiple property crimes' arrests (from 4 to as many as 13) prior to the San Francisco cold hits. CODIS' primary role in property crimes may be to curtail recidivism with multiple rounds of DNA identifications. Repeated associations then may catalyze the point at which the criminal justice system grows weary of the offender and seeks lasting criminal interruption. Multiple CODIS associations also allow criminal prosecutors to "join" cases and the potential for stiffer penalties.

"Do past experiences with CODIS inform future public safety improvements?"

"How can the effectiveness of probative DNA hits be maximized?"

ARRESTEE DNA LEGISLATION

Expanding the depth of CODIS across all 50 states is the single most important factor for improving CODIS' ability to contribute to public safety. Approximately 10 states collect DNA samples from those arrested for any felony offense and many states have only recently begun to compel DNA collection from individuals convicted of any felony offense. Since the

Forensic Identification Database and Data Bank Act of 1998 expanded to include DNA collection from California felon arrestees in January 2009,³³ SFPD has had eight CODIS hits (i.e., one homicide, three sexual assaults and four burglaries) due to this state DNA legislation. The crime scene DNA profiles for these eight cases resided on CODIS an average of 29 months (several for up to four years) before the associated cold hit to the felon arrestee. With exception of the homicide DNA profile (which hit to a known third party), each cold hit to an arrestee was probative and solved the incident. Interestingly, the arrests that qualified the seven offenders for DNA collection were each different than the crimes solved; DNA collection from arrests for domestic violence or narcotics offenses solved the prior sexual assaults and burglaries.

BENEFITS OF STRATEGIC CASEWORK ANALYSIS: CASE TRIAGE, COLD CASE UNITS, AND AUTOMATED COLD CASE TRACKING

Strategic approaches to DNA testing in cold cases are crucial for effective use of resources. All cold cases are not amenable to CODIS; thoughtful prioritization of casework testing is a prudent use of the DNA Data Bank that prevents laboratories from stretching limited resources. Without considering case-specific circumstances, significant numbers of probative cold hits under the DNA Cold Hit Program led (not surprisingly) to high percentages of case dismissals and victim declinations (48%). Such default paths of wholesale DNA testing³⁴ confound the ability to solve cases and delay attention to the cases that are most amenable to CODIS. Following the DNA Cold Hit Program, a more mature CODIS prompted proactive, focused uses of the Data Bank under the ASAP program and SFPD's property crimes initiative. These efforts concentrate on curtailing active, out-of-custody recidivists through a streamlined analytical approach to "best evidence."³⁵ For example, the property crimes initiative develops CODIS profiles in 90% of the cases and benefits from a corresponding 72% cold hit rate. This smart use of technology and organizational strategy largely depends upon cooperation among criminal justice team members.

CODIS hit rates will continue to increase as ~25,000-30,000 new arrestee and convicted offender DNA profiles are entered in California each month. Local jurisdictions taking advantage of this growth through strategic DNA testing offer the added benefits of (1) analysis of "best evidence" and more meaningful CODIS output (increased percentage of probative hits); (2) rapid CODIS searches (fewer samples required to identify the perpetrator(s)); (3) timely perpetra-

tor identification and arrest; (4) increased potential for more immediate interruption of criminal activity (victim and district attorney more inclined to proceed toward case resolution); and (5) introduction of sound fiscal policies and effective utilization of resources.³⁶ Analysis of best evidence items also avoids a “first come first served” mentality of DNA testing and more effectively utilizes limited police resources by allowing investigators to focus on those cases that do not contain biological material or are not well-suited for CODIS. Proper utilization of CODIS simultaneously strengthens both laboratory and policing efforts.³⁷

Challenges to law enforcement in coordinating activities after the DNA cold hit are exacerbated without dedicated personnel and technology to track cases. In compiling the performance metrics reported herein, we established baseline measurements for SFPD’s success in unsolved casework testing. These data helped to spark creation of the San Francisco Cold Case Unit, currently comprised of five police investigators (in Homicide, Sex Crimes and Burglary Details), an Assistant District Attorney and SFPD FSD personnel. Keeping with the model of strategic case investigation, Cold Case Units must establish a common set of goals and promote open discussion to pursue sound casework approaches. Healthy team dynamics are best achieved when Cold Case Units are comprised of critical personnel who are accountable for work product and/or hold decision-making authority to move cases toward legal resolution.

Due to the increasing number of DNA database hits nationwide, it is incumbent upon state governments to provide the necessary tools for local jurisdictions to track cold hits, post-hit investigations and criminal case outcomes.³⁸ State governments can alleviate bottleneck shifts³⁹ that already threaten to overwhelm police, criminal prosecutors and defense counsel by providing inter-agency cold case tracking. California Attorney General Lockyer’s 2003 California Task Force on Forensic Services Report⁴⁰ sought to improve the California forensic system and “...develop a unified strategy for future improvement...for the most effective use of public resources and a coherent voice is needed to advise public policy makers on forensic science issues.” The report indicated that the use of automation and computerized databases, and specifically the tools offered by CODIS (as well as AFIS and the National Integrated Ballistics Information Network (NIBIN)), was one of the major national trends for improving forensic science delivery in California. After two of the most significant DNA database increases nationwide (to all felony convictions in 2004 and all felony arrests in 2009 and more than a quadrupling of the California Data Bank population), there currently

is no automated cold case tracking system available to local jurisdictions for real-time data sharing and cold hit case management.⁴¹ A national Cold Case Tracking System, integrated with the FBI Criminal Justice Information System Wide Area Network (CJIS WAN), may be the most practical way to address this CODIS limitation for public agencies nationwide.

Even as CODIS promotes case resolution in spite of the counteracting forces within the criminal justice system, DNA cold hit cases face many challenges. Despite these obstacles, not a single San Francisco cold hit case that has navigated the criminal justice system resulted in acquittal by jury trial as of this writing. The strength of DNA evidence, coupled with a commitment to investigate and prosecute, has the potential to lead more than 60% of probative cold hits in this study to legal remedy. Further, these cases withstand local defense arguments to exclude DNA evidence for perceived violations of clients’ rights to speedy trial, analyst adherence to proper protocols and DNA procedures⁴² and ongoing DNA discovery requests including release of the California state Data Bank.

The use of evidence-based performance management models to better measure DNA Data Bank progress not only provides a more clear understanding of the national CODIS endeavor but can ultimately lead to the transformation of the national DNA Data Bank effort into a unified public safety program.

Acknowledgements

The authors would like to express their gratitude to Patrick Paton for compiling offender data and discussing various aspects of this study. Without the efforts of past and present members of SFPD Forensic Biology Unit, Crime Scene Investigations Unit, and SART nurse examiners in the San Francisco Trauma Recovery/Rape Treatment Center, many of the cases discussed herein would remain unsolved. To these individuals, we thank you immensely for your hard work and dedication. Thanks to James Mudge, SFPD Crime Lab Manager, and the San Francisco Cold Case Unit for continued support and assistance in solving crime. The efforts of the San Francisco Sheriff’s Department, especially Deputy Joseph Leake, continue to ensure that eligible individuals are represented on CODIS. We are especially grateful to have worked alongside Dr. Boyd Stephens, former San Francisco Chief Medical Examiner, to assist in solving many homicides within San Francisco. We thank and commend SFPD Chief of Staff Morris Tabak for his exemplary leadership, dedication and support; DC Tabak’s vision for San Francisco Police Department and a clear understanding of the impact of high quality forensic service delivery have enabled significant progress within SFPD Investigations over the years.

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2. R. Willing, “Many DNA Matches Aren’t Acted On,” *USA Today*, November 21, 2006, available at <http://www.usatoday.com/news/nation/2006-11-20-dna-matches_x.htm> (last visited May 11, 2010).
3. F. R. Bieber, “Turning Base Hits into Earned Runs: Improving the Effectiveness of Forensic DNA Data Bank Programs,” *Journal of Law, Medicine & Ethics* 34, no. 2 (2006): 222-233.

4. As of the writing of this manuscript, "hit counting" is performed by the crime laboratories not by the police investigators, the district attorneys or the courts who ultimately determine the meaningfulness of database hits. Quite possibly, the impact of a hit is best measured in asking, "Did this DNA database hit increase public safety?"
5. The SFPD Forensic Services Division provides scientific support for criminal investigations of a metropolitan area with a resident population of ~800,000.
6. California's DNA Cold Hit Program provided funding for local laboratories to reduce DNA backlogs in sex crimes and homicides with a sexual component by conducting wholesale typing of unsolved cases. The property crimes and ASAP programs introduced a more comprehensive case review and sample evaluation prior to laboratory analysis. ASAP and property crimes testing utilize a proactive approach to the Data Bank for identification of out-of-custody perpetrators.
7. As of this writing, nearly 300 DNA cold hits have been obtained for SFPD criminal investigations. A participating laboratory of the National DNA Index System (NDIS) since 2001, the San Francisco Police Department Forensic Biology Unit receives less than 10% of the total DNA database hits within California and has benefitted greatly from CODIS; the overwhelming majority of the cold cases had no known suspect(s) at the time of DNA testing. For those cases with "possible" named suspects, if CODIS confirmed identification of the individual(s) in question, the hits were categorized as "warm hits."
8. Under the California Office of Criminal Justice Planning (OCJP) DNA Cold Hit Grant, wholesale DNA testing of more than 600 backlogged sexual assaults and homicides with sexual components were analyzed; DNA profiles suitable for CODIS upload were generated in several hundred cases.
9. The San Francisco Medical Examiner retained a considerable number of microscope slides prepared during autopsy. Autopsy slides were on occasion the only source of perpetrator biological material available for DNA analysis; C. L. Holt, "Rebuilding Cold Cases: Laboratory, Investigative and Legal Issues," paper presented at the American Academy of Forensic Sciences 56th Annual Meeting, Dallas, Texas, February 2004.
10. The main objectives of the Property Crimes program are (1) rapid DNA analysis and (2) high percentage of perpetrator identifications. "Best evidence" includes Category 1 items such as blood, saliva, cigarette butts, and drinking containers; Category 2 items include articles of clothing, eyeglasses, etc.; Category 3 or "contact DNA" items include samples from door handles and burglary tools, etc.
11. "Other" incidents are reported as a group and include juvenile sexual assault, felony gun possession, robbery, and other violent assaults.
12. Cold hits were obtained in Homicide, Sex Crimes, Burglary, Robbery, Juvenile, General Work, Gang Task Force, and Night Investigations. Since 2006, cold hits have also occurred in the Hit and Run and Fencing Details.
13. While judicial resolution is not expected in every case, the number of cases without legal filing may be somewhat inflated as many of these cold hits were generated for DNA cases in accumulated backlogs (from 1995-2004) such that complicating factors may have been introduced disproportionately by wholesale DNA testing. For property crimes, an understanding of filing thresholds and cooperation with SFDA's Office was obtained prior to program implementation. Refer to Discussion points for additional information.
14. San Francisco Drug Court and the more recent Behavioral Health Court allow San Francisco judges to offer rehabilitative services, and potential expungement of arrests, to non-violent offenders. For more information, see H. Knight, "Special Court in S.F. Offers Hope and Help to Those Short on Both," *The San Francisco Chronicle*, November 13, 2007, available at <<http://www.sfgate.com/cgi-bin/article.cgi?file=/c/a/2007/11/13/MN3ST0DCQ.DTL&type=>> (last visited May 14, 2010).
15. A recent National Institute of Justice (NIJ) study suggests that burglary cases with DNA evidence are 2.5 times more likely to result in conviction by jury trial than cases without DNA evidence. Quite possibly, the DNA evidence may have changed the outcome of this jury trial; N. Ritter, "DNA Solves Property Crimes (But Are We Ready for That?)," *National Institute of Justice Journal* 261, no. 261 (2008): 2-12.
16. P. J. Cook, J. Ludwig, and A. A. Braga, "Criminal Records of Homicide Offenders," *JAMA* 294, no. 5 (2005): 598-601.
17. For this group of offenders (Felons #1-12 and ten randomly chosen burglars), arrests occurred in the California counties of Alameda, Contra Costa, Merced, Monterey, Sacramento, San Francisco, San Mateo, Santa Clara, Santa Cruz, and Solano.
18. A. N. Groth, R. E. Longo and J. B. McFadden, "Undetected Recidivism among Rapists and Child Molesters," *Crime and Delinquency* 28, no. 3 (1982): 450-458.
19. One should note that only California criminal histories were analyzed in this study. Several offenders also have criminal records in neighboring states; these data were not analyzed.
20. Offenses in Figure 2 were placed in the general categories as described. Offenses and not individual arrests were measured. For example, if an individual was arrested for kidnapping, sexual assault, and robbery, then this arrest was counted as three distinct offenses. However, if an individual was charged with multiple sexual acts in one assault (e.g., oral copulation, sodomy, rape by force), then only a single sexual offense was tallied. The authors recognize that criminal history data entries may not be complete. General trends were noted when data were inadequate to provide more accurate accounting.
21. Past prior acts may affect sentencing guidelines in these instances and have led to more significant criminal interruption.
22. As many of the DNA cold hits described here have only recently reached case resolution, the authors could not measure future "time to crime" estimates. In other words, after the prisoners' release for crimes with a DNA cold hit, a future study to understand recidivism rates might shed light on long-term CODIS impact.
23. Data for homicide offenders Speer, Laudenberg, and Puckett were only included in Table 1.
24. Dateline NBC, "The Santa Strangler," available at <<http://www.msnbc.msn.com/id/25142725/page/1>> (last visited May 11, 2010); information related to Laudenberg's request for an appellate court review is available at <http://www.dailybreeze.com/ci_10742547> (last visited October 22, 2009).
25. J. Van Derbeken, "Sex offender, 74, Convicted in 1972 Murder," *San Francisco Chronicle*, February 22, 2008, available at <http://articles.sfgate.com/2008-02-22/bay-area/17142079_1_sexual-assault-offender-john-puckett> (last visited May 20, 2010).
26. R. Chakraborty and J. Ge, "Statistical Weight of a DNA Match in Cold-Hit Cases," *Forensic Science Communications* 11, no. 3 (2009): 1-9.
27. For the ASAP program, sexual assault "best evidence" items were submitted to the California Bureau of Forensic Services (BFS) for limited biological screening and immediate DNA analysis; items were tested with the goal of obtaining a foreign, male DNA profile within 72 hours post-assault.
28. Only ASAP cold hits obtained before 2007 were included in this study.
29. An in-depth analysis of these challenges – and a full policy review – is beyond the scope of this paper. Extensive literature on criminal behavior, recidivism, intervention, and re-entry programs has been published. Several literature citations on these topics follow: G. M. Willis and R. C. Grace, "Assessment of Community Reintegration Planning for Sex Offenders: Poor Planning Predicts Recidivism," *Criminal Justice and Behavior* 36, no. 5 (2009): 494-512; S. X. Zhang, R. E. L. Roberts, and V. J. Callanan, "Preventing Parolees From Returning to Prison Through Community-Based Reintegration," *Crime & Delinquency* 52, no. 4 (2006): 551-571; F. T. Cullen and F. Gendreau, "Assessing Correctional Rehabilitation: Policy, Practice, and Prospects," *Criminal Justice* 2000, no. 3 (2000): 109-175; the May 2004 United States Sentencing Commission

- report entitled "Measuring Recidivism: The Criminal History Computation of the Federal Sentencing Guidelines," is available at <http://www.ussc.gov/publicat/Recidivism_General.pdf> (last visited May 11, 2010).
30. R. McCleary, *Dangerous Men: The Sociology of Parole* (Albany NY: Harrow and Heston, 1992).
 31. A study of current practices for supervision of probationers and parolees and their interaction with criminal courts may identify some underlying causes for continued violence during and after probationary periods. Improvements in these areas could reduce the need for repeated CODIS assistance to identify the same individuals.
 32. F. R. Bieber, C. H. Brenner, and D. Lazer, "Finding Criminals through DNA of Their Relatives," *Science* 312, no. 5778 (2006): 1315-1316.
 33. U.S. database laws are sometimes propelled by victim advocates affected by violent crimes. In California, a campaign led by Mr. Bruce Harrington, whose brother was a victim of murder, resulted in the November 2004 amendment of the California Penal Code Sections 295-300 to make California one of the first "all felon" and "felon arrestee" state databases. These efforts resulted in a rise in the convicted offender population from ~300,000 to more than 1 million DNA profiles in less than three years. Other victim advocates, such as Mrs. Debbie Smith, have undertaken similar challenges to raise awareness for the DNA Data Bank to strive for database expansion. In 2004, the Debbie Smith Act was signed into law as part of the federal Justice for All Act. H.R. 5107, Public Law 108-405, available at <<http://www.ojp.usdoj.gov/ovc/publications/factshts/justforall/welcome.html>> (last visited May 11, 2010); California Penal Code Sections 295-300.2, November 3, 2004 Amendment.
 34. A recent proposal for wholesale DNA testing is available at <http://www.californiaprogressreport.com/2009/04/ab_1017_would_s.html>; S. Tofte, "Justice for rape victims: Don't ignore evidence," *San Francisco Chronicle*, June 24, 2009, available at <<http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2009/06/23/ED9R18BJ6R.DTL>>.
 35. *Strategic Plan to Improve Forensic DNA Policy in Florida*, 2008: at 5 This plan states as one objective to: "Improve laboratory efficiency by training local law enforcement agencies to select and submit best evidence rather than all evidence for analysis." (Strategic plan prepared by Florida Department of Law Enforcement stakeholders in response to the National Governors Association Center for Best Practices Improving Forensic DNA Policy Project.) The entire report is available at <<http://www.nga.org/Files/pdf/0810FLORIDADNAPLAN.PDF>> (last visited May 11, 2010). And, the National Law Enforcement and Corrections Technology Center (NLECTC)-Southeast seeks to "develop best evidence policies, which will minimize the over submission of samples by prioritization of samples based on expected success rate." Solving Property Crimes with DNA, *TECHBeat* (Winter 2009): at 2. Additional information related to this study is available at: <<http://www.justnet.org/TechBeat%20Files/SolvingCrimesDNA.pdf>> (last visited May 11, 2010).
 36. R. A. Wickenheiser, "The Business Case for Using Forensic DNA Technology to Solve and Prevent Crime," *Journal of Bio-law and Business* 7, no. 3 (2004): 34-50.
 37. See Ritter, *supra* note 16. The NIJ report also states investigators were roughly 2.5 times less likely to solve property crimes cases when biological evidence was not available. Coincidentally, even when arrests were made in cases without DNA evidence, 50% less cases were charged by district attorneys. Due to the strength of DNA evidence, trends to present such testing to jurors in the majority of instances or the "CSI effect" are increasing, regardless of whether DNA information is crucial to establish elements of the case.
 38. Data derived from Performance Metrics I and II can be used in a CompStat-like approach to hold criminal justice partners accountable for cold case resolution, deploy resources as needed to promote public safety and safeguard against cases "slipping through the cracks." The practical limitations of sharing real-time cold case information between agencies without automated cold case tracking databases are difficult to overcome. In San Francisco, the lack of a single administrative database connecting the SFPD and SFDA's Office challenges the ability to track all cold hit cases. W. J. Bratton, *Turnaround: How America's Top Cop Reversed the Crime Epidemic* (New York: Random House, 1998): at 233.
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 40. B. Lockyer, *2003 California Task Force on Forensic Services Report*, 2003, at 5; the full report is available at <<http://www.ag.ca.gov/publications/#forensic>> (last visited May 11, 2010).
 41. The second version of California's Cold Hit Outcome Project (CHOP2) will hopefully make some initial strides as a model for state-wide cold hit tracking; however, such a system must surpass the data management solutions already in place in local agencies or accommodate data generated by the disparate systems currently used for laboratory case management without additional burden to the local labs or unreasonable workflow alterations. Due to the critical need for Cold Case Units to utilize real-time data sharing through automated case tracking databases, many laboratories are developing 'home grown' or other software-based solutions. The SFPD Forensic Services Division was recently awarded more than \$1 million under NIJ's 2008 Efficiency Improvement Grant to develop a multi-agency, web-based DNA Cold Case Tracking module within a larger Forensic Case Management System.
 42. Speedy trial motions are referred to as Jones motions (*United States v. Jones* 811 F.2d 1505 86-5114 (4th Cir. 1981); admissibility hearings to determine if proper DNA testing procedures are utilized follow the third prong of *Frye v. United States*, 293 F. 1013 (D.C. Cir. 1923) in San Francisco.

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