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The Value of Forensic DNA Database

Joe H Smith[1], and JS Horne[2]

Abstract

This paper explores the importance and impact of DNA databases in forensic investigations. It responds to a recent publication by Kostiuchenko, Vynohradova, Sereda, Svoboda, and Polunina (2024), highlighting challenges in setting up and using DNA databases. These challenges include logistical, staffing, legal, security, growth, public interest, and international cooperation issues. By examining South Africa's successful NFDD implementation, the authors stress the need for thorough planning and implementing a comprehensive value chain. Drawing insights from South Africa's successful NFDD implementation, the authors emphasise the importance of meticulous planning and implementing a value chain. This value chain should cover DNA evidence collection, follow-up investigations, and presenting evidence in court.

Keywords: Criminal investigations, DNA, DNA database, DNA forensic investigative leads, international exchange

Dear Editors

In a recent article, the authors, Kostiuchenko, Vynohradova, Sereda, Svoboda, and Polunina, discuss the significance and impact of DNA data in forensics. Their study identified multiple obstacles in establishing and using DNA databases. They discuss logistical constraints, staffing problems, legal deficiencies, security risks, slow database growth, and lack of public interest and international cooperation. The authors emphasised the advantages of DNA analysis in identifying persons, assessing crime scene involvement, and linking suspects to evidence. They advance the creation of an international strategy for DNA database utilisation and promote global collaboration in exchanging forensic DNA information. This strategy is believed to improve law enforcement effectiveness (Kostiuchenko et al., 2024). Forensic DNA databases are effective investigative tools in criminal investigations (Doleac, 2017; Smith & Horne, 2023a; Smith & Singh, 2024; Tegner Anker, Doleac, & Landersø, 2021; Wickenheiser, 2022).

[1] School of Criminal Justice, College of Law, University of South Africa. E-mail: 38761556@mylife.unisa.ac.za or thejhsmith@gmail.com; https://orcid.org/0009-0001-9960-8889 (Corresponding author)
[2] Professor, Department of Police Practice, School of Criminal Justice, College of Law, University of South Africa. hornejs@unisa.ac.za; https://orcid.org/0000-0002-5706-4879

We agree with Kostiuchenko et al. (2024) that establishing an effective forensic DNA database raises and involves many issues. It would be appropriate to add to their invaluable study findings and enrich them with the South African experience. Based on our experience in South Africa with establishing the National Forensic DNA Database (NFDD), we strongly advise law enforcement to plan and consider every aspect of the value chain meticulously. This value chain should consider collecting DNA evidence for follow-up investigations and presenting evidence in court. South Africa boasts a progressive Constitution that prioritises the protection of human rights. Following numerous years of deliberations, the Criminal Law (Forensic Procedures) Amendment Act, often called the DNA Act, was ultimately approved by Parliament. The Act became operational in 2015 (Republic of South Africa, 2015). Legislators faced the challenge of balancing individual rights and societal interests. These interests were considered while establishing a forensic DNA database designed to serve as an effective tool for law enforcement in crime resolution. The DNA Act had the primary purpose of regulating the taking of DNA samples, DNA analysis, and the establishment, administration, and management of the NFDD, with the main aim of:

1. Regulating the taking of specified bodily samples for forensic DNA analysis.
2. Ensuring the protection of the rights of women and children while taking DNA samples.
3. Regulating the proof of specific facts by affidavit or certificate that forensic analysts could use to submit their results, and which is accepted as prima facie evidence.
4. List the mandatory offences (e.g., all property crimes, assault, murder, sexual offences, crimes against the state, firearms, and explosive crimes) in the Criminal Procedure Act, 1977, for which DNA samples must be taken from a person.
5. Establishing and regulating the National Forensic DNA Database of South Africa.
6. Outlining conditions for retaining or destroying DNA samples from persons or forensic DNA profiles.
7. Ensuring that DNA profiles are used in crime investigations to determine guilt or innocence and identify missing persons and unidentified remains.
8. Protecting children's rights regarding retaining and removing forensic DNA profiles.
9. Overseeing the National Forensic DNA Database and handling complaints related to the taking, retaining, and using DNA samples and profiles.

10. Providing access control, security, and data storage measures to ensure data integrity on the NFDD.
11. Establishing a National Forensic Oversight & Ethical Board (NFOEB) to monitor compliance with the DNA Act.

The South African team tasked with implementing the NFDD dedicated several months to meticulously mapping out every detail of the value chain (Smith, 2023). The responsibilities and resource requirements were clearly defined. The primary focus was ensuring that each step was regulated through legislation, supporting regulations, or organisational procedures. Additionally, the flow of data and the necessary information technology (IT) systems were identified. However, in some cases, either no IT system existed, or the existing system needed more functionality to support specific aspects. For instance, although police stations had systems for capturing charged suspects, they could not record buccal sample reference numbers and link them to fingerprint numbers and personal details. The systems lacked integration, interfacing, and sharing of crucial data. These shortcomings included interfacing between station systems, forensic systems, criminal record systems, national systems hosting citizens, and information linked to fingerprints. Furthermore, the entity responsible for administering and managing the NFDD needed an IT system to meet legislative requirements and support the NFDD. Moreover, access and security of the NFDD must be maintained. (Smith, 2023). The system required a solution that effectively performs comparison searches and reports DNA investigative leads (Smith & Singh, 2024; Wickenheiser, 2022).

The allocation of adequate human and physical resources is of utmost importance to successfully support the entire value chain of the identification and investigation of DNA forensics (FILs). Sufficient, skilled, and well-equipped crime scene examiners must be employed to gather evidence. Sufficient and competent forensic analysts who analyse exhibit material are vital to prevent backlogs. Moreover, sufficient forensic analysts who are accountable for conducting comparison searches and reporting FILs derived from forensic databases are critical to ensuring the success of the NFDD. Detectives must undergo training to be equipped with the necessary competencies. Detectives should be provided with sufficient resources (e.g., office space, vehicles, and IT equipment) to perform the follow-up investigations of FILs efficiently.

Many law enforcement organisations prioritise performing comparative searches and identifying FILs neglecting other essential tasks. These tasks include integrating laboratory IT systems between the forensic laboratory and detectives with the NFDD system solution. It also requires additional resources to capture

similar information repeatedly on the different systems, and there is a real risk of data capture errors. By implementing IT systems to support the work process, management can access a substantial amount of management information and metrics to monitor the process.

Monitoring and following the specific information in the exhibit material is crucial. The evidence from the crime scene and mouth swabs collected at the police station until they are physically sent to the laboratory for examination must be closely monitored. The importance of timely analysis of exhibit material and the forensic DNA profile uploaded onto the NFDD must be emphasised (Smith & Horne, 2024; Speaker, 2020; Taylor & Abarno, 2023; Wickenheiser, 2022). The DNA FIL generated from the comparison search on the NFDD must be recorded in the NFDD system. The FIL should be electronically shared with the detectives' system. Detectives must document the subsequent actions and investigation of reported DNA FIL in the case file and on the system (Smith, 2023; Smith & Horne, 2023a).

Although the value chain supporting the NFDD in South Africa can still be improved, the NFDD has proved to be an effective and valuable tool to support criminal investigations. Since implementing the DNA Act, indexes have added 1,219,913 forensic DNA profiles to the NFDD. The DNA Act has strict finite retention periods for DNA profiles derived from arrested persons, persons under investigation, and persons whose criminal case was withdrawn and acquitted. Furthermore, in compliance with the DNA Act, forensic DNA profiles of innocent persons are removed daily. To date, 786,246 forensic DNA profiles have been removed from the database. The principle of the EU case of *Harper v. EU* has provided the foundational basis for legislators to consider finite retention periods for DNA profiles derived from different categories of persons. The NFDD comparison search produces two kinds of FILs (FILs): person-to-crime and crime-to-crime DNA matches. Person-to-crime FILs link a person of interest with a database profile in one or several instances. Crime-to-crime familial investigative leads (FILs) connect forensic DNA profiles from many connected crimes in cases where the individual's DNA profile is not in the database. Since the DNA Act was implemented, 20 141 person-to-crime FILs and 9 155 crime-to-crime FILs have been identified. The database has helped identify 4,313 serial sexual offenders (Smith & Horne, 2023a).

Kostiuchenko et al. (2024) propose creating an international regulatory legal act. This proposed Act is envisaged to enhance the effectiveness of forensic examinations. Moreover, the proposed Act should reinforce the impact of DNA databases on law enforcement and justice administration. The proposal resembles the 2008 Prüm Decisions that facilitate the automatic exchange and comparison of

DNA data among national databases within the European Union. The proposed Act aims to combat terrorism and cross-border crime (EU Council, 2008). The transnational exchange of DNA data encompasses four primary methods: (1) utilisation of international DNA databases; (2) interconnection of national DNA databases; (3) exchange of data based on requests; and (4) a hybrid approach combining these methods (Amankwaa, 2020; Interpol, 2009).

Several nations, including South Africa, submit forensic DNA profiles from crime scenes to INTERPOL for international comparative searching. In Africa, only a handful of countries have functional operating DNA databases. The South African example illustrates that without neighbouring nations having efficient DNA databases, the forensic DNA database will not successfully combat crimes related to terrorism and cross-border activities. Implementing a forensic DNA database in a country enhances its investigation capabilities for crimes committed inside its borders. This is particularly true where DNA evidence may be left at the crime scene (Smith, 2023).

Forensic DNA analysis and databases must comply with ISO standards. They must undergo regular independent peer review through accreditation bodies. This peer review ensures forensic evidence's accuracy, reliability, impartiality, and legal admissibility. Compliance and accreditation instil public trust and uphold quality standards. Moreover, accreditation enhances credibility in forensic investigations and legal proceedings (Doyle, 2024; Nteziryayo, Wang, Qian, Liang, Liu, Liu, Uwantege, & Joseph, 2024; Gestring, 2023; Luparia, Gennari, & Salvaderi, 2024; Neuteboom, Ross, Bugeja, Willis, Roux, & Lothridge, 2024; Smith & Horne, 2023b).

Conclusion

The lessons learned and experience gained by South Africa in establishing forensic DNA investigative leads are invaluable. Moreover, to maintain public trust, it is advisable to establish independent regulatory oversight to monitor and regulate the forensic DNA value chain and examination process. Oversight bodies and forensic and law enforcement management should establish key performance indicators (KPIs) and metrics. These metrics should measure and evaluate the effectiveness of different stages in the value chain. KPIs and metrics in forensic DNA laboratories and detective environments must be regularly managed to prevent backlogs. Backlogs can devalue forensic DNA databases as investigative tools. Even though forensic DNA analysis should be subject to regular external peer review for compliance with the ISO 17025 standard through accreditation, it is essential that both the forensic DNA database and crime collection implement quality management systems based on the ISO 9001 standard. The primary reason

for establishing a forensic DNA database in a country is to add value as an investigative tool for crimes committed within the country where there is potential to leave DNA at the crime scene.

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