Understanding Familial DNA Searching: Policies, Procedures, and Potential Impact

Summary Overview

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Table of Contents

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I. Introduction

In recent years, jurisdictions across the United States have expressed a growing interest in the use of familial DNA searching (FDS) to aid criminal investigations. Proponents of FDS have cited its potential to aid the identification and conviction of suspects, prevent crime, resolve cold cases, exonerate wrongfully convicted individuals, and improve public safety; however, the practice has also led to some legal, ethical, and practical concerns. To date, little empirical work exists documenting current practices and outcomes of using FDS. The *Study of Familial DNA Searching* begins to fill these gaps in knowledge and provides important information on this emerging practice for jurisdictions trying to decide whether or not to implement FDS. ICF, with support from the National Institute of Justice (NIJ), conducted a multi-phase, mixed-methods study on FDS policies and practices in the United States. Through a series of components (see sidebar), this study provides a balanced examination of controversies and considerations from thought leaders on this topic; a national portrait of FDS policies and practices; an in-depth exploration of how it is used within states with varying philosophies and procedures regarding FDS; and a cost model about the expected expenditures and cost savings related to FDS.

Study of Familial DNA Searching Components:

- Systematic literature review
- Two expert roundtables
- Policy review
- National Survey of CODIS Laboratories
- Intensive state case studies
- Econometric cost model

II. Background on Familial DNA Searching

Since Sir Alec Jeffreys first discovered the technique of DNA profiling in 1984 in England, DNA forensic technology has rapidly gained popularity as an investigative tool for law enforcement (Bureau of Justice Statistics [BJS], 1991; Andrews v. State, 1988). Forensic DNA profiling identifies unique patterns in alleles and STRs (short tandem repeats) at specified locations (called loci) on an individual's genome. This allows for DNA matching between two DNA profiles to determine whether the two samples are likely to have come from the same

person (e.g., comparing DNA left at a crime scene with a suspect's DNA). Forensic DNA profile matching in the United States involves matching alleles at 20[1] specified loci that have been termed CODIS markers or core loci. These 20 loci only have non-coding regions of DNA (this DNA is also referred to as "junk DNA"), which means the DNA does not code for any known genetic traits and is unrelated to observable characteristics such as race, gender, or health (Gabel, 2010; McCarthy, 2011).

The use of DNA in criminal investigations has continued to increase due to scientific innovations and expanding legislation that authorizes DNA collection from increasingly wider numbers of those coming into contact with the legal system (McCarthy, 2011). Currently, all 50 states, the District of Columbia, and the Federal Government participate in the Combined DNA Index System (CODIS), software used to manage the system of databases storing DNA profiles collected at the local, state, and Federal levels (FBI, n.d.; Murphy, 2010). CODIS software allows crime labs to share and compare DNA profiles from evidence obtained at crime scenes to offender/arrestee samples, as well as across multiple forensic samples (e.g., to identify serial offenders) (FBI, n.d.; Durose, Walsh, & Burch, 2012).

Terminology:

CODIS: The Combined DNA Index System is software designed by the FBI to facilitate the sharing and searching of DNA profiles within and between jurisdictions across the country. CODIS has national (NDIS), state (SDIS), and local (LDIS) levels.

Familial DNA Searching: A deliberate search of a DNA database using specialized software (separate from CODIS) to detect and statistically rank a list of potential candidates in the DNA database who may be close biological relatives (e.g., parent, child, sibling) to the unknown individual contributing the evidence DNA profile, combined with lineage testing to help confirm or refute biological relatedness.

Partial Matching: A moderate stringency search of a DNA database using the routine search parameters within CODIS that results in one or more partial matches between single-source and non-degraded DNA profiles that share at least one allele at each locus, indicating a potential familial relationship between the known individual in the DNA database and the unknown individual contributing the evidence DNA profile. *Disclosing or proceeding with* a partial match would be to use information learned through partial matching in an investigation.

Lineage Testing: Additional genetic testing, such as Y-STR and mtDNA analysis, used to help confirm or refute biological relatedness between the known individual in the DNA database and the unknown individual contributing the evidence DNA. Y-STR analysis is the examination of STR patterns specific to the Y-Chromosome that is used to determine paternally derived relatedness among DNA profiles, whereas mtDNA is found in the mitochondria of cells and is used to determine maternally derived relatedness.

[1] As of 2017, the FBI is requiring 20 profiled loci for submission to NDIS. However, previously this requirement was 13 or 15 core loci.

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CODIS is organized into separate indices for different types of samples: Convicted Offender Index, Arrestee Index, Forensic Index (for biological evidence collected from a crime scenes), and indices for unidentified human remains and voluntary samples collected from relatives of missing persons (42 U.S.C. §14132). CODIS is also organized into three jurisdictional levels, the National DNA Index System (NDIS) maintained by the FBI, State DNA Index Systems (SDIS) which are typically overseen by the state-level crime lab, and Local DNA Index Systems (LDIS) which have profiles from individual, local-level labs. Each level has different criteria for including DNA profiles in their system, with NDIS having the most stringent rules (FBI, 2005).[2]

CODIS software can be set to search at three different stringency levels: high, moderate, and low. High-stringency searches require all alleles to match exactly at all loci, while moderate and low stringency levels allow for the identification of partial matches (also referred to as near or close matches) (Steinberger & Sims, 2008). Traditionally, DNA profiling has been used to find exact matches between unknown genetic samples from crime scenes to those obtained from convicted offenders, arrestees, or crime scene samples from other cases (Ram, 2011). However, the ability to identify partial matches or close associations through lower stringency searches also makes it possible to identify potential family relationships, due to the inherited nature of DNA and the fact that family members have more genetic similarities than non-related individuals (Greely et al., 2006).[3]

Although lower stringency searches of CODIS can uncover partial matches fortuitously, it is not designed to identify familial matches. To overcome this, some jurisdictions have pursued separate software and genetic algorithms to specifically identify family relationships, implementing a technique called FDS.[4] Lineage testing is an important additional component of FDS, as it further supports biological relatedness between the unknown evidence sample and

[2] For example, all samples uploaded to NDIS must generally include all 20 CODIS Core Loci, whereas LDIS and SDIS databases may allow profiles to be included in the database even if they have fewer loci profiled (FBI, n.d.).
[3] According to the FBI, recent updates to the NDIS search parameters have reduced the number of partial matches.
[4] Currently, most FDS software employs Identify by State, Likelihood Ratio, or some combination of these two statistical techniques to determine the strength of potential familial associations found during familial searching.

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