The Importance of Forensic DNA Investigative Leads in the Investigation of Serial Rape Casework

J.H. Smith [1], J.S. Horne [2]

[1, 2] Department of Police Practice, School of Criminal Justice, College of Law, University of South Africa, Preller Street, Muckleneuk Ridge, Pretoria, South Africa.

[1] Corresponding author: hornejs@unisa.ac.za

OIDA International Journal of Sustainable Development, Ontario International Development Agency, Canada.

ISSN 1923-6654 (print) ISSN 1923-6662 (online) www.oidaijsd.com

Also available at https://www.ssrn.com/index.cfm/en/oida-intl-journal-sustainable-dev/

Abstract: This study reports some aspects and findings of an exploratory study on identifying and processing forensic investigative leads in investigating crime. This study highlights the findings relevant to investigating rape casework. Forensic investigative leads (FILs) play an essential role in aiding law enforcement in investigating and resolving crimes such as serial rape cases. The South African Police Service (SAPS) dedicates substantial resources to analysing trace and forensic databases that contain critical forensic biometric data. Through comparison searches within these databases, Forensic Investigative Leads (FILs) are produced and shared with detectives to support further investigations, enhancing detection and conviction rates. This study aimed to investigate and characterise FILs and identify pertinent factors influencing the use of FILs in crime investigations within the South African Police Service. A qualitative research approach was adopted in this study. Data were collected using a semi-structured interview schedule to conduct in-depth interviews with 30 detective participants from various police stations in the Gauteng Province, South Africa. Qualitative data were analysed using thematic content analysis. This study revealed the potential for increased utilisation of FILs; however, detectives experience high workloads and significant resource challenges, hindering the effective investigation of crime.

Keywords: deoxyribonucleic acid, forensic investigative leads, investigation, serial rape, serial rape offenders

Introduction

Deoxyribonucleic acid (DNA) is the hereditary material considered the blueprint of life in all living organisms (Abbas et al., 2023:1; Alketbi, 2023:815-816; Chhachhar et al., 2023:e1841). The identification of persons from biological traces is based on analysing specific variable loci (polymorphism) within the genetic material (Bukyya et al., 2021:136). DNA encodes everything, from protein expression and tissue function to physical traits or attributes, such as height and hair colour (Panneerchelvam & Norazmi, 2023:6). DNA trace analysis has transformed forensic science by providing crucial information for suspect identification, crime scene connections, and linking perpetrators to offenses such as rape. However, the misconception of DNA profiling as infallible can lead to overlooked laboratory errors and the dismissal of other vital evidence in court. Given the potentially severe consequences of identification errors, ensuring rigorous quality control in forensic procedures is both a scientific and ethical imperative (Machado & Granja, 2020:59; Saeed, AlShafea, AlFaya, Asiri, Saeed & Alnasser, 2023:e4759; Smith & Horne, 2023:555969).

Even though it is relatively easy to find an excuse for dropping a cigarette butt in a public place, it becomes much more challenging for those being investigated to explain away their DNA being discovered in a privately owned home that has recently been broken into or is the same as that found in the rape post-coital samples taken from a victim (Neves & Zieger, 2023:102939; Smith, 2024:113). Forensic DNA investigative leads not only aid in the assailant's identity but also help detectives establish patterns and connections between seemingly disparate incidents, shedding light on the extent of the perpetrator's criminal activities. The value of forensic DNA in serial rape cases cannot be overstated as it uniquely identifies a person of interest based on their genetic code. In serial rape cases, where the assailant frequently leaves biological traces like semen or other bodily fluids, forensic DNA analysis has emerged as an indispensable tool for detectives attempting to decipher the clues in these egregious offences (Smith & Singh, 2024b:1).

One of the primary advantages of forensic DNA investigative leads in serial rape casework is their ability to link a person of interest to a crime scene or a victim. Given that minimum standards and quality management are adhered to, the precision and reliability of DNA profiling render it an unmatched tool for establishing associations between a person of interest and physical traces left behind at various crime scenes (*Tom v S*, 2021:para 26; Smith & Singh, 2024a:141). This is particularly crucial in serial rape cases where a single perpetrator may be responsible for a series of assaults over an extended period, often across multiple jurisdictions. Forensic DNA analysis can be pivotal for corroborating or refuting persons of interest statements and alibis (Alketbi, 2023:817; Brown, Julian & Howes, 2023:424-425; Campbell, Gregory, Goodman-Williams, Javorka, & Engleton, 2025:9; Smith & Singh, 2024b:347).

In many serial rape cases, the accounts of survivors and eyewitnesses may vary, leading to challenges in constructing cohesive narratives. DNA evidence is an unbiased and scientifically sound means of validating or disproving statements by victims, witnesses, or suspects. By comparing forensic DNA profiles derived from crime scenes or post-coital samples collected from victims with those of persons of interest or potential suspects, detectives can either strengthen cases against a person or exclude innocent persons from consideration, streamlining the investigative process and ensuring a more accurate pursuit of justice.

The value of forensic DNA extends beyond mere identification as it also aids in establishing timelines and sequencing events in a series of crimes. By analysing the temporal patterns of DNA evidence, detectives can create a timeline of the perpetrator's activities, helping to discern patterns, modus operandi, and potential escalation in committing these offences. This chronological insight is invaluable for law enforcement in developing targeted strategies, effectively allocating resources, and anticipating an offender's next move. Additionally, it can assist in establishing the credibility of a suspect's alibi by aligning their movements with a timeline constructed from DNA evidence (Smith & Singh, 2024b:347).

Moreover, forensic DNA analysis plays a crucial role in resolving unresolved cases, providing renewed prospects for justice for victims and their families. Many serial rape cases languish in unsolved files for years, if not decades, but advancements in forensic DNA technology have enabled detectives to revisit these cases with fresh perspectives. Forensic DNA analysis and direct-to-consumer genetic databases enable the comparison of crime scene profiles with those of the relatives of persons of interest in criminal investigations. This technique can aid in identifying suspects who previously evaded justice through familial connections, reigniting investigations and potentially providing closure to victims and their communities (Smith, 2024:20).

This paper explores the value and utilisation of forensic DNA investigative leads in the investigation of serial rape casework by the South African Police Service. To achieve this aim, this study formulated research objectives appropriate to this paper: exploring and describing forensic investigative leads (FILs) and explaining how identifying FILs relates to investigating a crime.

Literature Review

Forensic Investigative Leads in Enhancing Crime Detection and Conviction

Forensic biometric databases, such as the National Forensic DNA Database, fingerprint database, and IBIS, have been perceived as invaluable investigative resources for detectives. The biometric markers in these databases can recognise potential perpetrators, connect them with crime locations, and rule out individuals from investigations. Consequently, these biometric databases have generated forensic investigative leads that can aid in investigating specific offences (BIS Research, 2023:np; Saini & Kapoor, 2016:1000108; Smith & Horne, 2023:555969).

FILs are communicated by means of the Case Administration System or Integrated Crime Docket Management System (CAS/ICDMS) by forensic examiners to the detectives. The detectives utilise CAS/ICDMS to identify FILs communicated to them and update the system as the case investigation progresses. Through communication from forensic systems to CAS/ICDMS, the forensic examiner provides the detective with forensic investigative leads (SAPS, 2022:35; Smith & Singh, 2024b:286). The SAPS has defined four distinct categories of forensic investigative leads (FILs) that detectives investigate and report in the annual performance plan (SAPS, 2023). These categories include DNA person-to-crime forensic investigative leads, DNA crime-to-crime forensic investigative leads, Integrated Ballistic Identification System (IBIS) forensic investigative leads, and fingerprint forensic investigative leads.

FILs serve as a crucial tool for the early detection of crimes with high recidivism rates. The DNA database and FILs are excellent investigative tools that support transnational exchange and contribute to investigations by enhancing

detection, securing convictions, and influencing sentencing outcomes, especially when multiple cases are linked (Anker, Doleac, & Landersø, 2021:32; AGSA, 2023:1-53; Doleac, 2017:165; Smith & Singh, 2024b:347; Speaker & Wells, 2021:10; Triverio & Márquez, 2022:158; Walsh, Curran, & Buckleton, 2010:1174; Wickenheiser, 2021:10021). FILs can serve multiple purposes, such as identifying potential suspects through DNA comparison with crime scene evidence, determining the innocence or guilt of an accused in a court of law, exonerating falsely accused individuals, and aiding in the identification of missing persons or human remains (Smith & Singh, 2024b:347; South Africa, 2013:18).

When identical DNA profiles through FILs are found at multiple crime sites, profiling the samples can aid in identifying the behavioural patterns of serial offenders. This information can aid in investigating past, present, and future offences, particularly in serial rape casework. In addition, it makes it possible to link suspects to multiple crime scenes (Heathfield, 2014:94; Hetchler, 2023:8). Forensic DNA investigative leads are valuable in the investigation of serial rape casework.

The procedure for the administration and examination of FILs delineates the specific processes that the investigator must adhere to during the inquiry of FILs. Furthermore, the procedure necessitates updating systems and completing the investigation diary at every FIL processing and inquiry stage (SAPS, 2022:15; Smith & Singh, 2024b:347). Additionally, the content within the case docket must be scanned and saved on the CAS/ICDMS used by the stations and detectives. This electronic copy of the case document ensures that the content, including witness statements, can be printed when a docket must be reconstructed in the case of misfiled dockets (SAPS 2022:4).

Challenges in Managing and Investigating Forensic Investigative Leads

Multiple factors may influence investigators' efficient use and examination of FILs. Influencing variables include non-compliance with the procedure for FIL management, which reflects inadequate oversight in mentorship and the proper execution of FIL investigations (Smith, 2024:501-504; Smith & Singh, 2024b:347). Furthermore, inadequate supervision and mentorship from commanders, the absence of enforcement of daily docket inspections, detectives' noncompliance with docket inspection protocols, and dockets being closed without investigation (Kempen, 2016:11; Mofokeng, 2012:82; Schwartz, [n.d.]), and resource limitations experienced by detectives further contribute to the challenges in their workload (Dikotla & Legodi, 2022:36; Kempen, 2016:11; Motsepe, 2019:146; Schwartz, [n.d.], Sibisi, 2019:94; Smith, 2024:198; Smith & Singh, 2024b:347).

Additionally, supplementary measures must be considered beyond operational concerns to effectively resolve the case. It is crucial to prioritise key operational variables in criminal investigations. One such variable is performing thorough interviews with a range of individuals, including witnesses, close associates, friends, and neighbours. These interviews can provide valuable insights and information for the investigation. Other important variables include assigning cases to multiple investigators and conducting computer system searches. Witnesses, given their vital role, provide essential information that can aid in solving cases (McEwen & Regoeczi, 2015:1190; Smith & Singh, 2024b:5; Soukara, 2020:64). Novice investigators require three to eight times more time than their experienced counterparts to investigate comparable offences (Schwartz, [n.d.]). Furthermore, when inexperienced detectives are appointed as commanders and with poor managerial skills, case dockets are often mismanaged due to lack of investigative guidance, inadequate inspections, and poor-quality investigations (Motsepe, 2019:146; Schwartz, [n.d.]). Detectives frequently do not always timely receive FILs, and struggle to link suspects to other crimes using forensic investigative leads (Smith, 2024:352; Wickenheiser, 2021:10021.). Key concerns include insufficient supervision, excessive caseloads, and a lack of essential resources such as vehicles, and office and information technology equipment, in addition to the challenge of inexperienced detectives (Smith, 2024:501-503). Detective commanders should proficiently manage case dockets and ensure the quality of FIL investigations from initiation to conclusion, enhancing crime detection by conforming to the prescribed procedures. Ongoing concerns highlight the need to enhance detective skills through continuous professional development (Magubane, 2017:np; PMG, 2013:4; Western Cape Government, 2019:np; Wiestra, 2014:14).

FILs are often identified long after an investigation commences. When handling FIL notifications without clear procedures, law enforcement organisations frequently require assistance in determining which actions must be taken and by whom. As Heurich and Haskins (2019:np) noted, neglecting these issues is akin to disregarding a potential suspect as a criminal. By emphasising the importance of FIL investigations, we can underscore their significant role in facilitating the resolution of past crimes (cold/ unresolved cases), which is of utmost importance (Panneerchelvam & Norazmi, 2023:15; Wickenheiser, 2021:10021).

Improving the Effectiveness of Forensic Investigative Lead Investigations

NIJ (2017:50) advises law enforcement agencies to establish a framework for accountability to ensure timely responses to FILs, especially concerning sexual assault casework. Only a few international law enforcement agencies have sufficient or dedicated FIL units and investigation protocols (Hetchler, 2023:13-14; Smith, 2024:358). Numerous agencies allocate detectives a specific amount of cases to investigate during their leisure time. However, operational FIL units staffed by detectives with specialised training in conducting such inquiries are crucial to the success of unresolved-case investigations (Hetchler, 2023:12; Smith, 2024:359). It is only since the end of 2023 that the South African Police Service approved a permanent structure for dedicated units to investigate FILs. However, due to the insufficient capacity of these dedicated FIL units, it will take several years before these teams are considered adequate. Some law enforcement organisations in Australia have successfully implemented techniques to improve communication and results between detectives and forensic laboratories during the investigative stage. This communication has allowed the benefits from earlier phases of the procedure to manifest both during the arrest phase and throughout the lead durations (Bruenisholz, Vandenberg, Brown, & Wilson-Wilde, 2019:93).

According to Moran (2022:np), the solvability of cases is determined through documentation and supporting evidence. FIL units should use contemporary investigative techniques and the latest scientific technologies whenever feasible. Closing FIL cases gives victims peace of mind and assures them that law enforcement will never give up on finding solutions. According to Davis and Wells (2019:47), DNA evidence is not the only factor that determines conviction, even if it is essential in constructing a case that can be prosecuted. Other considerations include the crime's circumstances, the victim's accountability, their trustworthiness, their cooperation, and the defendant's ability to mount a defence based on consensual sex.

In the Combined DNA Index System (CODIS) located in San Francisco, sexual assault offenders were connected to two or more sexual assault incidents (Davis & Wells, 2019:45). In one-third of these instances, convictions were obtained; however, this figure may have been affected by ongoing legal challenges and the hesitance of victims and prosecutors to initiate charges (Davis & Wells, 2019:45; Gabriel, Boland & Holt, 2010:400). A separate study revealed that 44% of DNA samples had become invalid due to the legal statute of limitations. Furthermore, fewer than fifty percent of the filed criminal complaints were rejected due to insufficient evidence. However, in fewer than half of sexual assault cases, the suspect is ultimately apprehended (Davis & Wells, 2019:44).

Improving FIL Investigations and Enhancing Conviction Rates

According to research conducted in 2020 by Bryanna Fox and colleagues, cases may be labelled as unresolved after an indefinite period, which might be anything from a few weeks to several years (Fox, Miley, Allen, Boness, Dodge, Norair, Lyle, McKinely, Peake & Rozo, 2020:94). The research conducted by Fox et al. (2020:94-107) also highlighted the obstacles that case detectives must overcome owing to the case's age, scarcity of solid evidence, and insufficient paperwork. Inaccurate addresses make it difficult to identify and track suspects found by FILs, and administrating the dockets requires a significant amount of energy and work (Makhaza, 2018:54). Furthermore, relatively few FILs resulted in convictions. Legodi and Dikotla (2022:36) recommended that adequate training, optimising the network speed of the ICDMS. Improving the use of ICDMS (e-docket) and optimising specific features on the system will positively support casework investigations.

Although these approaches prove beneficial for detectives in tackling new FILs within unsolved cases, their effectiveness can be limited because of the scarcity, cryptic recording, disorganised, and unreliability of available information (Fox et al., 2020:106). These tactics involve employing advanced technology to examine historical data and, when possible, gather further information. However, it is essential to note that no single strategy can solve the cold cases. Interaction with other law enforcement agencies, the media, and the relatives of people impacted by the case is essential. Additionally, diligent follow-up with witnesses and suspects can yield new details that are crucial to resolving the case.

Criminologists in the US have indicated that the detection rate (clearance rate) is decreasing rapidly (Heurich & Haskins, 2019:np). This poses a substantial risk to both offender reintegration and public safety. A significant proportion of violent criminals, upon parole, are again rearrested within a few years, hence elevating the probability of serial offending (Hetchler, 2023:20; Heurich & Haskins, 2019:np). Resolving FIL cases is essential to prevent crime, improve public safety, and maintain the public's favourable opinion regarding law enforcement. According to Heurich and Haskins (2019:np), the successful processing of cases assists in maintaining public trust and is consistent with the primary goal of law enforcement. Consequently, resolving cases helps stop repeat offenders and victimisation, especially when FILs are involved.

Research Methodology

Research for the Doctor of Literature and Philosophy degree served as the basis for this study (Smith, 2024). The investigation used empirical research as defined by Punch (2014:1-448). Furthermore, an analysis of recently released secondary sources, academic literature from 2012 to the present, was conducted on studies on forensic investigative leads. This information was combined with one of the researchers' practical experiences and expertise in gathering the data. The researchers gathered fresh data and cross-checked them with previously collected data to confirm or deny their findings. Moreover, secondary data of forensic investigative leads identified and reported to detectives for investigation and registered on the CAS/ICDMS system from 1 January 2015 to 31 December 2022 were collected.

The study draws its main data from a pool of 21 000 detectives within the South African Police Service (SAPS). Acknowledging the impracticality of involving every member of such a vast population in research, a targeted population was identified based on criteria that considered various traits and attributes essential for drawing scientifically valid conclusions (Mouton, 2014:135; Babbie, 2017:195). Hence, the selected target population in this study consisted of experienced detectives proficient in navigating the FILs.

Considering the opinions expressed by Mouton (2014:135), this study was conducted in the province of Gauteng, which has the highest reported crime rate. Most FILs are processed and reported, and personal discussions with the Provincial Detective Head have revealed significant issues with FIL investigations. The sample population for this study consisted of detectives working at 159 police stations in Gauteng, based on the top ten police stations with the most significant number of filed complaints between 1 April 2015 and 31 January 2022.

The following criteria were used to select participants from the police stations: participants had to have completed the detective course successfully, have been a detective for at least five years, and have expertise in investigating forensic investigative leads. Using a semi-structured interview schedule, targeted convenient in-depth interviews were conducted with detectives (n = 30) at several police stations (n = 10) in the Gauteng Province in South Africa. Data from participants and a thorough analysis of the current literature were used to gather research data.

The literature, document analysis, and interviews conducted in this study were subjected to thematic and content analysis techniques. The collected data were divided into themes, collated, and assessed. In this study, data obtained from CAS/ICDMS were analysed according to the sexual offence-related crime category and DNA FILs.

Ethical approval and clearance were obtained from the University of South Africa. In addition, permission to conduct the research in the SAPS environment was requested and granted. Individual interviews with participants and assurances were conducted in a private setting, given that their identities would not be revealed in the study's findings, thus protecting their privacy. Access to data was restricted to ensure confidentiality. In addition, the participants provided informed consent to participate in the study and semi-structured interviews.

Results

In this section, the compressed findings are presented and discussed under various themes.

Theme 1: Knowledge of Forensic Investigative Leads and Training of Participants

The participants revealed several insights regarding their training and knowledge of FILs. Forty percent (12 out of 30) received on-the-job training, while 36.6% (11 out of 30) attended a workshop on investigating FILs. Additionally, 26.6% (8 out of 30) reviewed and discussed the procedure for managing FILs with their commander. Regarding their knowledge, a significant 70% (21 out of 30) reported having some knowledge of FILs, and 30% (9 out of 30) considered themselves very knowledgeable. This high percentage of knowledgeable participants should instill confidence in our audience. All participants were aware of the FILs, with some detectives, forensic examiners, and international forensic experts demonstrating high expertise.

Theme 2: Participants Experience

The participants' experiences in the field and with FILs were noteworthy. Eighty percent (24 out of 30) had more than ten years of practical experience, while 10% (6 out of 30) had between five and ten years of experience. None of the participants had less than five years of practical experience. This wealth of experience highlights the importance of their opinions and recommendations on FILs in shaping future policies, procedures, forensic science advancements, and investigation training programs.

Theme 3: Process of Investigating Forensic Investigative Leads

Participants uniformly said that FILs are documented and processed via their information technology system, which initiates a notification in opening the case. The FIL cases are then assigned to a detective for investigation. The case docket is inspected to ensure completeness, including the presence of key documents such as witnesses' statements. Further evidence is sought. If a person of interest is associated with the case via a FIL, the complainant is contacted to ascertain whether they identify the individual. If the culprit is unidentified or there are compelling justifications for intervention, they are located and apprehended. As the investigation progresses, Function 5.16, the forensic lead management function on CAS/ICDMS, is updated, and the inventory diary is maintained (Participants, No. 1-30).

Theme 4: Challenges Experienced

The participants highlighted multiple factors contributing to the difficulties in probing FIL-related casework involving unidentified individuals of interest. Sixty-six-point seven percent (20 out of 30) reported that forensic reports, such as DNA match reports, take too long to be communicated to the stations, negatively impacting investigations and potentially affecting court enrolment or withdrawal. Sixty-three-point three percent (19 out of 30) noted a lack of information in the linked case dockets about the perpetrator, often unknown to the complainant, with no identikits or descriptions available. Sixty percent (18 out of 30) indicated that older cases are difficult to investigate, face a higher risk of the complainant, witnesses, or suspects becoming untraceable. Additionally, 40% (12 out of 30) mentioned incomplete dockets, including missing A1 and witness statements.

Thirty percent (9 out of 30) cited a lack of resources. Twenty-three-point three percent (7 out of 30) stated that tracing the complainant to obtain further details, such as an identikit, is only possible when the complaint was registered. Sixteen-point seven percent (6 out of 30) reported that FIL-linked cases are outside the district and are incomplete and require substantial further investigation. Another sixteen-point seven percent (5 out of 30) mentioned that a lack of knowledge or skill on how to process and investigate FILs by either commanders or their members negatively affect the completion of investigations.

Thirteen-point three percent (4 out of 30) noted that complainants lost interest in continuing the case, and another 13.3% (4 out of 30) said the trace material had no evidential value. Three-point three percent (1 out of 30) indicated that FILs are time-consuming to investigate, with many other cases also requiring attention. Another 3.3% (1 out of 30) referred to poor communication between detectives and the State Public Prosecutor, and 3.3% (1 out of 30) said that the docket could not be traced and was difficult to reconstruct. The subsequent narratives emphasise the presentation of responses concerning numerous problems that adversely affect the processing and investigation of FILs:

The ongoing delays of forensic services in providing police with forensic reports have a harmful domino effect. Immediate repercussions are seen in preparing court proceedings, as a lack of prompt reports may cause cases to be withdrawn or struck off the court calendar due to a lack of essential evidence (Participant No. 2).

The detectives' task becomes increasingly challenging as they struggle to maintain momentum in their investigations without the necessary evidence, leading to significant setbacks in court proceedings.

Forensic backlogs did not assist our investigations. We cannot close our dockets while awaiting the forensic results (Participant No. 3).

This backlog creates an overwhelming challenge for detectives, who find it impossible to close cases while awaiting forensic results, further complicating their workload.

The detectives submitted a confirmation sample in the minority of the FILs, resulting in a DNA match report to be used in court procedures (Participant No. 7).

The sporadic availability of these reports only adds to the complexity of managing their cases, highlighting the ongoing struggle with forensic delays.

Monitoring the follow-up and investigation of FILs in their countries is challenging due to the absence of designated personnel for this responsibility. A system needs to be implemented to ensure proper oversight and tracking of follow-up actions. (Participant No. 8).

This lack of dedicated oversight further compounds the difficulties detectives face in navigating the backlog of forensic reports, making effective case management nearly impossible.

In police precincts, where most of the population consists of migrants and foreigners, the age of linked cases in their precinct becomes critical. In old, linked cases, it becomes challenging to trace the complainant, witnesses, and suspects (Participant No. 10).

The backlog of forensic reports adds another layer of complexity as detectives grapple with the challenge of tracing old cases with limited resources, often leading to dead ends.

Detectives are entangled in a complicated web, unable to close cases because they have trouble keeping up with their dockets, which is made worse by new cases (Participant No. 19).

The backlog of forensic reports exacerbates the situation, ensnaring detectives in a cycle of accumulating unresolved cases, thereby rendering effective case management increasingly elusive.

The extended delay in acquiring forensic agencies' reports makes it challenging to follow up and investigate cases. The delay also negatively impacts the detection and conviction rates (Participant No. 21).

This delay severely hampers the detectives' ability to manage their cases, leading to declining detection and conviction rates and putting immense pressure on their already stretched resources.

This sluggishness in the reports frequently creates a chain reaction to problems within the criminal justice system. Cases were withdrawn or removed from the court roll due to insufficient evidence, negatively impacting court preparedness dockets (Participant No. 22).

Detectives are left in a precarious position, unable to progress their cases due to the absence of timely forensic evidence, resulting in cases being withdrawn or removed from court dockets.

The delay in obtaining DNA profiles impacts court cases and the finalisation of the FILs (Participant No. 23).

This issue highlights the significant challenge detectives encounter as they attempt to conclude cases without the crucial forensic evidence necessary for securing convictions.

As the time spent waiting for forensic reports increases, it becomes increasingly difficult to locate complainants for additional statements and hunt suspects. This delay makes it more difficult for detectives to manage their case dockets effectively because they get stuck in a cycle where open cases are never resolved while new cases keep piling up (Participant No. 25).

This delay intensifies the challenges faced by detectives, entangling them in a cycle of accumulating unresolved cases while new cases continue to arise, thereby further complicating their workload.

The lengthy time it takes for forensic services to provide the police with crucial forensic reports has several negative consequences. These delays affect court readiness, which may cause cases to drop or be removed from court rolls because crucial evidence is missing. In addition, the delay makes it more challenging to solicit the location of the suspects (Participant No. 26).

Detectives face mounting challenges as the delay hinders their ability to prepare cases for court, often resulting in crucial evidence being unavailable when needed.

The criminal justice system suffers because forensic services do not supply detectives with crucial forensic reports at a rapid rate. These repercussions are significant, particularly regarding how ready the cases are for court. More evidence is needed to prevent cases from being withdrawn or removed from the court calendar because of delays in forensic results (Participant No. 28).

This inefficiency places detectives in a challenging position as they struggle to advance cases without the critical evidence required to prepare them adequately for court.

Waiting for these forensic reports increases, and it becomes more challenging to track down the complainants for additional statements (Participant No. 29).

The prolonged wait for reports not only complicates detectives' efforts to close cases but also diminishes the likelihood of securing the necessary statements to strengthen their investigations.

Detectives are constrained by the backlog of unfinished forensic reports, which makes it difficult for them to wrap up cases while managing the constant influx of new cases. Obtaining additional statements from complainants and

locating suspects becomes more challenging as the time spent waiting for forensic reports lengthens (Participant No. 30, Sample A).

This backlog creates a continuous cycle of unresolved cases for detectives, significantly impeding their ability to manage their case dockets and effectively handle their workload (Smith & Horne, 2024:29).

The participants' replies indicate that detectives face significant challenges due to a backlog of delayed forensic results, which hinders their case management efficacy. Dockets increase the difficulty of addressing incoming cases and negatively impact detection rates and court processes. The participants indicated the extent to which various resources present challenges in investigating FILs, as presented in Table 1.

Table 1: Resource Challenges Affecting Forensic Investigative Leads' Investigations

Resources	No Challenges	Some Challenges	Serious Challenges
Detectives	8 (26.7%)	7 (23.3%)	15 (50%)
ICDMS Speed	6 (20%)	15 (50%)	9 (30%)
Vehicles	11 (36.7%)	10 (33.3%)	9 (30%)
Email	6 (20%)	16 (53.3%)	8 (26.7%)
PCs or Laptops	8 (26.7%)	14 (46.7%)	8 (26.7%)
Office Space	13 (43.3%)	11 (36.7%)	6 (20%)

The participant responses in Table 1 indicate challenges with the availability of detectives, speed of the ICDMS, vehicles, and PCs or laptops, which affect the investigation of FILs.

Theme 5: Underutilisation of Forensic Investigative Leads

The participants revealed several reasons why FILs are underutilised. Seventy percent (21 out of 30) indicated a lack of knowledge, while 43.3% (13 out of 30) pointed to poor command and control by commanders. More resources were noted by 36.7% (11 out of 30) of the participants, and 23.3% (7 out of 30) referred to delays in receiving forensic reports. Twenty percent (6 out of 30) mentioned that detectives needed to perform their duties more effectively, and 13.3% (4 out of 30) highlighted that reducing the number of dockets was not a priority. Additionally, 13.3% (4 out of 30) reported unsuccessful attempts to trace complainants or suspects, 13.3% (3 out of 30) confirmed that buccal samples were not taken, 13.3% (2 out of 30) said that some dockets could not be found, and 13.3% (1 out of 30) suggested that corruption might be involved in some cases. The most frequently cited reasons for the underutilisation of FILs were a need for more knowledge in conducting comprehensive FIL-related investigations, followed by poor command and control, insufficient resources, and delays in forensic results. These findings underscore the crucial role of policymakers in addressing the underutilisation of FILs, making the detectives feel the importance of their involvement in this issue. Moreover, the following responses from the participants elucidate why FILs are underutilised:

Due to the heavy caseload and limited resources at the station, balancing FIL follow-ups and investigations is challenging. The situation is further exacerbated by the availability of only one operational vehicle for both investigations and court appearances, despite a team of ten detectives (Participant No. 11).

This participant response underscores how logistical limitations can hinder the effective use of FILs, where critical follow-up actions are delayed or deprioritised due to competing demands on limited resources.

Our commander is an inexperienced detective with limited guidance on handling FIL investigations. Additionally, more relevant comments need to be included on the SAPS5 form during docket inspections (Participant No. 22).

The participant highlights a leadership challenge, indicating that a novice detective commander may lack the necessary experience and guidance for effectively conducting FIL investigations. Furthermore, the absence of detailed oversight during docket inspections, exemplified by the omission of critical remarks on the SAPS5 form, suggests deficiencies in procedural adherence and accountability. These gaps in leadership and procedural rigor contribute to missed opportunities for the effective utilisation of FILs within the investigative process.

In our province, the state prosecutor will only proceed with the case if a buccal confirmation sample is collected and a DNA match report verifying the FIL is obtained. As a result, we do not immediately arrest an individual whose DNA links them to a suspect of interest (Participant No. 24).

The participant illustrates how legal and procedural requirements can delay or prevent immediate action on FILs. In this case, the need for additional buccal samples and a verified DNA match before a prosecutor will file a case creates a significant hurdle. This significant criterion delays the arrest of suspects otherwise related to a crime through DNA evidence, limiting the potential impact of FILs in rapidly apprehending offenders.

The CAS/ICDMS data for DNA person-to-crime FILs in the sexual offence category, encompassing 6,286 cases, show that 22% (1,371 cases) are still under investigation, while 18% (1,124 cases) have resulted in convictions. The State Public Prosecutor withdrew fifteen percent (940 cases), and 13% (811 cases) still need to be solved with undetected status despite the identity of the person of interest being known. Additionally, 10% (654 cases) indicate that the complainant withdrew the case, 2% (775 cases) have the suspect arrested with the case pending in court or with the State Public Prosecutor, 4% (226 cases) resulted in acquittals, and another 4% (216 cases) involve deceased suspects or complainants. Furthermore, 1% (89 cases) had persons of interest excluded for legal or valid reasons for being at the crime scene. In 1% (80 cases), neither the victim nor the complainant could be traced, leaving the status of the FIL undetected.

In the DNA crime-to-crime FILs category, covering 4,127 cases of sexual offences, the data reveal that 51.3% (2,117 cases) are undetected, and the State Public Prosecutor withdrew 13.9% (575 cases). Another 12.9% (532 cases) are still under investigation, 5.3% (219 cases) saw the complainant withdraw the complaint, and 4.8% (197 cases) had the suspect arrested with the case pending in court or with the State Public Prosecutor. Convictions occurred in 4.6% (190 cases), while 2.5% (105 cases) had persons of interest or complainants excluded. Additionally, 2% (83 cases) involved deceased suspects or complainants, 1.4% (59 cases) resulted in the accused being acquitted, and 1.2% (50 cases) indicated that the complainant was undetected.

Theme 6: The Value of FILs in Criminal Investigations

The general values of FILs in criminal investigations, as perceived by the participants, are shown in Table 2.

Table 2: Value of Forensic Investigative Leads Perceived by the Participants

Value of FILs	Number of Participants Agree	Number of Participants Disagree
Early Detection and Prevent Recidivism	30	0
Can Improve the Detection Rate	30	0
Can Improve the Conviction Rate	30	0
Can Improve Sentencing Terms	30	0
Can Resolve Cold Cases	30	0
Optimises Investigations	30	0
Saves Investigation Time	30	0
Contributes to Citizens Feeling Safe and Secure	24	6

All study participants indicated that FILs enhance early detection, improve detection rates, increase the likelihood of conviction, and lead to longer sentences. This is mainly due to the centralisation of connected cases, facilitating simultaneous judicial procedures. Furthermore, by correlating crimes—such as serial rape incidents—through FILs, they are seen as crucial in resolving unresolved cases, enhancing investigations, and conserving time throughout the investigative process. While the majority of participants agreed that FIL investigations support the National Development Plan (NDP) by improving public safety, removing serial offenders from society, and preventing reoffending, it is important to recognise that participants may have differing opinions. The following narratives underscore and highlight the responses:

FILs provide crucial evidence that can corroborate or refute witnesses' testimony to establish the truth in a case (Participant No. 2).

This role of FILs is pivotal for ensuring accurate adjudication and aligns with the NDP's aim to bolster public safety through reliable and fair legal processes. By reinforcing the credibility of evidence, FILs contribute to a more secure and just society.

The value of FILs lies in their ability to uncover hidden connections and associations, revealing potential suspects or accomplices (Participant No. 3).

This perspective supports the NDP's goal by enhancing the ability to identify and address complex criminal networks, which is essential for maintaining public safety and preventing organised crime.

By analysing FILs, detectives can reconstruct crime scenes, comprehend the sequence of events, and identify critical actors (Participant No. 4).

This analytic capability supports the NDP's objectives by providing a clearer understanding of criminal activities, which is crucial for both preventing future crimes and securing convictions.

The value of forensic investigative leads lies in their ability to provide answers to questions that would otherwise remain unanswered, revealing crucial details that could have been neglected (Participant No. 7).

This function of FILs enhances investigative thoroughness and supports the NDP's focus on comprehensive crime resolution, thereby contributing to the prevention of reoffending and ensuring greater public safety.

By leveraging forensic investigative leads, detectives can identify patterns or methods of operation, enabling them to link seemingly unrelated crimes and potentially identify serial offenders, even in cold cases (Participant No. 10).

This capability is directly aligned with the NDP's goal of targeting habitual offenders and preventing recidivism, thereby enhancing societal security.

Forensic investigative leads can potentially exonerate innocent individuals by providing concrete evidence that disproves accusations and establishes an alternative picture (Participant No. 15).

This aspect of FILs supports the NDP's commitment to justice by ensuring that wrongful convictions are avoided, thus safeguarding the integrity of the criminal justice system.

Establishing databases supporting FILs will benefit the CJS in the medium to long term. Using them is also more cost-effective than relying solely on traditional investigative techniques (Participant No. 21).

This efficiency supports the NDP's objective of optimising resource allocation and improving the overall effectiveness of crime-solving efforts.

FILs provide a scientific and objective investigation approach, reducing reliance on subjective evidence (Participant No. 23).

This objectivity enhances the reliability of investigative outcomes, aligning with the NDP's goal of ensuring a fair and evidence-based criminal justice process.

The value of forensic investigative leads is demonstrated by their capacity to link suspects to crime scenes, locations or activities, facilitating the establishment of motive and opportunity (Participant No. 25).

This linking capability supports the NDP's goal by providing a clearer understanding of criminal behaviour's and facilitating more effective crime resolution.

FIL evidence provides tangible and irrefutable proof to be presented in court. It can assist detectives in building compelling cases (Participant No. 28).

This capacity of FILs to deliver concrete evidence is crucial for the NDP's goal of ensuring public safety and security. By strengthening the evidentiary foundation of cases, FILs contribute to more effective prosecution and the conviction of offenders, thus directly supporting efforts to eliminate serial criminals from society and prevent future crimes. This aspect underscores FILs' role in achieving the NDP's objectives through robust and reliable investigative outcomes.

FIL provides a firm foundation for developing and narrowing the pool of potential suspects, saving valuable time and resources (Participant No. 30).

This efficiency supports the NDP's objective of enhancing investigative processes and expediting the resolution of criminal cases. These varied perspectives of the participants collectively underscore the significant role of FILs in advancing the NDP's goals of improving safety and security through effective crime resolution, targeting serial offenders, and preventing reoffending.

Discussion

Knowledge and Experience

Based on the participants' responses, most detectives were familiar with the concept of an FIL Nonetheless, it's clear that there's a need for improved training, as only a third of the participants fully comprehended the procedures for investigating FILs. This lack of understanding may be a key factor in the absence of information in the investigation diary in the docket, the case system not being updated during the follow-up and investigation of the FILs, and unresolved case dockets. The importance of continuous learning and improvement cannot be overstated, as it corresponds with literature that underscores inadequate command and control in training and assuring adherence to the procedures, prematurely finalising dockets without investigation or using forensic products, and detectives disregarding docket inspection directives. (Kempen, 2016:11; Schwartz, [n.d.]; Smith, 2024:501). Additionally, the participants noted that commanders sometimes took on responsibilities typically assigned to the detective in charge of the FIL investigation and the case docket.

Value of Forensic Investigative Leads

Based on the literature review and the participants' previous responses and insights, FILs play a crucial role in solving cold cases and can help save investigation time. They are invaluable tools for the early detection of crimes with high recidivism rates. FILs can enhance investigations by improving detection, securing convictions, and influencing sentencing outcomes, especially when multiple cases are linked, such as in serial rape cases. Despite this, the detective has been given the name of the person of interest. While it is correct that FILs have contributed to solving many serial rape cases, it is disappointing to discover that from 2015 until the end of 2022, only 18% of all DNA person-to-crime FILs related to sexual offences reported to detectives resulted in convictions. The 13% of DNA person-to-crime FILs and 51.3% of DNA crime-to-crime FILs of sexual offence-related cases that are closed as undetected, as well as the 15% of person-to-crime FILs and 13.9% of crime-to-crime FILs of sexual offence-related cases that the State Public Prosecutor withdrew, undermine the potential value of FILs in solving cases and giving closure to victims of rape. Notably, a sizable portion of DNA FILs, 22% of DNA person-to-crime and 12.9% of DNA crime-to-crime, remain under investigation. The SAPS must address the underlying cause to identify the factors contributing to the low enrolment of cases that result in convictions and poor follow-up and investigation.

Processing of Forensic Investigative Leads

International law enforcement handles the follow-up and investigation of FILs differently based on their legal frameworks, structure, and resource allocation. Unlike the SAPS, which operates nationally with uniform policies and guidelines that all provinces and police stations must follow, many other countries delegate law enforcement to regional, state, or county levels, allowing each entity to operate independently regarding certain protocols and investigative procedures. Despite these differences, a key element shared across countries is the essential cooperation between forensic laboratories and investigative units, even though each operates under its own legal and procedural framework. The foundation for successfully resolving cases relies on this relationship.

The transnational exchange of information, best practices, and insights is a powerful tool that can stimulate innovation and significantly improve the management of FILs. This exchange, according to each instance's experience level and particulars, has led to most participants reporting adherence to broadly analogous procedures, with only minor variations. As a result, law enforcement agencies have been able to implement diverse methodologies, customising them to their specific legislative frameworks and operational protocols. However, this also highlights a need for improved training, as only a third of the participants fully comprehended the procedures for investigating FILs. This lack of understanding may be a key factor in the absence of information in the investigation diary in the docket, the case system not being updated during the follow-up and investigation of the FILs, and unresolved case dockets. The importance of continuous learning and improvement cannot be overstated, as it corresponds with literature that underscores inadequate command and control in training and assuring adherence to the procedures, prematurely finalising dockets without investigation or using forensic products, and detectives disregarding docket inspection directives. Some law enforcement agencies use direct-to-consumer genetic genealogy databases to find familial matches of perpetrators and forensic DNA databases for individual identification (Smith, 2024:278). Forensic Investigative Genetic Genealogy (FIGG) is an emerging strategy increasingly used to solve crimes such as serial rape,

paving the way for broader and more widespread use of genetic data in criminal investigations. Some countries have specialised units dedicated to handling forensic investigative leads and cold cases, with staff specifically trained to investigate FIGG casework. The use of advanced tools like FIGG represents a shift in investigative methods, offering new perspectives for resolving complex cases. However, given the resource-intensive nature of FIGG techniques, a careful balance must be maintained between seeking justice, addressing ethical concerns, and ensuring efficient resource use. Furthermore, law enforcement organisations underscore the significance of seasoned investigators and genealogists, robust collaboration with prosecutorial entities, and rigorous compliance with ethical standards during investigations of FILs, including FIGG.

Incomplete Investigations and Challenges

FILs do not automatically result in solved cases; regardless of the type or quantity of FILs involved, a disproportionate number of cases are either withdrawn or still need to be solved and, consequently, are not ready for court enrolment (Smith, 2024:394). Given that many historical FILs are still being investigated and many FIL cases have been closed as undiscovered or withdrawn, it is evident that FILs are underutilised in South Africa (AGSA, 2023:13-16; Smith, 2024:418). This underscores the necessity for detectives to finalise investigations and ensure the case docket is comprehensively prepared before submission to the State Public Prosecutor. This procedure facilitates the consideration of related cases for court registration. Additionally, participants noted that the investigation process is both demanding and time-consuming.

Participants indicated that in many of the retrieved case dockets with FILs, the docket and the investigations must still be completed, including chain-of-custody, and witness and complainant statements. The analysis of CAS/ICDMS data underscored that, in most criminal case categories, including serial rape casework, cases have occasionally been closed quickly and without conducting thorough investigations, putting more emphasis on statistics than actual investigation. Detectives often prioritise cases with greater visibility or serial rapists.

Several factors can prevent FIL cases involving serial rape from being enrolled and heard in court. Factors such as the sufficiency of the evidence supporting the complainant's statement, the comprehensiveness of the police investigation, the gathering of evidence, and the perceived gravity of the rape incident all influence the prosecutor's decision to proceed with the case. However, it's important to acknowledge that these factors are not the only ones at play. Performance metrics for monthly case resolutions and conviction rates are also significant. Legal and extra-legal factors, which can influence case attrition at various stages of the criminal justice system, add another layer of complexity to prosecutorial decision-making. Efficient evidence gathering, meticulous processing, and offenders' successful apprehension and prosecution are essential legal elements that facilitate case advancement throughout police investigations and prosecutor involvement (Machisa, Jina, Labuschagne, Vetten, Loots & Jewkes, 2023:608; Smith & Singh, 2024b:4).

The State Public Prosecutor carefully examines cases submitted to the court, avoiding less severe offences if the evidence on the docket is flimsy, defective, or lacking crucial components. Forensic evidence requires additional supporting evidence because it is circumstantial. Due to their excessive caseloads, courts must allocate more attention to cases with substantial evidence. As a result, there are many other reasons why cases are not enrolled, including the sufficiency of evidence supporting the complainant's version of events. The depth of the police investigation, gathering of evidence, and perceived seriousness of cases such as the rape incident all impact prosecutors' decisions to proceed with court actions. Understanding that legal- and evidence-based standards do not influence prosecutorial decisions is essential. The benchmarks for monthly case resolution and conviction rates were equally significant.

Challenges and Resources

The detective participants indicated that substantial caseloads and constrained resources hindered their capacity to oversee FIL follow-ups and investigations. Significant resource-related issues, including a deficiency of detectives, information system integration, and IT equipment, adversely affect case resolution. If detective units receive adequate funding, proper staff, mentorship and supervision, initial and continuing training, support staff, forensic and information technology, and vehicles, they should succeed in their investigations (Eck & Rossmo, 2019:611; PMG, 2012:np; Smith & Singh, 2024b:4). Although the detective role promises to lower crime, institutional orthodoxy, conservative traditions, and negligence have hindered its progress (Eck & Rossmo, 2019:612).

The challenges in detecting environmental impacts include investigating FILs or using forensic resources (Kempen, 2016:11). The detectives underscored the challenge of executing comprehensive investigations due to the substantial volume of cases they manage concurrently. This situation aligns with contemporary studies, which suggest that detectives necessitate support due to resource constraints, hence exacerbating their burden (Legodi & Dikotla,

2022:36; Kempen, 2016:11; Motsepe, 2019:146; PMG, 2012:np; Schwartz, [n.d.], Sibisi, 2019:87; Smith & Singh, 2024b:5). Eck and Rossmo (2019:616) indicate that the proportion of crimes allocated to law enforcement that are effectively resolved is comparatively low. Instead of proactively seeking answers, investigators frequently embrace a detrimental "rapid fix" mentality, passively awaiting developments such as witness testimonies, informant insights, or forensic findings (Eck & Rossmo, 2019:609-615; Smith & Singh, 2024b:5). Moreover, contingent upon the investigation techniques employed, these "quick fix" methodologies may inadvertently bolster the notion that a specific tactic is adequate for resolving the majority of instances. Should these tactics prove ineffective, detectives may erroneously deduce that no more action is possible. It is essential to acknowledge that crime resolution necessitates both human intervention and technological resources (Eck & Rossmo, 2019:616-617). An adept detective must employ all accessible resources to examine a case, as time is of the essence, and any postponement may lead to the loss or destruction of crucial evidence (Smith & Singh, 2024b:5).

In reply to a parliamentary question directed at the Minister of Police, it was revealed that the current staffing level of Detective Services is 40.4% of the ideal capacity. Furthermore, the Minister of Police stated that the high caseload per detective is a result of significant employee turnover, which negatively impacts the effectiveness of investigations (Daily Maverick, 2023:np). During a discussion between the SAPS Management and the Portfolio Committee on Police, it was confirmed that the high attrition rate and considerable docket caseload allotted to each detective are the leading causes of the poor performance of detectives (Parliament of the Republic of South Africa, 2023:np). The obstacles within the investigative milieu affect enquiries, particularly those concerning FILs (Kempen, 2016:11; Machisa et al., 2023:608; PMG, 2012:np). Moreover, investigators have substantial resource-related obstacles, including a deficiency of personnel, cars, and information technology equipment. Moreover, difficulties are observed at the supervisory level, where talent levels and the effective execution of command and control pose obstacles (Schwartz, [n.d.]; Smith, 2024:401).

Supervisors

Concerns about inexperienced commanders needing more direction and lack of detailed information on the investigation diary during docket inspections were also highlighted. Moreover, difficulties are observed at the supervisory level, where talent levels and the effective execution of command and control pose obstacles (Schwartz, [n.d.]). Supervisors are expected to monitor the investigations conducted by their members and perform docket inspections to evaluate and guide detectives (Smith, 2024:540; Smith & Singh, 2024b:5).

Delay in Forensic Reports

The backlog and delays in forensic services complicate and prolong the processing and finalisation of FIL cases, particularly when forensic results, such as the DNA match report, are received after submitting a confirmation sample. The solving of the case is made worse because it becomes more challenging to track down the suspect as the case ages. Serial rapists who are not apprehended promptly will persist in violating the lives, privacy, and dignity of innocent victims (Smith, 2024b:194; Smith & Singh, 2024b:5).

A recent example demonstrates the detrimental effects of delays in forensic DNA analysis on judicial proceedings. Between 2016 and 2019, Xolani Gcelu raped and assaulted eight young women. Gcelu's capture occurred in June 2019 following his assault on two women. Although Gcelu was apprehended in 2019, the charges were initially dismissed due to extensive DNA testing backlogs. He was linked through the DNA FILs to six other rape cases. He was apprehended again only in 2022 (Daily Maverick, 2024:np).

Reasons for the Underutilisation of FILs

The primary reasons for the underutilisation of FILs include a lack of sufficient information, inadequate command and control by superiors, and insufficient funding (Smith, 2024:501). Additional contributing factors encompass the inability to associate case dockets via FILs, delays in obtaining forensic results, a focus on docket reduction, detectives neglecting their responsibilities, failure to collect confirmation samples, challenges locating complainants or suspects, and corruption occurrences (Smith & Horne, 2024:296). Detectives often take ineffective actions in attempting to trace suspects. Tracing most suspects identified is challenging due to the lack of valid addresses, and maintaining case dockets requires considerable effort (Makhaza, 2018:54).

Novice detectives require three to eight times longer than seasoned detectives to investigate comparable offences. (Schwartz, [n.d.]). The investigators' insufficient investigation abilities significantly impaired their work, which was worsened by the appointment of novice detectives as leaders. Poor managerial skills, inadequate supervision, case docket administration, insufficient inspections, ineffective utilisation of the ICDMS (e-Docket system), the absence

of guidelines, and substandard investigations exacerbated these difficulties. (Legodi & Dikotla, 2022:36; Mofokeng, 2012:77; Motsepe, 2019:146; Schwartz, [n.d.]; Smith, 2024:540). Failure to adhere to proper norms and standards means that detective commanders cannot efficiently manage case dockets or ensure the quality of FIL investigations from start to finish, negatively impacting crime detection. Additionally, the interaction between key parties such as detectives, forensic scientists, and legal professionals (e.g., State Public Prosecutors) influences how evidence is interpreted and used during investigations (Carlson, Kennedy, Zeller & Busey, 2022:100199; Roberts, 2015:9).

Detective Procedures

Detectives receive FILs either when no person of interest is linked to a crime scene or when a person of interest is identified. During the investigative phase, law enforcement authorities collect information from complainants, witnesses, and informants to ascertain the suspect's name, physical characteristics, last known whereabouts, and possible leads. Detectives may use surveillance at areas linked to the suspect to monitor their movements. Law enforcement can enlist public aid by disseminating suspect descriptions and requesting tips via social media or media. Detectives rely on the comprehensive information stored in databases, including criminal histories, driving records, and immigration records, to identify links based on the gathered information, reassuring the audience about the thoroughness of the investigative process. Furthermore, law enforcement organisations may employ mobile phone tracking, social media monitoring, or surveillance cameras to ascertain the suspect's location or online activities (Smith & Horne, 2024:298).

Cooperation across diverse governmental and law enforcement entities to share information and resources can be exceedingly beneficial in apprehending the perpetrator. Law enforcement may utilise undercover operatives or informants to collect intelligence and covertly identify suspects. In FIL situations, such as serial rape, the media can disseminate suspect identikits (SAPS, 2022:16; Smith & Horne, 2024:290).

The CAS/ICDMS system data on FILs demonstrated that a significant percentage of all FIL case types were designated as "undetected" in the system. Commanders should focus more on these FIL cases that were concluded as undetected and ask tracing teams and crime intelligence for help before closing these investigations. Insufficient collaboration and communication between these entities and supporting units can hinder investigative procedures and lead to inefficiencies. However, a well-structured agency with robust investigative resources and policies significantly enhances investigative practices and improves case clearance rates (Alexander, Manpaya & Oswusu-Manu, 2023:127; Lum, Wellford, Scott, Vovak & Scherer, 2018:56). Additional efforts are necessary to identify undiagnosed FIL cases that are trial-ready in order to enhance the detection rate.

In certain instances, identifying a suspect is a hurdle despite thorough investigative endeavours and the attentiveness of detectives. Likewise, instances arise where insufficient evidence obstructs the authorities from identifying a suspect or effectuating an arrest. Although the technology and tools used by detectives have greatly advanced in recent years, there are still circumstances where it remains impossible to apprehend certain individuals (Pennsylvania Office of Victim Services, [n.d.]). In such cases, a comprehensive approach is often required, involving cooperation between law enforcement agencies (e.g., detectives, crime intelligence, investigative psychology units, and forensic services), the use of technology, and thorough investigative techniques to successfully apprehend suspects. Docket analysis can help identify patterns, similarities, and distinctive behaviours in stranger rape cases, connecting them with other incidents. Other forensic evidence from different cases can complement this information.

Suspects can be identified through information provided by victims, witnesses, and individuals acquainted with the crime or the suspect. In addition to their input, physical evidence from the crime scene, police records, informants, personal identification numbers, psychological profiling, vehicle registration numbers, and physical descriptions, including photographs, all play a part. Detectives necessitate comprehensive information from multiple sources, including victims and witnesses, to identify a culprit. This comprehensive approach is necessary to ensure a thorough and accurate investigation. It becomes much easier to find suspects when victims or witnesses can provide descriptions or identify those responsible for the crime. This information can include the suspect's motivation, skills, and potential non-suspects. Personal descriptions are often gathered by interviewing individuals who can characterise the alleged offender. Informants can also be a valuable source of information. In cases where a complainant's cell phone is stolen and used by the perpetrator, cell phone surveillance can aid in tracking the suspect (Smith & Horne, 2024:295). The details provided by witnesses and victims are often crucial in helping analyse the dockets and identify the suspect (SAPS, 2022:35). Based on earlier responses and declarations by the participants, the presence of evidence, such as a DNA match to a crime site, can motivate suspects to confess or negotiate plea deals.

Additionally, the number of FILs in the sexual offence-related category finalised as convicted was low. Historically, law enforcement officials have only been able to resolve a small percentage of crimes assigned to them (Eck & Rossmo, 2019:601, HSF, [n.d.]). Moreover, detectives fall victim to a counterproductive "short-cut" mentality, waiting impassively for things to happen, such as the appearance of a witness, a tip from Crime Stoppers, or the arrival of forensic findings. However, this strategy has several limitations (Eck & Rossmo, 2019:606). Experienced detectives should first use all resources at their disposal. Second, time is frequently an important consideration, and needless postponements may result in the destruction or loss of substantial evidence (Eck & Rossmo, 2019:606). This strategy might unintentionally support the notion that specific methods are sufficient to resolve cases. Detectives may mistakenly believe that nothing more can be done if these methods prove ineffective. It is critical to remember that human effort, not just the use of equipment, is required to resolve crimes (Eck & Rossmo, 2019:606).

System integration and improved utilisation of ICDMS (e-docket) need to be enhanced, as indicated by the literature (Legodi & Dikotla, 2022:36). Furthermore, detectives must thoroughly investigate the modus operandi of suspects in their cases and identify patterns where multiple suspects employ the same methods (SAPS, 2020; SAPS, 2022). A collaborative approach should be adopted, seeking support from the Crime Intelligence Analysis Centre for modus operandi and intelligence screening to confirm the link between a person of interest and a crime scene or to identify potential suspects. Additionally, detectives should engage the Investigative Psychology Section to verify behavioural connections between cases, such as those involving serial murderers and rapists.

Detectives must notify the State Public Prosecutor of the National Prosecution Authority if a trial-ready case pertains to FILs or contains information that associates the suspect with other cases (SAPS, 2020). Timely communication with the State Public Prosecutor is essential to evaluate the robustness of evidence and obtain direction on any additional required investigations. To achieve a thorough understanding, detectives must combine forensic evidence with supplementary information regarding the suspect's past and behaviours, as it offers merely a partial perspective of the case. Analysing evidence based on its context and mobility allows detectives to formulate coherent interpretations and theories. Upon confirming that the suspect lacked a legitimate rationale for being on or within the premises, the interview technique must provide the suspect with the opportunity to present an independent narrative of their actions.

FIL evidence can then be used to verify the accuracy and truthfulness of the suspect's statements. Detectives follow the investigative process, incorporating corroborative evidence and similar act evidence to build the case and strengthen the investigation. Corroborative evidence is essential for linking suspects to crimes. In property crimes, corroborative evidence may include witness sightings of the suspect's vehicle near the crime scene, CCTV footage showing the suspect in the area, search or call data from the suspect's phone originating at the crime scene, and photographs of the suspect nearby. Additional evidence can support the reasonable suspicion of the suspect's involvement (Brown et al., 2023:427).

Recognising the importance of behavioural data and the need for a multifaceted approach, docket analysis emerges as a crucial tool. It serves as a connective instrument that can uncover patterns, similarities, and unique behaviours in stranger rape cases. More importantly, it connects these findings with additional forensic evidence such as FILs, especially in cases where witness testimony and tangible evidence are lacking (Labuschagne, 2014:197; Van der Watt, Benson, & Labuschagne, 2015:75). Van der Watt et al. (2015:75) stress that challenges exist in tracking unidentified criminals. Docket analysis that identifies patterns, similarities, and distinctive behaviours can be valuable in investigating the possibility of a single offender committing multiple offenses, such as in FIL cases, assisting law enforcement in addressing ongoing threats (Van der Watt et al., 2015:75). This procedure aids in forming reasonable suspicions about a suspect's potential involvement.

FIL cases are significantly more complex when there is no relationship between the victim and perpetrator, and no witnesses are available. Examining the offender's method of operation and identifying a pattern, often indicated by a signature, can be valuable when investigating serial or multiple offenders in forensic casework (Van der Watt et al., 2015:75).

Misinterpretations, where evidence is wrongly viewed as contradicting a valid hypothesis, should be avoided (Smit, Morgan & Lagnado, 2018:135). FIL cases may be deemed unreliable due to concerns over validity, particularly when identifications are based on biased information or when interdependent evidence is presented as independently supporting a hypothesis, compromising the integrity and investigation of the casework (Smit et al., 2018:135). Misunderstandings about FILs can be resolved by clarifying sub-hypotheses regarding the source and activity levels and expanding knowledge on factors such as the rarity of observed characteristics within a population and the dynamics of evidence (Smit et al., 2018:128-137). Many overturned rulings on appeal did not involve new evidence,

suggesting that these issues could have been prevented with better interpretation during the trial (Smit et al., 2018:128-137).

Suspects can be identified through various means, including information from victims, witnesses, knowledgeable individuals, physical evidence from the crime scene, psychological profiling, law enforcement records, informants, identification numbers, vehicle registrations, and photographic or physical descriptions. To accurately identify a perpetrator, investigators must gather comprehensive information from multiple sources, particularly victims and witnesses. The process becomes significantly more effective when these individuals provide detailed descriptions or directly identify the offender, as this specific information is of great value in suspect identification. This information may include the suspect's motives, skills, and potential alternative persons of interest. Personal descriptions are typically obtained through interviews with individuals capable of providing relevant details about the alleged perpetrator (Smith & Horne, 2024:295). Informants can also serve as useful sources of information. In cases where a complainant's cell phone is stolen during the crime and used by the perpetrator, cell phone surveillance can be helpful. The details from witness and victim accounts are often instrumental in analysing dockets and identifying the suspect (SAPS, 2022:24).

Recommendations

In order to identify and process forensic investigative leads in the investigation of serial rape casework, it is essential to strengthen interagency collaboration. Improved cooperation between law enforcement entities such as Crime Intelligence, Investigative Psychology, and Forensic Services can enhance the identification of suspects and facilitate case resolution. The sharing of intelligence and resources across these agencies ensures a comprehensive and coordinated approach to solving complex cases, particularly those involving FILs. A more strategic and focused approach to FIL case management is necessary to enhance detection rates. Commanders should prioritise unresolved cases classified as "undetected" and actively engage tracing teams and crime intelligence before prematurely closing investigations. Strengthening investigative efforts at this stage can prevent offenders from avoiding prosecution and ensure that all available leads are fully pursued.

The effective use of advanced technology in investigative procedures is critical for identifying and tracking suspects. Law enforcement agencies should integrate tools such as mobile phone tracking, CCTV surveillance, and social media monitoring to obtain crucial intelligence. These technologies improve surveillance capabilities and provide valuable leads that contribute to case development and suspect apprehension. A thorough docket analysis is also vital in identifying patterns, similarities, and distinctive behaviours in serial rape investigations. Detectives should systematically analyse case dockets to establish connections between different incidents, ensuring investigative consistency and improving the likelihood of linking offenders to multiple crimes.

Collaboration with the National Prosecuting Authority should be prioritised to facilitate trial readiness. Engaging prosecutors early in the investigative process can help strengthen case preparation, address potential evidentiary gaps, and prevent unnecessary delays in court proceedings. Effective communication between detectives and prosecutors is essential for building strong legal cases. Detectives must also adopt a proactive investigative approach rather than relying on passive strategies such as waiting for witness testimonies or forensic results. By actively pursuing leads, utilising all available investigative tools, and exploring various avenues of inquiry, detectives can significantly improve case resolution rates.

Finally, continuous training and the provision of modern investigative resources are crucial to maintaining high investigative standards. Regular training on evolving forensic techniques and investigative advancements ensures that detectives remain well-equipped to handle complex serial rape cases. Investing in skills development and cutting-edge technology ultimately enhances investigative efficiency, leading to higher conviction rates and increased public confidence in law enforcement.

Conclusion

In conclusion, forensic DNA analysis is a powerful tool for detectives, aiding forensic investigative leads, witness statement validation, timeline creation, and bringing perpetrators to justice. As technology advances, its role in criminal investigations evolves, offering potent tools for combating complex cases, such as serial rape. However, DNA evidence is not a standalone solution and must be considered alongside other evidence. Detectives play a pivotal role in gathering evidence and influencing the solving of cases, especially in the high finalisation rates of sexual-related cases; challenges such as heavy caseloads and limited resources impact case quality.

In serial rape casework, detectives must adhere to standards, conduct thorough investigations, and use docket-case inspections and reviews to find missing details. Obstacles such as resource limitations and inefficient technology systems hinder their effectiveness. Government investments in forensic services should prioritise addressing these challenges. Participants' perspectives highlight the need for extraordinary efforts to address forensic backlogs, resource challenges, and system integration for effective FIL utilisation. Failure to implement these measures could render the SAPS ineffective in improving detection rates in serial rape investigations.

List of References

1. Abbas, H.M., Erum, F. & Gillani, A.H. 2023. Significance and challenges of DNA profiling in the medicolegal setup of Pakistan. Forensic Insights, 1(1), 1-5. Available from: https://doi.org/10.56770/fi2023111. Accessed on 13 July 2024.
2. Alexander, A.Y., Manpaya, M. & Oswusu-Manu, D. 2023. Enhancing Criminal Investigations through sustainable forensic assistance: A case study of the Ashanti region in Ghana. *International Journal of Scientific and Research Publications*, 13(12), 119-133. Available from: https://doi.org/10.29322/IJSRP.13.12.2023.p14414. Accessed on 11 July 2024.
3. Alketbi S.K. 2023. The role of DNA in forensic science: a comprehensive review. Available from: https://ijsra.net/sites/default/files/IJSRA-2023-0624.pdf. Accessed on 11 July 2024.
4. Anker, A.S.T., Doleac, J.L. & Landersø, R. 2021. The effects of DNA databases on the deterrence and detection of offenders. *American Economic Journal: Applied Economics*, *13*(4), pp.194-225. Available from: https://doi.org/10.1257/app.20190207. Accessed on 11 July 2024.
5. Auditor General of South Africa (AGSA). 2023. Management Report. Department of Police. Pretoria: Government Printer. 1-53.
6. Babbie, E.R. 2017. The practice of social research. 14th edition. UK: Sage.
7. BIS Research. 2023. Biometrics in Forensic Science: Using Unique Identifiers to Solve Crimes. https://bisresearch.com/news/biometrics-in-forensic-science-using-unique-identifiers-to-solve-crimes.
8. Brown, C., Julian, R. & Howes, L.M. 2023. Strands in a cable: effective investigator decision-making using forensic identification evidence in volume crime investigations. *Policing and Society*, 417-433. Available from: https://doi.org/10.1080/10439463.2023.2279063. Accessed on 13 July 2024.
9. Bruenisholz, E., Vandenberg, N., Brown, C. & Wilson-Wilde, L. 2019. Benchmarking forensic volume crime performance in Australia between 2011 and 2015. *Forensic Science International: Synergy*, 1, 86-94. Available from: https://doi.org/10.1016/j.fsisyn.2019.05.001. Accessed on 12 July 2024.
10. Bukyya, J.L., Tejasvi, M.L.A., Avinash, A., Chanchala, H.P., Talwade, P., Afroz, M.M., Pokala, A., Neela, P.K., Shyamilee, T.K. & Srisha, V. 2021. DNA profiling in forensic science: a review. *Global medical genetics*, 8(04), 135-143. 10.1055/s-0041-1728689.
11. Campbell, R., Gregory, K., Goodman-Williams, R., Javorka, M. & Engleton, J. 2025. The prosecution of sexual assault cases with forensic DNA evidence: Survivors' testimony experiences. *Psychology, Public Policy, and Law.* Advance online publication. Available from: https://doi.org/10.1037/law0000453. Accessed on 11 July 2024.
12. Carlson, L., Kennedy, J., Zeller, K.A. & Busey, T. 2022. Describing communication during a forensic investigation using Pebbles on a Scale metaphor. *Forensic Science International: Synergy*, 4, 100199. Available from: https://doi.org/10.1016/j.fsisyn.2021.100199. Accessed on 11 July 2024.
13. Chhachhar, V., Vishwakarma, A., Singh, B.D., Singh, P. & Verma, K. 2023. Exploring the Role of DNA Technology in Administration of Justice in India: A Comparative Analysis with USA. *Journal of Law and Sustainable Development*, 11(12), Article e1841. Available from: https://doi.org/10.55908/sdgs.v11i12.1841. Accessed on 11 July 2024.
14. Daily Maverick. 2023. Annual report. Specialist skills-deprived saps lumbers on to tick the boxes of performance targets amid downbeat perceptions. Available from: https://www.dailymaverick.co.za/article/2023-10-03-specialist-skills-deprived-saps-lumbers-on-to-tick-the-boxes-of-performance-targets-amid-downbeat-perceptions/. Accessed on 11 July 2024.
15. Daily Maverick. 2024. Eight life sentences for rapist initially released due to DNA delays. Available from: https://www.dailymaverick.co.za/article/2024-05-06-eight-life-sentences-for-rapist-initially-released-due-to-dna-delays/. Accessed on 11 July 2024.
16. Davis, R.C. & Wells, W. 2019. DNA testing in sexual assault cases: When do the benefits outweigh the costs? *Forensic Science International*, 299, 44-48. Available from: https://doi.org/10.1016/j.forsciint.2019.03.031. Accessed on 12 July 2024.

17. Doleac, J.L. 2017. The Effects of DNA databases on crime. *American Economic: Journal Applied Economics*, 9(1), 165–201. Available from: https://doi.org/10.1257/app.20150043. Accessed on 13 July 2024.
18. Eck, J.E. & Rossmo, D.K. 2019. The new detective: Rethinking criminal investigations. *Criminology and Public Policy*, 18(3), 601-622. Available from: https://doi.org/10.1111/1745-9133.12450. Accessed on 11 July 2024.
19. Fox, B., Miley, L., Allen, S., Boness, J., Dodge, C., Norair, K., Lyle, M., McKinely, S., Peake, J. & Rozo, M. 2020. Law enforcement and academics working together on cold case investigations: lessons learned and paths forward. *Journal of Criminal Psychology*, 10(2), 93-111. Available from: https://doi.org/10.1108/JCP-09-2019-0040. Accessed on 11 July 2024.
20. Gabriel, M., Boland, C. & Holt, C. 2010. Beyond the cold hit: Measuring the impact of the national DNA data bank on public safety at the city and county level. *Journal of Law, Medicine & Ethics*, *38*(2), pp.396-411. Available from: https://doi.org/10.1111/j.1748-720X.2010.00498.x. Accessed on 12 July 2024.
21. Heathfield, L.J. 2014. Policy required for entry of DNA profiles onto the National Forensic DNA Database of South Africa. *South African Journal of Science*, 110(7), 1-3. Available from: https://doi.org/10.1590/sajs.2014/20130374. Accessed on 11 July 2024.
22. Hetchler, S. 2023. DNA Analysis: The Answer for Unsolved Cases? Thesis, Concordia College of Human Services and Behavioral Sciences: Criminal Justice Leadership CJU 596: Criminal Justice Capstone University, St. Paul). Available from: https://digitalcommons.csp.edu/criminal-justice_masters/. Accessed on 11 July 2024.
23. Heurich, C. & Haskins, P.A. 2019. Expert Panel Issues in the New Best Practices Guide for Cold Case Investigations. National Institute of Justice. Available from: https://nij.ojp.gov/topics/articles/expert-panel-issues-new-best-practices-guide-cold-case-investigations. Accessed on 11 July 2024.
24. HSF. [n.d.]. Crime and Punishment in Contemporary South Africa III - From Crime Reporting to Cases Finalised. Available from: https://hsf.org.za/publications/hsf-briefs/crime-and-punishment-in-contemporary-south-africa-iii-from-crime-reporting-to-cases-finalised. Accessed on 11 July 2024.
25. Kempen, A. 2016. The back to basics approach of the SAPS-personal insights from the acting national commissioner. Servamus Community-based Safety and Security Magazine, 109(8), 10-13. Available from: https://hdl.handle.net/10520/EJC192468. Accessed on 12 July 2024.
26. Labuschagne, G.N. 2014. The Use of Linkage Analysis Evidence in Serial Offence Trials (Pp. 197-224). In J. Woodhams & C. Bennell (Eds.), Crime Linkage: Theory, Research, and Practice. New York: CRC Press.
27. Legodi, A.L. & Dikotla, M.A. 2022. E-docket system for improved administration and justice delivery in selected Limpopo province police stations. *Journal of the South African Society of Archivists*, *55*, 27-40. Available from: https://doi.org/10.4314/jsasa.v55i.3. Accessed on 11 July 2024.
28. Lum, C., Wellford, C., Scott, T., Vovak, H. & Scherer, A. 2018. Identifying effective investigative practices: A National Study Using Trajectory Analysis, Case Studies, and Investigative Data. Final Report to the Laura and John Arnold Foundation. Fairfax, VA: George Mason University. Available from: https://cebcp.org/wp-content/uploads/2021/05/LumWellfordInvestigationsProjectFINAL.pdf. Accessed on 12 July 2024.
29. Machado, H. & Granja, R. 2020. Forensic Genetics in the Governance of Crime. Singapore: Palgrave McMillan.
30. Machisa, M., Jina, R., Labuschagne, G., Vetten, L., Loots, L. & Jewkes, R. 2023. Factors associated with rape case attrition in the South African criminal justice system: a national cross-sectional study. *The British Journal of Criminology*, 63(3):588-614. Available from: https://doi.org/10.1093/bjc/azac044. A Accessed on 12 July 2024.
31. Magubane, K. 2017. White areas get bulk police resources, SAPS deployment figures show. Business day. Available from: https://www.businesslive.co.za/bd/national/2017-07-19-white-areas-get-bulk-of-police-resources-saps-deployment-figures-show/. Accessed on 13 July 2024.
32. Makhaza, Z.E. 2018. The effectiveness of detectives in the investigation of housebreaking cases in the Secunda Cluster, Mpumalanga South Africa [Unpublished Masters Technology Dissertation] University of South Africa, Pretoria.
33. McEwen, T. & Regoeczi, W. 2015. Forensic evidence in homicide investigations and prosecutions. Journal of Forensic Sciences, 60(5), 1188-1198. Available from: https://doi.org/10.1111/1556-4029.12787. Accessed on 12 July 2024.

34. Mofokeng, J.T. 2012. Perspectives on supervision and mentorship within the South African Police Detective Service. Acta Criminologica: African Journal of Criminology & Victimology, (sed-1), 70-84. Available from: https://hdl.handle.net/10520/EJC138453. Accessed on 11 July 2024.
35. Moran, J. 2022. Applying Modern Investigation Methods to Solve Cold Cases. National Institute of Justice. Available from: https://nij.ojp.gov/topics/articles/applying-modern-investigation-methods-solve-cold-Cases. Accessed on 11 July 2024.
36. Motsepe, L.L. 2019. A Critical Analysis of the Investigative Capacity of General Detectives in Handling Fraud Cases. [Unpublished D Litt et Phil Thesis] University of South Africa, Pretoria.
37. Mouton, J. 2014. *How to succeed in your master's or doctoral studies: A South African Guide and resource book*. Pretoria: Van Schaik.
38. National Institute of Justice (NIJ). 2017. National best practices for sexual assault kits: A multidisciplinary approach. US Department of Justice, National Institute of Justice. Available from: https://www.nsvrc.org/sites/default/files/2017-08/250384.pdf. Accessed on 13 July 2024.
39. Neves, C. & Zieger, M. 2023. Total Human DNA Sampling –Forensic DNA profiles from large areas. *Forensic Science International: Genetics*, 67, 102939. Available from: https://doi.org/10.1016/j.fsigen.2023.102939. Accessed on 12 July 2024.
40. Panneerchelvam, S. & Norazmi, M.N. 2023. DNA profiling in human identification: from past to present. *Malaysian Journal of Medical Sciences*, 30(6), 5-21. Available from: https://doi.org/10.21315/mjms2023.30.6.2. Accessed on 11 July 2024.
41. Parliament of South Africa. 2023. High Case Load For Detectives Worries Police Committee. Retrieved from: https://www.parliament.gov.za/news/high-case-load-detectives-worries-police-committee.
42. Pennsylvania Office of Victim Services [n.d.]. There is no Suspect or there is Insufficient Evidence for Arrest. Available from: https://pcv.pccd.pa.gov/available-services/Pages/There-is-no-Suspect-or-there-is-Insufficient-Evidence-for-Arrest.aspx. Accessed on 11 July 2024.
43. PMG. 2012. Detective Dialogue: SAPS Detective Services: roles, training, careers, modernisation & other challenges. Available from: https://pmg.org.za/committee-meeting/14823/. Accessed on 11 July 2024.
44. PMG. 2013. Presentation to Portfolio Committee on Police: SAPS. Detective Service. Available from: https://pmg.org.za/files/130521policy.ppt. Accessed on 11 July 2024.
45. Punch, K.F. 2014. Introduction to social research: quantitative & qualitative approaches. (3rd edition). Sage.
46. Roberts, P. 2015. Paradigms of forensic science and legal process: a critical diagnosis. *Phil. Trans. R. Soc. B,* 370: 20140256. Available from: http://dx.doi.org/10.1098/rstb.2014.0256. Accessed on 12 July 2024.
47. Saeed, A., AlShafea, A., AlFaya, F.A., Asiri, M.Y., Saeed, A.B. & Alnasser, A. 2023. Short tandem repeat (STR) DNA analysis for using coffee cups as forensic medicine evidence. Cureus, 15(10), e47592. Available from: https://doi.org/10.7759/cureus.47592. Accessed on 11 July 2024.
48. Saini, M. & Kapoor, A.K. 2016. Biometrics in Forensic Identification: Applications and Challenges. *Journal of Forensic Medicine*, 1(2): 108. Available from: https://doi.org/10.4172/2472-1026.1000108. Accessed on 11 July 2024.
49. Schwartz, G.J. [n.d.]. When detectives speak up. Available from: https://www.academia.edu/83487005/When_detectives_speak_up?f_ri=168613. Accessed on 11 July 2024.
50. Sibisi, N.T. 2019. An analysis of occupational stress among South African police service detectives working on murder cases: A case study of Inanda Police Station (Unpublished master's in social science dissertation), University of KwaZulu-Natal, Durban.
51. Smit, N.M., Morgan, R.M. & Lagnado, D.A. 2018. A systematic analysis of misleading evidence in unsafe rulings in England and Wales. *Science & Justice*, 58(2): 128-137. Available from: https://doi.org/10.1016/j.scijus.2017.09.005. Accessed on 11 July 2024.
52. Smith J.H. 2024. An exploration of the identification and processing of forensic investigative leads to investigating crime in the South African Police Service in South Africa. [Thesis]. Pretoria: University of South Africa.
53. Smith, J.H. & Horne, J.S. 2023. The value of forensic DNA investigative leads in South Africa. *Journal of Forensic Science & Criminal Investigation*, 17(4), 555969. Available from: https://doi.org/10.19080/JFSCI.2023.17.555969. Accessed on 11 July 2024.
54. Smith, J.H. & Horne, J.S. 2024. The processing of forensic investigative leads in criminal investigations conducted by the South African Police Service. *International Journal of Social Science Research and Review*, 7(4), 284-303. Available from: http://dx.doi.org/10.47814/ijssrr.v7i4.198. Accessed on 11 July 2024.

55. Smith, J.H. & Singh, M. 2024a. Forensic DNA Profiling: Legal and Ethical Considerations. *Journal of Scientific Research and Reports*, 30(5), 141-144. Available from: https://doi.org/10.9734/jsrr/2024/v30i51929. Accessed on 11 July 2024.
56. Smith, J.H. & Singh, M. 2024b. Forensic DNA and Forensic DNA Investigative Leads. *Journal of Forensic Medicine*, 9(2), 347. Available from: https://www.hilarispublisher.com/open-access/dna-forensic-and-forensic-investigative-leads-105209.html. Accessed on 11 July 2024.
57. Soukara, S. 2020. The role of investigative interviewing on witness testimony. *Cyprus Review*, *32*(1), pp.63-88. Available from: https://cyprusreview.org/index.php/cr/article/view/724. Accessed on 11 July 2024.
58. South Africa. 2013. Criminal Law (Forensics Procedure) Amendment Act 37 of 2013. Pretoria: Government Printers.
59. South African Police Service. 2020. Regulations under section 15AD of the South African Police Service, 1995 (Act No. 68 of 1995), (GNR 396 of 2020). Pretoria: Government Printers.
60. South African Police Service. 2022. Standard operating procedure for the management of forensic investigative leads. Pretoria: Government Printer.
61. South African Police Service. 2023. Annual Performance Plan 2023/2024. Retrieved from: Available from: https://www.saps.gov.za/about/stratframework/strategic_plan/2023_2024/annual_performance_plan_2023_2024.pdf. Accessed on 11 July 2024.
62. Speaker, P.J. & Wells, R. 2021. The Return on Investment from Rapid DNA Testing of Sexual Assault Kits. *Medical Research Archives*, 9(11):1-14. Available from: https://doi.org/10.18103/mra.v9i11.2600. Accessed on 11 July 2024.
63. Tom v S (CA 01/2021) [2022] ZAECMKHC (98). Available from: https://www.saflii.org/za/cases/ZAECMKHC/2022/98.html. Accessed on 11 July 2024.
64. Triverio, S.C. & Márquez, M.C. 2022. The need for cross-border exchange of genetic data for criminal investigation purposes in Latin America: Implementation challenges. Spanish *Journal of Legal Medicine*, 48, 158-162. Available from: https://doi.org/10.1016/j.remle.2022.03.002. Accessed on 12 July 2024.
65. Van der Watt, M., Benson, B. & Labuschagne, G. 2015. From stranger to serial: (Re) emphasising the value of docket analysis as a linkage tool in serial rape identification. Acta Criminologica: Southern African Journal of Criminology, 28(2), 62-77. Available from: https://hdl.handle.net/10520/EJC185957. Accessed on 11 July 2024.
66. Walsh, S.J., Curran, J.M. & Buckleton, J.S. 2010. Modelling Forensic DNA Database Performance. *Journal of Forensic Sciences*, 55(5), 1174-1183. Available from: https://doi.org/10.1111/j.1556-4029.2010.01426.x. Accessed on 12 July 2024.
67. Western Cape Government. 2019. *Detective services report confirms lack of training and under-resourcing.* Available from: https://www.westerncape.gov.za/ news/detective-services-report-confirms-lack-training-and-under-resourcing. Accessed on 07 July 2023.
68. Wickenheiser, R.A. 2021. The value of forensic DNA leads in preventing crime and eliminating the innocent. *Forensic Science International: Synergy*, *3*, p.100201. Available from: https://doi.org/10.1016/j.fsisyn.2021.100201. Accessed on 11 July 2024.