Rape, Sexual Abuse Investigation and the Use of DNA Evidence in the Northern Cape, South Africa

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Abstract

Gender-based crimes such as rape and abuse have increased exponentially, as shown in the quarterly South African Police Service (SAPS) crime statistics. In Northern Cape, in particular, these crimes seem to be increasing rapidly, and socio-economic factors such as high unemployment and substance abuse seem to be the main contributing factors. Crime statistics from the last quarter of 2023 showed that 103 sexual offences were reported. This represents 1.4% of the overall reported sexual offences in South Africa. These statistics are very concerning and require police to develop novel strategies to stop rape and sexual abuse. The number of unsuccessful prosecutions due to lack of or insufficient evidence such as Deoxyribonucleic Acid (DNA) is particularly worrying. A qualitative research approach including the phenomenological research design were adopted during research for this article. Fifty-five (55) participants) were purposively sampled. In addition, unstructured key informant interviews (KIIs) and focus group discussion (FGDs) were adopted for data collection. The collected data were analysed using inductive Thematic Content Analysis (TCA). This article focuses on the effective use of DNA evidence during the investigation process of sexual offences in Northern Cape, South Africa. It also highlights the importance of incorporating DNA evidence to improve the accuracy and efficiency of sexual crimes investigations. The article also seeks to explore the significance of DNA analysis in the investigation of sexual assault crime.

Keywords: Deoxyribonucleic acid evidence; investigations; Northern Cape; rape; South Africa

UNISA university of south africa PRESS
Journal of Law, Society and Development
#16030 | 21 pages
https://doi.org/10.25159/2520-9515/16030
ISSN 2520-9515 (Online)

Introduction

The quarterly South African crime statistics, especially sexual crimes are worrisome considering the long-term impact endured by victims and society in general. The authorities emphasise efforts to address criminal problems, but sexual crime and gender-based violence remain a major challenge. This requires multi-disciplinary approaches and cooperation between different stakeholders, as research shows that various factors contribute to sexual crimes such as socio-economic factors, drug abuse and other social ills. It is also important to emphasise the need to strengthen the police and effectively train investigators to ensure that perpetrators are successfully prosecuted. The 2024 second quarter crimes statistics show an increase in almost all categories of crime in the country, and there are no signs that this picture will improve, as all factors contributing to crime (such as high unemployment and substance abuse) remain unresolved. Incidents of rape and sexual assault increase significantly every reporting quarter of all police areas.

Sexual crime investigations are complicated and this complexity is exacerbated by resource constraints and other challenges. Research has shown that DNA evidence is an essential tool for the search or unravelling of truth (Lynch and Hancock 2012, 19). DNA provides hope for victims of sexual crimes and may eventually be the only tool against impunity. This article analyses the use of DNA evidence in rape investigations in the Northern Cape. Sometimes members of the community lose confidence in the Criminal Justice System (CJS) and take the law into their own hands.

A study conducted by (Lynch and Hancock 2012) indicates that DNA evidence plays a significant role in the investigation and successful prosecution of rape offences. They emphasise the importance of collecting DNA samples from all possible areas, such as the clothing and body parts of victims and suspects and immediately sending these tests to laboratories for analysis. Sir Alec Jeffreys, who pioneered DNA analysis, discovered that individuals could be easily differentiated on the basis of detectable variances in their DNA (The Royal Society 2017). The DNA profiling was utilised for the first time in a criminal investigation in the United Kingdom (UK) during the examination of the rape and murder incidents involving Lynda Mann and Dawn Ashworth, which transpired between 1983 and 1986 (The Royal Society 2017). In this instance, Richard Buckland was acquitted following DNA analysis in 1987, while Colin Pitchford was later found guilty. Since 1987, significant research and resources have been dedicated to advancing and refining DNA analysis technologies. The United Kingdom National DNA Database was established in 1995 with the aim of optimising the investigative utilisation of DNA profiles and identifying repeat offenders. In the Mann and Ashworth case, DNA results indicated that only one perpetrator was responsible for the assault, and none of the six accused men's DNA profiles matched that of the assailant. Following the results, the six men who were wrongly accused were promptly released and absolved of the crime.

Another suspect, the young girl's mother's former boyfriend, was arrested and sent to the DNA laboratory for analysis. The DNA results revealed an accurate DNA match to the rapist (the mother's former boyfriend of the young girl). He was sentenced to life imprisonment (Little and Hancock 2012, 97).

Furthermore, Albert, Johnson, Lewis, Ram, Roberts and Walter (2014, 18) stated that "forensic scientists use DNA to analyse semen, blood, saliva, skin, or hair from criminals at the scene of a crime." This method is officially known as DNA profiling. McInnes (2017, 32) defined DNA as a molecule that transmits genes used to grow, function, develop, and reproduce all known viruses and many organisms. McInnes (2017, 33) also points out that "DNA is a tool that can be used properly to provide accurate information on rape suspects." Lynch and Hancock (2012, 97) argue that "the main reason DNA is the most important evidence in the investigation of rape is that DNA is found in all cells in our bodies (except red blood cells), and therefore rapists are bound to deposit and leave evidence at the scene of the crime."

Smith and Urbas (2012, 113) add that "DNA has made an important contribution to criminal investigation worldwide since its widespread adoption." Direct matching of DNA profiles, such as comparing DNA profiles obtained from suspects and databases, is still a widely used technique in criminal investigations, helping to solve many rapes and violent crimes. When considered as exculpatory evidence, the weight of DNA is much greater than the weight of other non-DNA evidence materials. Moreover, Lynch (2013, 102) adds that:

> DNA evidence has freed those who have been falsely accused, while it has also helped investigators to link those who have been involved in a string of rape and violent crimes (linkage analysis), in such a way that DNA has been considered the new 'gold standard' of rape investigations.

Wilson, McClure and Weisburd (2012, 98) point out that "identifying persons involved in crime is an important undertaking in the investigation of rape." When potential suspects are identified, it is easier to understand the role played or not by each suspect in the commission of the crime. The more precise the method used to identify this event, the better understanding of the events that occurred. DNA testing is the most accurate and reliable method of identification in this case, and the certainty is higher than in other methods. Murphy (2015, 69) agrees with previous authors that "DNA evidence is a single tool for criminology investigations that investigators should rely on in rape investigations, because it is a silent witness that can stand alone without necessarily relying on other evidence." Murphy (2015, 85) further argues:

> Critical analysis of DNA may be helpful in addressing four critical levels of investigation, namely, source (Referring to the accused the source of semen found at the crime scene?), sub-source (Where are the DNA exhibits found, are they found at the crime scene, in the victim's vagina or are they from the semen of the accused?), activity

(Did the accused have intercourse with the victim?) and offence (Did the accused rape the victim?)

Research has shown that many sexual crimes are not prosecuted well and that the perpetrators are released to continue to commit similar crimes or other horrible crimes (Murphy 2015, 85; Wilson 2012, 98). The section below, highlights salient features of DNA evidence. It also describes the methodology used to carry out the research and analysis of the results. The article concludes with the findings and recommendations.

Literature Review

DNA evidence plays a significant role in solving criminal cases and forms the basis of all sexual and murder cases investigations. In addition, DNA unlocked cases where there were no eyewitnesses, exonerating the wrongly accused, and assisting law enforcers to ensure that perpetrators rape or murder crimes face the might of the law (Mulaudzi 2020; Maluleke 2016; Dintwe 2009; Ubisi 2023; Maffa, 2020). The significance of DNA evidence strongly lies in its analysis and the understanding of DNA processes by those who are charged with the responsibility in the value chain of DNA analysis from the time a crime was committed to the point where collected evidence is presented in the court of law (Lonsway, Archambalt, O'Donnell and Ware 2016, 48; Lyman 2013, 101).

DNA is present in blood, skin cells, tissues, organs, muscles, brain cells, bones, teeth, hair, saliva, mucous membrane, sweating, fingernails, urine and waste, amongst others (Lonsway et al. 2016, 48). These authors repeat that "DNA evidence collected at the scene of crime can identify a suspect with the crime or exempt him from the crime and the scene of a crime". If DNA samples have been discovered at the scene of crime, investigators must gather these DNA samples properly to compare them with known samples to locate or remove the suspect from the scene of crime. Criminal investigators of sexual offence should have the necessary equipment and training to search for any or all the evidence mentioned to identify the perpetrators. During sexual assault, biological evidence such as hair, skin cells, semen, and blood is almost undoubtedly left in the victim's body or in the scene of crime. Lonsway *et al.* (2016, 79) argue that DNA evidence aids investigators in addressing the following aspects of rape:

Establish sexual contact: Firstly, biological evidence can help establish that a sexual act took place. Establishing that sexual contact has occurred or that certain sexual acts (including rapes) have been committed (as a result, focusing on determining whether sexual contact [rape] has occurred) can be crucial not only for investigating and prosecuting sexual acts, but also for sentence purposes. In addition, the absence of biological evidence does not necessarily mean that there have been no sexual acts. There are many reasons why there could no biological evidence in sexual assault cases, such as the absence of medical examination, the delay between the assault and medical examination and the suspects wearing condoms.

Identify or exclude a suspect: If the suspect is unknown, a DNA profile may be developed from evidence collected during the investigation and uploaded into the national DNA database known as the Combined DNA Index System (CODIS). The DNA profile can then be compared with others in the database, to identify who the suspect is. If the suspect's identity is known, investigators can compare legally obtained DNA reference samples with DNA recovered during the investigation. This can potentially match the individual(s) with biological evidence associated with the assault. This means that DNA reference standards should be collected from suspects whenever possible, and forensic profiles should be submitted to CODIS after the DNA from any consensual partner has been excluded. Excluding suspects is another key use of DNA evidence, and it can also exonerate wrongfully convicted individuals.

Identify prior convictions or arrests: If the suspect has already been arrested and arrested as a result of CODIS, this information can be provided in the prosecution of sexual assault cases. However, this is only true when previous cases are significantly similar to the current case, demonstrating patterns of criminal behaviour in the past. Otherwise, this information can only be provided in the preliminary stage of the trial and not for a conviction purposes.

Link cases based on evidence: DNA evidence may also assist in linking cases with evidence submitted in any past cases, not just for sexual assault, but also for any criminal offences (rape) included in the national database.

In a DNA-rich environment, the interpretation of the DNA of a single sample can provide key scientific evidence to exclude or include an individual as a possible source of DNA. This is done by calculating and presenting the probability of a match, i.e., by statistically calculating how rare any match DNA profile in a population is. DNA analysis focuses on examining specific DNA areas that are known to be particularly variable between individuals and creating DNA profiles. "In rape investigation, samples of body fluids, hair or tissue from survivors or other elements such as crime scene can be collected, which can contain traces of the attacker's DNA" (Gourarie 2018, 8). Gourarie further states that "DNA collected during the rape investigation can be analysed in two ways." One method is to extract DNA from samples taken at the scene of crime and compare it with the suspect's DNA. Another method is to extract DNA from the suspect assailant and compare it with the profile in the database, known as "slow DNA". Rapid DNA technology allows law enforcement agencies to receive DNA matches from a database in a matter of hours, speeding up the investigation process. According to Wyner, Barash and McNevin (2020, 39), "the significance of DNA analysis is supported by the fact that only small sections of an individual's DNA are analysed routinely for forensic evidence." The parts analysed are called Short Tandem Repeats (STRs), though mutations that affect the number of repeats is relatively common, so within a population there are usually several different versions of the DNA at an STR locus with different repeat lengths. The different versions are called alleles and the frequency of occurrence of a specific allele (i.e., a specific number of repeating

units) at the tested locus in a specific population provides a measure of how common that allele is in that population. This information is essential for calculating match probabilities. If only one STR was analysed, there would be many people with the same allele, purely by chance. It is therefore necessary to analyse a number of different STR loci to ensure that the chance of two unrelated people having matching DNA profiles is very small, and that assists in affording the investigator with conclusive DNA analysis results.

Wyner *et al.* (2020, 15), posits that, "what makes DNA analysis and testing process so unique and significant for rape cases is the fact that it is applied using different methods in order to obtain the required genetic profile which will make sure that the results obtained through DNA analysis are correct and unquestionable." These methods include:

The STR analysis: This is a commonly used method in forensic science that looks at specific regions of DNA where there are variations in repeated segments known as the STR.

Mitochondrial [mt]DNA analysis: This method looks at the DNA present in mt, which are organelles found within cells. By using this method, it is possible to analyse DNA samples that may be old or degraded.

Y-chromosome analysis: This method focuses on the Y-chromosome found only in males, which is useful in paternity testing or determining the origin of a lineage.

DNA sequencing analysis: This method involves the complete sequencing of DNA, providing comprehensive information on the genetic material of an individual (Wyner *et al.* 2020, 15). The Royal Society (2017, 29) recommends that "in order to ensure the results of accurate DNA analysis are achieved, it is also crucial to analyse the mtDNA contained in small structures (called mt) in cells". The mtDNA genome consists of only 16 500 bases, and unlike two copies of the parent DNA of nuclear DNA, the same cell contains thousands of copies of mtDNA. Both men and women have mtDNA, but it is inherited only from the mother. All mothers' children have the same mtDNA and all their mothers have the same mother's lineage. Because there are many copies of mtDNA in the cell, this analysis is useful for small amounts of DNA or for DNA samples that are very old and decomposed. "STR profiles and mtDNA analysis are distinctly different, and there are many more people who will just randomly match mtDNA profiles than STR profiles" (Royal Society 2017, 31). Suppose there is a correlation between the two DNA STR profiles, in that case, the suspect can be the source of the material, or the material is from a second person with an identical DNA analysis profile as the suspect, or the correlation is false due to contamination or other errors. "The likelihood of matching is an estimate of the likelihood (or probability) of observing DNA analysis profiles obtained if a source other than the suspect is not associated with it (Royal Society 2017, 31).

Furthermore, Singh (2018, 71) explains that "DNA analysis is based on comparing DNA images, and these images come from body fluids and other cell material deposited during criminal proceedings." Exhibitors carrying DNA exhibits are mostly hair, blood, saliva from discarded cigarettes or beverage cans, semen from intimate blood samples of victims, and the greatest advantage is that these evidence materials are always available. These exhibitions are called "questionable samples". DNA samples from a questioned sample are compared with DNA profiles of one or more suspected, victim or other persons with regular access to the place where the sample of the crime scene is collected, as well as other related individuals such as relatives. In general, mouth cells (buccals) are collected in known samples rather than blood (Singh 2018, 71). Singh (2018, 71) also notes that "Buccal cell collection includes the collection of skin cells by swabing on the inner cheeks of an individual's mouth." The sample is generally frozen to store. Known samples are collected from people who have been known for research or from people who have been found by searching for a DNA database, so that the DNA is so unique that researchers do not need to rely on a single DNA source. According to submissions by various authors (Lonsway *et al.* 2016; Lynch *et al.* 2013; Wilson *et al.* 2012; Lynch and Hancock 2012), Murphy 2015, Gourarie 2018, Wyner *et al.* 2020; The Royal Society 2017; Sing 2021, Singh 2018), critical analysis of DNA, its importance and value in rape investigations are clearly a major part of the fight and response to the current scourge of sexual crime. Researchers also observed that the importance of DNA may be influenced by several factors such as whether DNA specimens were properly identified from the crime scene, whether they were correctly collected, whether the custody chain was maintained and whether these biological specimens were properly analysed.

Identifying, handling, collecting, transporting and preserving DNA evidence until it is presented in a court of law plays an essential role in the investigations of rape cases. Several researchers (Wilson, McClure and Weisburd 2012, 98; Lynch and Hancock 2012, 97; Murphy 2015, 69; Gourarie 2018, 8; Wyner, Barash and McNevin 2020, 39) agree that DNA evidence is the most reliable piece of evidence during the commission of contact crimes and that it is always available at the crime scene; however, only the eye that is looking or searching can either identify or miss it.

The Challenges and Opportunities of Using DNA Evidence in Rape/Sexual Offences Cases in the South African Context

The rape/sexual offences survivors often do not report rapes and conviction rates are very low. Another problem in prosecuting sexual assault offences, including rape cases in South Africa is that its national DNA forensics technology system is slow in processing samples. Delays make it more difficult for authorities to keep a repository of samples, which could lead to quicker convictions and lengthy court proceedings. In addition; problems with technology exist and this gives a perception that offenders can get away with crime (Bhobo 2022).

The South African DNA backlog is crippling the CJS, with more emphasis placed on the Department of Justice and Constitutional Development (DoJ & CD), the justice system's ability to successfully prosecute perpetrators of rape. The police minister (Bheki Cele) revealed that over 10 000 rape cases were opened with police, between July and September 2022. DNA backlogs have been reduced to 71 000 from just over 240 000. He promised that DNA backlog will be cleared by January 2023. However, Lifeline's director of advocacy, Sinikiwe Biyela, responded that the figures are not a true reflection of the challenges women and children face (Milazi, 2022). Moreover, Machisa, Jina, Labuschagne, Vetten, Loots, Swemmer and Meyersfeld (2009, 12) establish that in the rape cases they studied, there were numerous irregularities that made it difficult for these cases to proceed to court.

Furthermore, there are many cases where the police investigation and documentation of physical evidence are found to be deficient. A deficient docket might be missing important details like the names and addresses of the crime victim or other important details relating to the actual crime. Lack of political will is not the only problem in victims pursuing justice against their rapists. Police themselves have been accused of such abuse. Since 2012, SAPS officers have been accused of committing nearly 1 000 rapes, some of which allegedly occurred within police custody, according to the Independent Police Investigative Directorate (IPID), a department of the South African government responsible for investigating complaints against the South African Police Service and municipal police services. A report from the directorate from 2020 to 2021 registered 95 cases of rape by police nationwide, 15 of them allegedly having taken place in police custody (Bhobo 2022).

To clearly understand the opportunities presented by DNA evidence in solving rape cases, Newton (2013, 27) further states:

> What separates DNA from other evidence material is that it is always there, and it is conclusive; however, the presence of DNA alone does not prove rape; therefore, DNA, examined together with other evidential material such as lack of consent from the victim, violence and trauma, becomes critical in securing a valid conviction…When two objects come into contact, there will always be traces of evidence left on both.

Huffman, Hanson and Ballantyne (2021, 210) add that DNA effectiveness over any other biological exhibit is strongly supported by the endless, robust, scientific research data and continuous development of quality standards. These have ensured that DNA evidence provided is accurate, and results are most often highly reliable. Lonsway *et al.* (2016, 7) argue that "many investigators and prosecutors only see DNA evidence as useful in stranger sexual assault cases, as a means of establishing or confirming the suspect's identity." This perspective fails to recognise the many purposes of DNA, especially in sexual assault cases where the victim and suspect know each other. Lonsway *et al.* (2016, 7) suggest a need to train investigators and prosecutors to stop viewing DNA as a means of confirming what they already know. They should instead appreciate its value for advancing an investigation by producing leads and

corroboration, as well as identifying and excluding suspects. According to Lyman (2013); Huffman, Hanson and Ballantyne (2021), the DNA is a silent witness that cannot lie. It is essential that pieces of evidence and its analysis is conserved, and that there should be continuous development and training for those involved in the value chain. There have been great improvements from the time DNA was first discovered and applied during the investigation of contact crimes.

Methods

A qualitative research approach was adopted for this article. This qualitative research methodology was selected because it encouraged open responses and allowed participants to reflect on other participants' responses and experiences. In addition, it helps researchers to gain insights that are harder to obtain using other methods such as surveys (Morgan 1997, 23). Minnaar, Mistry, Patel and Rustin (2016) view research approaches as generally related to the interpretation of epistemology and tend to refer to different forms of data collection and interpretation. These forms depend on understanding, focusing on meaning. This research approach also involves several strategies that usually include the participation of smaller sample sizes, to comprehensively examine the experiences of the participants. In addition, a phenomenological research design was adopted in the study to understand experiences of participants on this subject. The phenomenological approach allows participants to identify their own meaning of experience through a type of interview and a technique applied. The research design aims to describe individuals' "lived experiences (phenomena) in an attempt to enrich lived experiences by extracting their meaning" (Holoway, 2005). Research was supported by the objective of the exploratory research to ensure that the selected participants were familiar with the subject to improve their understanding of the chain of custody of rape DNA evidence in the North Cape.

Experimental research design was found to be appropriate in this paper. Maluleke et al. (2020) concurs that in this type of research, selected participants must add value to the study being conducted. Moreover, similar study conducted by (Burns and Grove 2001) shows that the lived experiences of the selected participants/sample are unique experiences in a particular area. For the purposes of this article, three focus group interviews with the participants concerned in Galeshewe were conducted. Interviews with participants were arranged in order to minimise inconvenience as such interviews only took place at agreed upon venues. Participants consent forms were distributed to participants and were signed by all concerned. Details of the focus group sessions were communicated to the participants and a time was set up to accommodate them. Sample demographics are presented in table 1. Fifty-five (55) participants participated in the focus group interviews. Records of deliberations during these interviews have been archived for possible future reference.

Table 1. Demographics

Participants	Male	Female
SAPS	10	15
Forensic Science Laboratory (FSL)	3	
CSIR	2	
Community members 12	13	
Total		**55**

Source: Researchers (2024)

In table 1, the selected twenty-five (25) were Northern Cape SAPS investigators who deal directly with rape investigations, three (3) South African Police Service Forensic Specialists (SAPS FS) from SAPS Forensic Science Laboratory (FSL), situated in Arcadia, and two (2) DNA specialists from the Council for Scientific and Industrial Research (CSIR), based in Pretoria, and 25 community members from the Northern Cape. Overall, 55 participants formed part of this study. The selected samples were distributed as follows:

Sample A: First Sample (25 participants): SAPS crime scene (Rape) investigators, stationed at the following five (5) police stations in Northern Cape: Kimberley Police Station (001310), Jan Kempdorp Police Station (001322), Galeshewe Police Station (001320), Roodepan Police Station (001324) and Pampierstad Police Station (007114). The 25 participants were selected based on their experience in rape investigations, or because they had responded to rape scenes as first respondents and collected DNA evidence.

Sample B: Second sample (5 participants): This sample comprised 3 randomly selected SAPS FS from the SAPS FSL, situated in Arcadia, Pretoria and the other 2 DNA specialists from the CSIR in Pretoria.

Sample C: Third sample (25 participants): consisted of community members residing within the 5 selected police stations (**Kimberley, Jan Kempdorp, Galeshewe, Roodepan and Pampierstad**).

Data Collection Methods

For data collection, unstructured KIIs were applied, with samples A and B targeting SAPS rape investigators, SAPS FSL specialists and DNA experts. The focus group discussion/discourse was aimed at 25 community members. The type of interviews was conducted using simple observation schedules, observing the reactions of the A and C samples, and the use of non-participating observation schedules, as some of the most

important information came from outside the parameters of the conducted KIIs and FGD. Furthermore, documentary review was also used in data collection, including textbooks, journal articles on DNA evidence and rape, internet sources on DNA evidence and rape fighting, investigations and police, dissertations and thesis on crime fighting, prevention and police of rape and DNA evidence. This article used the FGDs, as it involved gathering groups guided by facilitators to provide feedback on clearly defined topics (Leedy *et al.* 2010, 148).

Focus groups discussions proved to be a very effective way of collecting information from a substantive group. Several questions were used to guide the discussion. The following questions are described in this article: (1) How to best use DNA tests during rape investigations? (2) What is the selective source of DNA evidence from the rape investigation? (3) How can the chain of custody of rape DNA evidence be effectively maintained? (4) How can developed conceptual models maintain DNA evidence?

Data Analysis

The inductive TCA was used to analyse collected data. The TCA focuses on identifying and clarifying patterns and themes in qualitative research (Braun and Clarke 2014). This data analysis method refers to the identified themes are closely related to the data itself. Guided and based on the inference of Braun and Clarke, data analysis for this article is structured into six phases as follows:

Phase 1: Familiarisation with data

The researchers familiarised themselves with the collected data from samples A, B and C using the KIIs, FGDs and literature studies. This was achieved by transcribing, analysing and going through each script consisting of empirical data.

Phase 2: Generating codes

The researchers arranged codes to identify features of the collected data, focusing on semantic contents that appear interesting, referring to the most basic segment or element of the raw collected data, which was assessed in a meaningful manner based on the phenomenon under researcher. Key concepts were also identified from the participants' responses to check the commonality of their responses based on the posed questions.

Phase 3: Identifying themes

After codes have been identified across the data set, focus was then put on the analysis process of identifying the study themes, rather than codes. This involved sorting different codes into the study themes based on the objectives of this article.

Phase 4: Reviewing the study themes

This phase involved the review of the identified study themes, in terms of whether they correlate with the codes and the entire collected data, based on the objective of this article. The researchers also reviewed the identified study themes to ensure that they correspond with the research topic and objectives, supported by the Interview Schedule Guide.

Phase 5: Defining the study themes

This phase enabled the researchers to define and name the study themes after sorting the collected data, based on the research topic, problem statement, study aim, objectives and research questions, guided by the Interview Schedule Guide.

Phase 6: Article writing

The researchers believed that it was necessary to produce this paper *"Rape, Sexual Abuse Investigation and the Use of DNA Evidence in the Northern Cape, South Africa."* This was devised to possibly improve investigations and policing of rape, while guided by the participants responses by samples A, B and C and reviewed literature studies.

Study Findings

DNA evidence plays a significant role in criminal cases, both to convict the guilty and to exonerate those wrongly accused or convicted (McKenna, Cecil & Coukos 1997, 1). The 55 participants' responses are presented and discussed in this section, to gather perceptions on exploring the chain of custody for rape DNA evidence in the Northern Cape Province. Table 2 below depicts DNA evidence locations and sources.

Table 2. DNA evidence location and sources

Possible location of DNA evidence	Source of DNA
Bite mark or area licked	Saliva
Fingernail scrapings	Blood or skin cells
Inside or outside surface	Semen or skin cells of used condom
Blankets, sheets, pillows, or other linens	Semen, sweat, hair, or saliva
Clothing, including under-garments worn during/after assault	Hair, semen, blood, or sweat
Hat, bandanna/hood or mask	Sweat, skin cells, hair or saliva
Tissue, washcloth or similar items	Saliva, semen, hair, skin cells or blood
Cigarette butt; toothpick or rim of bottle, can or glass	Saliva
Dental floss	Semen, skin cells or saliva
Tape or ligature	Skin cells, saliva or hair

Source: Lynch (2013, 94)

The aim of the study was to investigate and analyse the efficacy of DNA evidence used in the Northern Cape in rape investigations. All research that was done, demonstrated that DNA could be used in rape investigations to link suspects to crimes. A remarkable case was that of a young girl who was brutally raped in the small town of Louisvale in Northern Cape which has demonstrated the practicality of this technology. DNA collected at the scene of the rape was the main evidence and practically demonstrated the benefits of DNA technology. It is the most accurate and reliable identification method used in rape investigations to help investigators identify, possibly arrest and prosecute perpetrators of crime. It emerged from research that SAPS investigators, DNA analysts and community members should be informed about the implications of reconstructing rape scenes. It was established that not all investigators understand the significance of DNA evidence, and not all have been properly trained and/equipped to deal with sexual offenses cases. The article suggests that certain phases such as the below mentioned should be adhered to during the rape investigation process:

Preliminary investigation (Rape is determined, suspect arrested, if possible, rape scenes are protected, victims and witnesses identified, basic statement taken and rape scenes processed).

In-depth investigation (The rape preliminary investigations data are re-examined, rape scenes revisited, rape scenes processed further, existing and new victims and witnesses are located and interviewed, documents processed, facts and evidence gathered, application of criminalistics ─ by SAPS investigators, SAPS FSL and DNA analysts should be arranged).

Concluding investigation (When a rape case is suspended, or a case is successfully concluded and prepared for a possible prosecution) stakeholders, in particular the SAPS investigators and DNA analysts should properly utilise resources available to them to clearly understand the commission of rape and determine what occurred during the rape incident. This will aid in maintaining the chain of custody, which refers to the proper procedure to be followed from the moment exhibits are collected from the scene until presented to court as evidence and ensure accountability and prevent possible evidence compromise. The rape scene reconstructions should be conducted carefully to avoid evidence contamination. The preliminary investigations of rape scenes should be conducted with as few mistakes as possible. An efficient rape investigation is very important for court proceedings, as the court will be able to arrive at a conclusive decision with less hassle and fewer deliberations.

To this end, the reconstruction of the rape scene must be carried out appropriately, regardless of whether the initial investigation of the rape scene was carried out by SAPS FSL. This allows the examination of photographs, notes, sketches, and physical evidence (DNA) collected during preliminary investigations to determine the sequence of the rape events, as originally stated.

DNA Evidence During Rape Investigations

Identifying DNA evidence is an essential skill in criminal investigations, especially in sexual crime. In this regard, first responders to these crimes must ensure the closure of the scene. In addition, they must ensure that unauthorised persons are not allowed to interfere with the scene until it is handed over to analysts who will ensure proper recording or record keeping, particularly in terms of ownership continuity. It is also important to note that crime scenes should be treated as sanctuary, and that victims of crime should be treated with respect and dignity, as they have just experienced traumatic experiences. According to section 32 of the South African Criminal Law Amendment (Sexual Offences and Related Matters), 2007, the DNA evidence should be properly analysed in the investigation of rape. Moreover, the Constitution (1996) emphasises that the South African legal system's guardian must afford victims of crime dignity. This emphasised the importance of training to ensure that the proceedings are followed from the outset until the case is brought before the courts and to successfully prosecute the perpetrator and release of innocent suspects. Furthermore, it emerged from the focus groups discussions that there are different views or perceptions of DNA evidence.

Wilson *et al.* (2012) highlights the importance of adequate training and experience for crime scene investigators. This will ensure the integrity of the crime scene, prevent the contamination of the crime scene, ensure the continuity of evidence and ultimately successful prosecution. Only properly trained and qualified crime scene investigators should be sent to the scene of crime. The study showed that participants have a complete understanding of what is expected of investigators and how to deal with DNA evidence at the scene of rape crimes. It also revealed the need for investigators to regularly attend refresher courses to ensure that their knowledge is always relevant and that they remain informed of the latest developments in crime investigations. Criminals do everything possible to hide their tracks, but the Locard Exchange Principle always prevails, because, according to this principle "*every contact leaves a trace*." This means that suspects are likely to leave something behind after the commission of crime or taking something after the commission of crime, which will eventually link the crime with a particular individual. Investigators must ensure that they make all efforts to track the evidence left behind by the perpetrators.

Discussions

We all transfer DNA through social or sexual contact with each other, touching objects, coughing, bleeding (Royal Society 2017, 29; Singapore 2021, 25; Singh 2018, 71). Transfer events require three factors to be considered namely, the source, opportunities and mechanisms. Analysts need to firstly consider whether DNA can be attributed to certain body fluids. Crime investigators use chemical tests or special lighting to identify bodies that may exist; however, tests of these bodies may differ in sensitivity and specificity and may also have several bodies. For example, if there is a very small, weak blood sample but a very strong DNA profile is obtained, it is also possible that the DNA

originated not from the blood sample, but from someone who touched the sample. This is commonly known as the linkage or elimination process. In this case, DNA analysts cannot give an opinion on the origin of body fluid. If an analyst has sufficient information to estimate that DNA originated from an identifiable body fluid, this information can help to assess the activity of DNA present in a sample (Royal Society 2017, 34). The integrity of the biological sample is very important in forensic casework. Biological contamination of evidence from another source is a very real possibility, especially when dealing with trace evidence. Sing (2021, 72) recommends the following precautions for investigators:

> Wearing full protective suits, face masks, disposable hand gloves before touching any evidence and change the gloves between handling different items. Use disposable instruments or clean them thoroughly before and after handling each sample. Avoid touching the area where you believe that DNA may exist. Avoid talking, sneezing, and coughing over evidence. Avoid touching face, nose, and mouth when collecting and packaging evidence. Air-dry the evidence thoroughly before packaging. Put evidence into new paper bags or envelopes, not into plastic bags. Do not use staples. Contact between victim and suspect samples should be always avoided. Each piece of evidence should be packaged separately into paper bags. Do not use plastic bags. Never re-use packaging.

Investigators and all those involved in the legal value chain must always remember that the use of DNA evidence in the investigation of rape is also subject to legal procedures and compliance requirements. Thus, the parties involved must respect the rights of the accused and ensure justice for the survivors. DNA evidence is admissible in court, but procedures for obtaining, testing and analysing DNA evidence are carefully regulated. Singh (2018, 71) emphasised that the use of DNA evidence "must comply with all constitutional requirements, especially in terms of human rights." Furthermore, the prosecutor must establish a clear custody chain, from the collection of DNA evidence to its analysis and submission to the court. Investigators should always remember that the collection of DNA evidence during rape investigations is especially intrusive and sensitive to victims. According to Grosseri (2018, 8; 2021, 39; Royal Society 2017, 29, 2021, 1, 2018, 71), DNA samples can easily be contaminated. "While it is easy for the perpetrator to leave their marks, the same applies to those who deal with this evidence, and therefore one must always be careful not to compromise the integrity of the exhibits found on the scene" (Wilson *et al.* 2012, 98).

Shortcomings of the DNA Evidence During Rape Investigations

In all investigations there are deficiencies such as identification, handling, transport and presentation of evidence, among others. Evidence contamination in rape and murder investigations has been identified as the most common defect in investigations. Human error can also lead to inaccurate results when DNA samples are collected, processed or analysed. It is important to note that the delay in rape DNA analysis is often due to the cost of private laboratories, while interpreting of data requires a high level of expertise,

and if not properly interpreted, it can lead to misinterpretation and costly errors in analysis.

Walke, Laporte, Willis, Schwarting, Nguyen, and Scott (2018, 98) state that while DNA evidence was generally considered to be very reliable, its use in rape investigations was limited. In addition, Meintjes-Van der Walt and Dhliwayo (2021, 48) argue that DNA can have a disproportionate impact on the CJS, and the use of DNA evidence can result in a higher percentage of convictions and a longer sentence. Research shows that sexual assault is a global challenge which in some instances is either under-reported or not reported at all. This assertion is in line with Rasool and Rasool (2020, 19); Skinner and Wienroth 2019, 30) who indicated an estimated one billion of such cases worldwide. Furthermore, Alshehhi and Haddrill (2019, 231) posits that "individual biological traces may be deposited in an incident before, during or after an alleged crime." Furthermore, "research shows that biological marks can be deposited directly or indirectly, which affects the interpretation of DNA tests" (Szkuta, Ansell, Boiso, Connolly, Kloosterman, Kokshoorn and Van Oorschot 2019, 34). Meintjes-Van der Walt and Knoetze (2015, 74) reveal that DNA evidence is one of the most valuable pieces of evidence used in criminal cases. As a former investigator, I dealt with sexual offences for over twenty-six years, and it is unimaginable how victims have to navigate through their lives after such experiences.

Most research participants indicated that they were sent to the scenes of crime, especially rape and murder ill-equipped. They also claimed that they did not have relevant training to enable them to understand the process of gathering DNA evidence. They indicated that their evidence was often susceptible to attack and rejection by the court, especially due to technicalities encountered during the collection of samples. This explains why rape cases in the Northern Cape and other parts of the country are low. Investigators and all those involved in the DNA analysis value chain must be fully aware of the challenges and shortcomings.

The use of DNA Evidence During Rape Investigations

This research found that DNA evidence analysis plays a crucial role in linking perpetrators of not only sexual-related crimes, but other crimes in general. It is noteworthy that crime scenes must be handled is a certain way to avoid compromise by ensuring appropriate recording and documentation processes from the scene until such evidence is presented in court. Wilson *et al*. (2012, 39; Newton 2013, 26), further argue that "although there are other traditional methods such as shoe prints, witness statements and victim statements, if DNA evidence is not presented to support them, the overall strength of these methods decreases."

Machado and Silva (2012, 56) also argue that DNA evidence is one of the best examples of how technology has changed criminal justice in the best way. In addition, Richardson (2012, 17) state that "DNA evidence is often seen as decisive evidence and is in most

cases regarded as sufficient evidence of guilt." Huffman, Hanson and Ballantyne (2021, 212) add that "DNA effectiveness in other biological exhibits is strongly supported by endless and robust scientific research data and the continuous development of quality standards." Lonsway *et al.* (2016, 7) argues that "many investigators and prosecutors see DNA evidence as the only means of determining or confirming the identity of a suspect as useful in cases of foreign sexual abuse." Furthermore, according to Wilson *et al*. (2012); Newton (2013); Machado and Silva (2012); Lynch (2013); Richardson (2012) and Huffman *et al.* (2021) DNA evidence can be derived as the most effective tool for conducting rape investigations. The researchers' opinions are also informed by the submission of the Locard Principle, which states "when two objects come into contact, there will always be traces of evidence left on both." As highlighted by Lynch (2013), Richardson (2012) and Huffman *et al.* (2021), "DNA is a silent witness that cannot lie, it is essential that this piece of evidence and its analysis is conserved, and that there should be continuous development and training for those involved in the value chain."

Conclusion

South Africa and particularly the Northern Cape continues to face many challenges in examining and prosecuting rape cases. Inadequate or lack of training of investigators and prosecutors, among other factors in rape cases investigation and prosecution using DNA evidence contributes to lesser convictions and failure of investigation. Limitations such as delays in processing DNA evidence was found to be a significant and pressing issue that largely compromise the effectiveness of the justice system in South Africa. The police acknowledges that there is a huge backlog in processing DNA evidence resulting in some cases thrown out of courts due to lack of or insufficient evidence. Budget cuts and human resources capacity among other challenges are cited for such delays. The SAPS crime scene investigators (rape), SAPS FSL forensic experts, and SAPS DNA experts are familiar with DNA technology. The availability of resources must be strengthened to avoid manipulating, contaminating or losing evidence of rape DNA. The investigation and collection of DNA exhibits/evidence must be conducted within 72 hours to retain their value and validity. Environmental conditions related to the protection and conservation of rape DNA evidence may result in the compromise on integrity.

In an attempt to offer pathways for continued exploration of this critical issue and broaden the discussions on the implications of the findings of this article for policy and practice, both locally and internationally, the researchers submit that the 'sexual violence (Rape) curriculum,' should be employed to enhance the limited knowledge on DNA evidence. The sexual violence knowledge that can be imparted within the schooling environment can make individuals develop consciousness whenever confronted with the opportunistic circumstances for the commission of rape. Therefore, future studies should cater for this area of research, which will closely look at available ideas and norms about sex, relationships, and bodily autonomy all shifted by the

schooling environment. There is a need for the incorporation of the sexual violence curriculum within the primary, secondary schools and tertiary institutions. In conclusion, the research established that, while the use of DNA evidence in sexual assault investigations in the Northern Cape, South Africa have been found to significantly enhanced the ability of investigators to solve crimes, there are some challenges which require attention. Challenges such as resources, training, especially in maintenance of the integrity of DNA evidence must be addressed. DNA evidence technology serves to strengthen the justice system and instil public confidence in the justice system.

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