

THE EFFICACY OF FORENSIC TECHNIQUES IN PROVIDING ADMISSIBLE EVIDENCE IN HOMICIDE INVESTIGATIONS IN KISUMU COUNTY; KENYA

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ABSTRACT

This study assessed the efficacy of forensic procedures in delivering acceptable evidence in homicide investigations in Kisumu County, Kenya. The study was anchored on Locard's Principle theory and The Actor Network Theory. The objectives of this study were: to assess the effectiveness of DNA sampling procedures in providing admissible evidence in homicide investigations within Kisumu County; to examine the use of toxicology in providing admissible evidence in homicide investigations within Kisumu County; to establish the efficacy of Fingerprinting in providing admissible evidence in homicide investigations within Kisumu County; and to investigate the forensic challenges. The study was carried out using an ex-post facto research design. The targeted population was the DCI officers and court prosecutors working in Kisumu County. The study used a census method to choose all 110 DCI officers in Kisumu County to participate. Prosecutors in Kisumu County, Kenya, were chosen via purposive selection. Questionnaires were the main method of data collection. Quantitative data was analyzed using descriptive and inferential statistics specifically linear regression aided by Statistical Packages for Social Sciences (SPSS) version 25. To describe the research findings, descriptive statistics in the form of measures of central tendency (frequency, mean, median, mode, and percentages) and measures of dispersion (range and standard deviations) was employed. The efficacy of forensic techniques on evidence admissibility was examined using inferential statistics, specifically Linear regression at 5% significance levels. Regression analyses uncover strong positive relationships between key variables, mainly, DNA Sampling Procedures, Use of Toxicology, Fingerprinting Efficacy, on Admissible Evidence forensic investigations. Multiple linear regression analysis predicts that these factors collectively account for 61.3 % a significant portion of the variability in Evidence Quality affirming their strength in providing admissible evidence for homicide cases. Specifically, DNA Sampling Procedures ($B = 0.304$), the Use of Toxicology ($B = 0.299$), and Fingerprinting Efficacy ($B = 0.354$) all demonstrate positive coefficients, indicating that improvements in these aspects lead to higher quality admissible evidence. On the other hand, Forensic Challenges ($B = 0.374$) carries a positive coefficient, suggesting that an increase in challenges faced during forensic practices corresponds to a decrease in the quality of admissible evidence. Equally, Forensic Challenges are shown to limiting in obtaining admissible evidence significantly. Based on the findings, the study recommends that the DCI Kisumu County work with the DCI headquarters and the NPS and the national government to address the challenges to ensure the DCI investigators using forensic service obtain admissible evidence for homicide cases.

Key Words: DNA Sampling, Toxicology, Fingerprinting, Forensic

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INTRODUCTION

Insecurity in the society is depicted by the presence of criminal activities and lawlessness. Violent crimes like homicides are irreversible and when they occur, they necessitate thorough and expeditious investigations to make sure that the perpetrators are brought to book and convicted accordingly; as a way of serving justice to the victims' families and the society as a whole. Homicide is the intentional killing of another person. Human life is treasured in all societies, and the sanctity of human life requires the police, who are not only law enforcers but are also tasked with protecting life and property, to properly investigate homicides and guarantee that justice is provided to the victim and his or her family members. This is despite the fact that homicide is a complex crime because it is typically committed in hidden locus with no one witness. This is complicated further by the fact that the victim is deceased and unable to speak, as opined by Magee et al., (2020), a challenge that should not allow the perpetrators to go free, hence the need for a forensic eye to assist in meaningful and objective reconstruction of the scene of crime. Nonetheless, the DCI, who are tasked with investigating violent crimes such as homicide, are expected to provide evidence for prosecution despite the fact that there are no eyewitnesses and the perpetrator has tampered with the scene to conceal his identity; all of this necessitates the use of a forensic eye to aid in the discovery of admissible evidence and the successful investigation of homicide cases.

Criminal investigation, according to Weston and Lushbaugh (2013), is the legitimate retrospective tracking of the what, where, when, who, and how of a crime, as well as the mental state that accompanies it. However, conventional methods of investigating crimes are severely constrained when it comes to complicated crimes such as homicide, due to the zealous efforts that criminals expend to make certain the cover-up of such horrible deeds. This is compounded by a lack of eyewitnesses who could provide evidence leading to the successful arrest, prosecution, and conviction of the perpetrator (Remund, Carmada, & Riffe, 2018), and this in itself highlights the critical need for a forensic eye to solve the dilemma by providing admissible evidence that can lead to a breakthrough in cases such as homicides.

Toxicology, on the other hand, assists in determining the cause of death by detecting residues of harmful components in deceased bodies in suspected poisoning scenarios. It is crucial in the examination of suspected poisoning, drug usage, and sudden deaths. This forensic technique use analytical chemistry to identify hazardous compounds, narcotics, alcohol, and chemicals that are damaging to the human body as proposed by McEwen, (2011). However, there is a dearth of studies demonstrating how effective this technique is in giving permissible evidence in the investigation of complex crimes such as homicides in Kenya.

Similarly, DNA analysis aids in tracing and tying a perpetrator to a crime scene by collecting trace evidence discovered at the scene or on the dead corpse, such as hairs, saliva, and sperm, among other things; in cases where the victim was raped prior to being murdered, (Ali et al., 2022). These are analyzed using DNA sampling protocols to assist in identifying the criminal and bringing him to justice. According to McEwen (2011), the role of forensic procedures in criminal investigations is to help establish the WHAT, WHERE, WHEN, by WHOM, and HOW. As a result, there is insufficient empirical evidence, particularly in developing countries such as Kenya, demonstrating the usefulness of these forensic procedures in providing permissible evidence that would aid in the resolution of homicide cases in court.

Mbaya (2016) investigated the current situation of forensic investigations in Kenya. The study attempted to characterize the process of forensic investigations, the level of training of experts, as well as the procedures in place for observing human rights and the obstacles that forensic investigators face in the country. The study found that the department was inefficient in terms of current forensic equipment and also lacked suitable infrastructure, making forensic investigations inadequate. While the study provided information about the state of forensics, it did not directly address how effective forensic science is in generating admissible evidence in homicides, which is a gap that this study will remedy. These and other research indicate that forensic procedures are still important in modern culture, including Kenya. Furthermore, the importance of

forensic science has led to the establishment of a state-of-the-art forensic laboratory at the DCI Headquarters in Nairobi, as well as the presence of Government Chemist Laboratories in Kisumu, Mombasa, and Nairobi. Despite the fact that forensic science has been practiced in Kenya for more than a decade, there is little empirical evidence demonstrating the efficacy of these forensic tools in providing admissible evidence in investigations, particularly in homicide cases; thus, there is a need to investigate the efficacy of forensic techniques in providing admissible evidence in homicide investigations in Kisumu County, Kenya.

Statement of the Problem

Forensic science is an authority that uses scientific analysis/techniques to assist investigators in determining the events of a crime. These procedures are employed in homicide cases and other violent crimes to gather, evaluate, and interpret trace evidence found at the site of crime, which aids in proving or disproving facts in any specific case. Notably, such evidence must be permissible in a court of law in order to hold out against the defense's cross-examination. Forensic science has been and continues to be used in a variety of sectors for a variety of goals. However, the studies that have been conducted fall short of explaining their role in acquiring admissible evidence in investigations especially in Homicides within Kisumu County. For example, Peterson and Sommers (2010) conducted a research on the role of forensic evidence in the Criminal Justice System process, Holder, Jr et al, (2015) studied the impact of Forensic Science on Research and Development, and closer to home, in Ghana, Koomson, et al, (2019) conducted a research on Forensic science; as a unique interdisciplinary tool aiding in the combat of crimes in Africa, and Mbaya, (2016) examined the state of forensic investigation in Kenya.

In Kenya today, the presence of the government chemist stations in Nairobi, Kisumu, and Mombasa, as well as the recently launched 'State of the art' forensic Laboratory at the DCI headquarters in Nairobi, could imply that yes, some of the forensic techniques are at play when it comes to investigation of crimes, in an attempt by investigators to yield admissible evidence, in courts. Despite the presence of forensic techniques in Kenya today, we are still experiencing a very low homicide case clearance rate among the courts. Equally, there is a dearth of knowledge on the efficacy of applying DNA analysis, toxicology and Fingerprinting in providing admissible evidence in Kenyan courts as far as homicide cases investigations are concerned. Notably, evidential admissibility is critical in homicide prosecutions. The increased number of unresolved homicide cases in the world today, despite the presence of forensic science presents a gap in determining whether they are efficacious or not in providing admissible evidence when it comes to investigation of homicides, hence necessitating this study within Kisumu County, Kenya.

Objectives of the study

The purpose of this study was to investigate the efficacy of forensic techniques in providing admissible evidence, in homicide investigations in Kisumu County, Kenya. The study was guided by the following specific objectives:

- To evaluate the effectiveness of DNA analysis in providing admissible evidence in homicide investigations in Kisumu County.
- To analyze the use of Toxicology in providing admissible evidence in homicide investigations in Kisumu County
- To establish the efficacy of Fingerprinting in providing admissible evidence in homicide investigations in Kisumu County
- To investigate the forensic challenges facing DCI officers while investigating homicide cases in Kisumu County

LITERATURE REVIEW

Role of Fingerprinting in providing admissible evidence in Homicide Investigations

A print is an invisible impression made by friction ridges on the human finger, palm, and foot as proposed by J. E. Hoover (2012). Finger prints are classified into three basic patterns: loops, whorls, and arches. They are a reliable method of personal recognition since the ridge arrangement on each human finger is unique and does not change with time, (Bose & Kabir, 2017). Dactyloscopy (Greek for "finger show") is the process of using finger prints to identify people. It has become a vital tool for modern law enforcement, particularly in investigations, because it assists in connecting the suspect to a crime scene or a crime. Fingerprints are distinct and unique to each and every individual, they can easily assist detectives in tracing the suspect and linking him/her to the crime scene or the victim in homicide investigations where the victim is deceased and unable to narrate the events of the crime (Roewer, 2013).

Fingerprints can be found on any solid surface, including the human body, and are classified as soft surface plastic prints, hard surface patent/visible prints, and latent/invisible prints (Crime Museum, 2022). Plastic finger prints are plainly visible to the naked eye and do not require any additional processing, making them easier to collect. Patent prints on the other hand, are obtained through high-resolution photography using a forensic measure, whereas latent prints are obtained by dusting a smooth/nonporous surface with fingerprint powder, lifting from the surface with an adhesive tape, and transporting them to the forensic lab for analysis, comparison, evaluation, and verification (Forensic magazine; Fingerprint Patterns, 2012). According to Saferstein (2015), computerized databases for fingerprint identification have substantially increased the efficiency of investigations, resulting in a large rise in positive identifications and links between individuals and physical evidence at crime scenes. In a UK examination of the fingerprint database, the collecting of fingerprint evidence in relation to high-volume crimes such as burglaries and car thefts was analyzed, demonstrating a higher capacity to identify suspects and expeditious case resolutions. Notably, fingerprints became an important identification of criminals in criminal investigation when Sir Francis Galton from England published a book titled "Fingerprints" in 1892 (Edmond, 2015), and subsequent studies have shown that fingerprint analysis as a technique has indeed become part and parcel of criminal investigations.

Smith et al., (2010) show how fingerprint analysis was used to give permissible evidence in a cold murder case that had gone unsolved for 30 years by analyzing Latent prints retrieved from the crime scene as well as the victim's car. Carroll Bonnet, 31, was murdered at home in 1978, while his automobile was stolen and later discovered abandoned in Illinois. Evidence was recovered from the crime scene, as were latent prints, but there was no match after analysis, leaving the case unsolved for a long time. Laura Casey compared the latent fingerprints to the IAFIS (Integrated Automated Fingerprint Identification System), which was not available at the time, and after a comparison, Jerry Watson, who was already serving a jail term for other charges in Illinois, was identified and charged, bringing to a close a murder case that had remained unresolved for 30 years, and this resulted in Herout and Casey receiving the 2012 Latent Hit of the Year award. Notably, the suspect was traced using latent prints that were admissible in court; however, the fact that the latent prints were ineffective in providing admissible evidence for nearly 30 years, until the same latent prints were compared against the IAFIS in 2008, leaves a gap on whether traditional analysis of latent prints can provide admissible evidence in homicide investigations. Closer to home, empirical evidence is insufficient in establishing how well DCI officers have exploited latent prints to provide permissible evidence in order to solve homicide cases, notably in Kisumu County, prompting this study.

Role of DNA in providing admissible evidence in Homicide investigations

Forensic DNA analysis, according to Bieber et al. (2016), can significantly be beneficial in criminal investigations. Since the establishment of national DNA databases in the 1990s and the introduction of global DNA data interchange in the 2000s, the value of forensic DNA has increased. The idea of reducing crime and raising the likelihood of apprehending criminals has fueled the development of DNA capabilities, legislation,

and policy. DNA stands for deoxyribonucleic acid and is the fundamental building block of all cells in the body. It is made up of four chemical bases: adenine, guanine, cytosine, and thymine. The sequencing and ordering of these bases in an organism's genome gives cells with the information they need to grow an organism, and forensic investigators can identify individuals using short tandem repeats of DNA. DNA also serves as a unique personal identification because each human being has a unique DNA material; even identical twins do not share the same DNA. While the utility of DNA can be observed in individual instances and some specific crimes, England and Wales' annual case resolution rate remains abysmal (Crime survey of England and Wales, 2020). The creation of high-quality standards and trustworthy scientific research data serves as a solid foundation for modern DNA profiling processes. These have ensured that the results are exceedingly dependable, as well as that the DNA evidence given is correct (Huffman et al., 2021). Human DNA can be found in nucleated cells in tissue, blood, or skin, as well as in spermatozoa (Inman and Rudin 2018), and it can be formed from white blood cells, sloughed epithelial cells, or sperm. They also believe that trace material retrieved from crime scenes, victims or suspects, or artifacts can be tested for DNA and profiled for identity reasons in many cases. According to Amankwaa and McCartney (2019), in addition to cells from blood, tissue, bone, and hair roots, saliva cells can be found on cigarette butts, drinking vessels, and toothbrushes, while hats, weapons, clothing, and car steering wheels can yield skin cells, which can be analyzed using DNA sampling procedures to provide admissible evidence. In the criminal justice system, DNA profiling is important since it leads to the identification of a suspect. DNA samples found at the scene of a murder are collected, and DNA from cells in such samples is extracted and copied using a technique known as capillary electrophoresis, which allows forensic scientists to identify distinct markers and the number of repeats for different markers in each allele, (Cao, et al., 2013).

Role of Toxicology in providing admissible evidence, in Homicide Investigations

Toxicology is the study of how pharmaceuticals and chemicals affect biological systems (Wilde 2011). It is considered the branch of science that deals with poisons, with a poison defined as any material that, whether accidentally or on purpose, causes harm to a living thing, whereas forensic toxicology applies toxicology and other fields to cases and issues where adverse effects of toxins or drugs can have legal implications and also, where the outcome is most likely to be used in the judicial process.

Postmortem toxicology and how it provides admissible evidence in Homicide investigations.

According to Essig (2012), post-mortem toxicology is the study of quantifying medications, poisons, alcohol, and other chemicals in order to determine how they caused death. According to Inman and Rudin (2018), the chemical content of blood or any other tissue must be quantified in order to show a cause-and-effect relationship. Human hair fiber study, for example, gives data on medications used and their dispersion over time (results are corrected depending on average hair growth). 4-5 Body parts contaminated with paint, bullets, drugs, or physiological fluids can potentially be used to link individuals to crimes. While empirical literature reveals that forensic toxicology has been used in several sectors, there is a lack of information proving how effective the approach is in giving permissible evidence in homicide cases, leaving a knowledge gap that this study tries to solve.

Griffiths (2015) conducted a study in which toxicology was utilized to determine the cause of death in 7 unexpected fatalities in Chicago, including a 12-year-old girl who died on September 29, 1982, after taking a capsule of Extra Strength Tylenol to relieve her headache. Later, six more people died after allegedly ingesting the same drug, prompting the Chicago police department to investigate the possible causes of the seven fatalities, and postmortem toxicology revealed that there was cyanide in each of the seven fatalities as a result of Tylenol drug, which the victims had ingested prior to their deaths. The medicine was promptly banned by the Chicago Police Department. This study is instructive in that it confirms that, yes, toxicology as a forensic technique is a silent witness in the absence of eyewitnesses, and that the Chicago police used postmortem toxicology to determine the cause of death in seven fatalities, providing admissible evidence.

However, the lack of empirical evidence in Kenya today demonstrating how effective this tool is in providing admissible evidence in homicide investigations leaves a gap on whether toxicology as a forensic tool is being used by DCI officers to determine causes of death while investigating homicide cases, particularly in Kisumu County, highlighting the importance of this study.

Forensic Challenges being faced by investigators in homicide cases.

Lack of enough resources for handling forensic science investigations

According to a study conducted by Irons and Lallie's (2014), there is an annual increase in forensic investigations worldwide, necessitating additional resources to handle the same. As the number of complex crimes requiring forensic science application increases, as stated above, there is a need for adequate forensic resources, which include personnel, facilities, equipment, and, of course, the expertise to handle such complex investigations, as opined by Brito et al., (2017). Adequate or inadequate evidence collection equipment at homicide scenes may result in selective evidence collection from a scene of crime, where by investigators will only pick evidence basing on availability of appropriate equipment, leaving out other crucial evidence due to unavailability of appropriate equipment picked. Zietkie et al. (2012) discovered that, this can lead to major disconnects in crime scenes' inquiries. Notably, the American Instructional Specialists Booklet on investigations emphasizes the importance of adequate hardware, which ultimately defines how investigators will carry out their task and the subsequent impact on case outcomes.

Inadequate in-service trainings for forensic investigators

All forensic investigators must be trained in the proper methodology, processing, documentation, and collection of physical evidence at crime scenes. Levinson and Almog (2015) offered many indicators to ensure that investigators of intense crimes like homicides receive professional training and that education programs are currently impeded by a lack of evidence-handling protocols and training in the proper use of scientific equipment. Dandura (2014) also conducted a study on the qualifications and abilities of forensic investigators and discovered that skill is very important when it comes to applying forensic technology in general criminal investigation. This study is consistent with Gardner's (2015) research on forensic investigation and investigator's competence, which discovered that forensic investigators with adequate forensic investigation skills performed investigations much more easily than their counterparts with limited expertise. It is worth noting that all of these studies are relevant to this study in the sense that an investigator's level of education may influence the outcome of investigations, especially when using forensic tools in search of admissible evidence; however, there is a lack of empirical evidence showing the status of our DCI officers in relation to special training on forensic science application, necessitating the need to determine whether they are adequately trained in accordance with the foregoing.

Lack of Policies and Regulations/ standard operating procedures on Forensic Science investigations

In the case of *Daubert vs. Merrell Dow Pharmaceuticals* (1995), the United States Supreme Court stated that the presence and preservation of rules controlling strategy activity is an important element in considering expert testimony. Most criminological science standards and best practices rely on the conscious cooperation of specific individuals from the scientific research network who strive persistently to improve overall quality (Pollanen et al., 2012). Irons and Ophoff (2016) conducted digital forensics study in South Africa. The research looked into the state of computer forensics in South Africa (mainly forensics on personal computers and laptops) and computerized forensics (forensics from digital artifacts, for example, cell phones, tablets, Global Positioning System (GPS) gadgets, and implanted frameworks). The investigation revealed that the country had passed legislation on the most effective strategy to combat cybercrime. Nonetheless, the inquiry concluded that a thorough and credible technique across the African mainland is required, culminating in broadly and globally applicable legislation. Mbaya (2016) investigated the current state of forensic investigation in Kenya. The study had several objectives, one of which was to examine the presence of standard operating procedures for forensic investigations, as one of the challenges facing investigating officers

of various crimes at the DCI, which were discovered missing, creating a significant gap in the investigation of complex crimes such as homicides. The two studies mentioned above demonstrate that, indeed, standard operating procedures are required to oversee and improve forensic science investigations. However, there has been no empirical study that shows a change in the status of the same since the one conducted by Mbaya, (2016), hence the need to discover the same among DCI officers investigating homicide cases in Kisumu County.

Theoretical framework

Locard's Exchange Theory /Locard's Principle/ Evidence Transfer Theory

According to Roncace and Nocosia (2016), Edmond Locard (1934) proposed this theory, which states that a perpetrator of a criminal act will frequently collect something from the crime scene and leave something that can later be used in the development of forensic evidence. This theory became widely recognized as Locard's exchange principle, according to P. L. Kirk (1953), noting that "wherever he steps, the things he touches, whatever he leaves, unconsciously as well, will act as a silent witness against him." Not just his footprints or fingerprints, but also his fibers, hair from his clothing, glass he fractures, tool marks he leaves, paint he scratches, and sperm or blood he gathers or deposits are silent witnesses to him" (Auma, 2018).

This idea, however, has a flaw in that it implies that the offender will always leave a clue that may be used to identify them, which is not always the case (Balakrishnan, 2020). In other cases, attackers may take great care to leave no evidence, or the evidence may be distorted or destroyed, making it difficult to identify the offender purely on trace and fragmented evidence. Furthermore, not every evidence uncovered at a crime scene may be relevant or acceptable in court, and detectives must be cautious when obtaining and analysing evidence in order to avoid erroneous convictions.

Actor-Network Theory

Actor-Network Theory (ANT) is a scientific field that studies the emergence of technology goods in society. Bruno et al. (1980) invented the term to describe their approach to technological and scientific innovation (Dwiartama & Rosin, 2014). As a result of social influences, ANT evolved from the interdisciplinary subject of science and innovation studies. According to supporters, research and innovation are not a linear or aggregate process that is independent of social dynamics and has a direct impact on society. When the social and the technology are implanted in one another, it is conceivable to include both advances and individuals using similar equipment in ANT (Sayes, 2014). ANT is most profitable since it enables for the equal and constant study of social and innovation. The significance of ANT in the current study arises from the overarching goal of analyzing the influence of various interventions on the application of forensic science in homicide investigations. ANT will contribute to the research on the utility of actor-network infrastructure, as well as the development of such networks, in discovering the ideal combination of human and non-human components to increase the reliability of forensic science in providing accepted evidence in homicide cases in Kenya. Given that forensic investigations rely on both human and non-human elements, ANT emphasizes the relevance of infrastructure components such as laboratories, field tools, social skills training, and forensic science laws and investigators in conducting forensic investigations.

Conceptual Framework

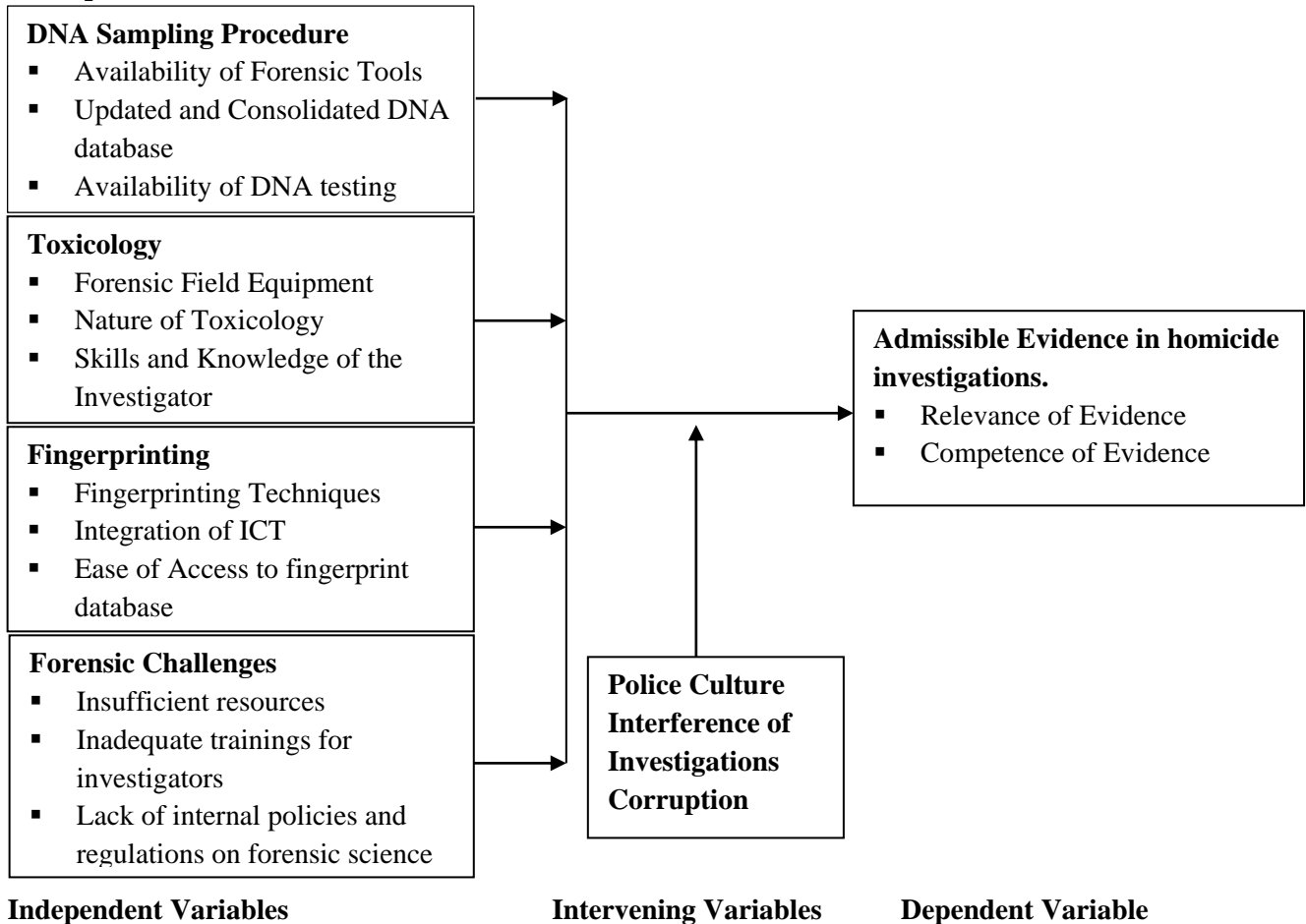


Figure 1: Conceptual Framework

METHODOLOGY

An ex-post facto/after-the-fact research design was used in this study. An ex post facto design is a form of experimental study design that analyses the links between factors that have already occurred, without the researcher's influence or control (Mertens, 2014).

All DCI officers in Kisumu county and court prosecutors at Kisumu High Court were included in the study's target group. This population was most appropriate for the study because the DCI is tasked with investigating serious crimes while the prosecutors at Kisumu High Court are tasked with prosecuting homicide cases; therefore, the study will be conducted in Kisumu County and will focus on homicide cases.

The researcher used purposive sampling design since the population was small and it was all inclusive and easily accessible. By use of censoring, the sample size for this study was 110 respondents as per establishment of DCI officers in Kisumu County (Inspection report, 2022). As for the prosecutors the study purposefully selected the four (4) who prosecute homicide cases in the High court of Kisumu. The total sample size of the study was therefore 114.

This study relied on primary and secondary data, both quantitative. A structured questionnaire was used to collect data. The researcher looked at secondary data from completed homicide case files.

The researcher ensured that all objectives were effectively captured in the instrument in this study to ensure content validity. Furthermore, construct validity was attained by accurately operationalizing the essential variables. The researcher in this study utilized a test-retest strategy to verify dependability.

The study collected quantitative data, and sampling and non-sampling mistakes were addressed through data cleaning and editing to avoid biased approximations. Data was categorized and coded using a research variables code book created specifically for the research variables. Statistical packages for social sciences (SPSS) Version 25 aided in data analysis. The data was summarized using descriptive statistics in terms of central trends (frequency, mean, median, mode percentages) and dispersion (range and standard deviations). Inferential data was presented using multivariate regression, which will aid in establishing the efficacy of forensic techniques on evidence admissibility. Multiple linear regression was utilized using the suggested model below to determine the effectiveness of forensic procedures on evidence admissibility in homicide investigations.

$$Y = B_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + \epsilon$$

Where Y= Evidence Quality

B₀ –the regression intercept

X₁ = DNA sampling procedures

X₂ = use of Toxicology

X₃ = efficacy of Fingerprinting

X₄ = forensic challenges

ε –error term

RESULTS

Response Rate

The response rate was as follows:

Table 1: Response Rate

Response	Frequency	Percentage (%)
Distributed Questionnaires	114	100
Returned Questionnaires	114	100
Unreturned Questionnaires	0	0
Total	114	100

Source: Research Data, (2023)

Table 1 displays that of the administered questionnaires 114 were completed and returned, resulting in a 100% response rate.

Findings of the main study objectives

DNA Sampling Procedures and Admissible Evidence

This section delves into the impact of DNA sampling procedures on the generation of admissible evidence. Table 2 presents the participants' responses to a Likert scale survey, where they indicated their level of agreement with various statements related to DNA sampling and the collection of admissible evidence. The scale ranges from 1-Strongly Disagree [SD] to 5-Strongly Agree [SA].

Table 2: DNA Sampling Procedures and Admissible Evidence

Statement	Mean	Std. Deviation
There are enough forensic tools in duty stations for effective DNA sampling procedures to yield admissible evidence	4.21	0.879
The DNA database is well maintained and updated so that when sample comparisons are done, they yield admissible evidence	4.19	0.939
The Standard Operating Procedures (SOPs) put in place regarding DNA sampling ensure that the evidence yielded is admissible	4.21	0.879
DNA sampling procedures yield admissible evidence which helps in the conviction of guilty suspects	4.19	0.939
Our management actively keeps the team informed about the latest trends in DNA technologies, fostering an environment where the collection, analysis, and interpretation of samples align with current advancements in the field, hence giving admissible evidence	4.20	1.002

Analysis and Implications

Availability of Forensic Tools

According to Table 2 above, homicide investigators within Kisumu County agree, with a mean of 4.21 and a Standard deviation of 0.879 that there are evidence collection kits which they use for collection of evidential material for DNA sampling procedures and this play a vital role when it comes to producing admissible evidence and this resonates with the study carried out by McKenna et al., (2017). The presence of appropriate swabs and collection kits ensures the accurate collection and preservation of DNA evidence. According to a study by McKenna et al. (2017), they observed that the quality of swabs directly impacts the integrity of DNA samples, highlighting the necessity of high-quality collection tools. Additionally, Johnson & Williams (2021) found that innovations in swab technology, such as the use of polymer-coated swabs, have significantly improved DNA yield and sample integrity, thereby enhancing the potential for admissible evidence.

Maintenance of the DNA Database

A well-maintained DNA database, rated at a mean of 4.19 with a standard deviation of 0.939, serves as a cornerstone of the forensic DNA analysis and this helps in yielding admissible evidence in homicide cases.

According to the findings of this study, investigators of homicide cases in Kisumu county do agree that indeed, they benefit from the DNA Database when it comes to identification of suspects and exoneration of innocent persons from the onset of investigations. The accuracy of DNA profiles in the database ensures reliable matching of samples drawn from a scene of crime and those found in the data base, in order to narrow down on the suspects by providing intelligence leads. Reliability in evidence is just but one of the components of admissibility in the sense that, for evidence to be admissible, it must be reliable, relevant and competent. Budowle et al. (2011) emphasized that accurate profiling reduces false positives and negatives, and therefore, enhancing the credibility of DNA evidence in court. Recent studies, such as those by Roberts and Cole (2020), further corroborate the importance of high-fidelity profiling techniques in maintaining the integrity of forensic databases, a key component in DNA analysis. Therefore, homicide investigators in Kisumu County, agree that they benefit from the updated DNA database that is available, when it comes to investigation of homicides.

Data Integrity Measures is also another component of DNA which ensures that we get admissible evidence. Implementing stringent data integrity measures, such as checksums and redundancy protocols, helps maintain the accuracy and reliability of the database In order for DNA data base to give admissible evidence, the evidence must be accurate in the sense that it is related to the case before court and it should also be reliable.

Data integrity measures as noted by Kloosterman et al. (2014) is critical for preventing data corruption and ensuring that evidence derived from the database remains admissible. Data corruption if allowed can bring about a mix up in DNA results hence giving false results and this will automatically lead to its inadmissibility. The utilization of advanced data integrity tools, such as those discussed by Liu and Zhang (2023), has further enhanced the robustness and reliability of forensic databases. In Kisumu County, it is worth noting that investigators of homicides agree to be benefitting to such measures in DNA data base which give admissible evidence.

Standard Operating Procedures (SOPs)

The implementation of SOPs, rated at a mean of 4.21 with a standard deviation of 0.879, provides a structured framework for DNA sampling, handling, and analysis. Detailed protocols for crime scene processing ensure the proper collection and preservation of DNA evidence for further analysis and documentation. In homicide investigations, a scene of crime is a very key element of the investigation process since its only by doing so, that investigators are able to process the scene, get necessary evidential material and also get a mental picture of what exactly happened. How one processes a scene of crime will determine the success or collapse of the case in question. Therefore, there is need for proper processing and crime scene documentation in order to be able to construct it properly. Horswell (2016) emphasized that meticulous crime scene processing is crucial for preventing contamination and maintaining the integrity of evidence. Recent advancements in crime scene technology, such as 3D imaging and enhanced evidence tagging systems, as highlighted by Gupta et al. (2021), have further improved the accuracy and reliability of crime scene investigations. In Kisumu county, homicide investigators agree that indeed they have proper protocols guiding crime scene processing, to ensure that they get admissible evidence.

Continuous Training and Technological Advancements

Management's efforts to keep the team informed about the latest trends in DNA technologies are well-received, with a mean score of 4.20 and a standard deviation of 1.002. This continuous education ensures that the collection, analysis, and interpretation of DNA samples align with current advancements in the field. Complex crimes like homicides, unlike other crimes cannot rely on the traditional methods of investigation to give admissible evidence, it requires a forensic eye to speak on behalf of the victim who can't speak for themselves. When imploring DNA technologies, in investigations, it is important that you keep updated on the newest developments in the field so that you don't miss out on yielding admissible evidence. Management on the other side has got the responsibility of sensitizing investigators from time to time on the newest technological advancements in the DNA procedures so that they also adjust accordingly. Use of archaic or obsolete methods of DNA analysis instead of the most current one will definitely interfere with the results hence the admissibility of the evidence.

Competency Assessments: Periodic competency assessments help maintain high standards of performance among forensic analysts who may wish to use DNA analysis in investigations in an effort of yielding admissible evidence as seen in Kisumu County. Looking at the complexity of homicide as a crime, and the ever spirited efforts of the perpetrators to defy the possibilities of being arrested, forensic investigators need competency assessment from time to time in order to acquaint themselves with knowledge and technological know-how on application of such techniques and how they can yield admissible evidence. According to Pollack et al. (2016), these assessments ensure that personnel remain proficient in their duties, thereby enhancing the reliability of DNA evidence. Advanced assessment tools, such as AI-driven evaluation systems discussed by Lee and Thompson (2021), have improved the objectivity and precision of competency evaluations, however, this is yet to be realized in Kisumu County as respondents are yet to fully have a one on one experience on the same. **Knowledge Sharing Sessions:** Regular knowledge sharing sessions among forensic analysts foster a collaborative learning environment. Horswell (2016), avers that such sessions encourage the exchange of best practices and innovative ideas, improving overall forensic processes. Virtual

knowledge-sharing platforms and forums, as noted by Williams and Taylor (2022), have facilitated global collaboration and knowledge exchange among forensic experts. Last but not least, **Access to Research and Publications**: Provides investigators of homicide in Kisumu County an access to the latest research and publications which ensures that they stay informed about new developments in the field of DNA. Butler (2012) noted that staying updated with current research enhances the analytical capabilities of forensic professionals, thereby improving the admissibility of DNA evidence. The implementation of digital libraries and research databases, as described by Harris and Brown (2023), has made it easier for forensic analysts to access and stay abreast of the latest scientific literature and advancements; something that is agreed upon by investigators of homicide cases within Kisumu County.

Use of Toxicology and Evidence Quality

This section seeks to understand how Use of Toxicology Impacts Evidence Quality The findings were presented in table 3.

1-Strongly Disagree [SD]; 2-Disagree [D]; 3-Neutral [N]; 4-Agree [A]; 5-Strongly Agree [SA]. The results are summarized in Table 3.

Table 3: Use of Toxicology and Evidence Quality

	Mean	Std. Deviation
The presentation of a strong case of intent or malice in homicide cases is facilitated by the utilization of toxicological tests which yield admissible evidence.	4.51	.859
The thoroughness and completeness of investigations are ensured by running different toxicological screenings, giving admissible evidence leaving no aspect overlooked in closing cases.	4.49	.839
The interpretation and drawing of conclusions from toxicological evidence are bolstered by the presence of sufficient skill within departments.	4.21	.879
The utilization of toxicology has significantly contributed to the reduction of unsolved homicide cases by giving admissible evidence in Kisumu county.	3.85	1.039
The assembly of evidence for cold cases within the county is greatly facilitated by the extremely useful application of toxicological techniques, further bolstering its admissibility.	4.15	1.102

Analysis and Implications

Presentation of a Strong Case of Intent or Malice

The high mean score of 4.51 with a standard deviation of 0.859 indicates that the utilization of toxicological tests significantly facilitates the presentation of a strong case of intent or malice in homicide cases. This may include, the role it plays in determining Cause of Death: Toxicology which is defined as the study of poisons and how they affect the body, Wilde (2011, tests analysis enables determination of pharmaceuticals and chemicals effects on biological system. (see Fajic 2020). Ability to detect pharmaceuticals and chemicals effects makes this forensic technique valuable in cases with medico-legal ramifications as it enables the investigators to determine the cause of death. Through toxicological analysis, the investigators are able to identify the compound composition of the poison taken and the effect it has on the human body. In addition, the test also facilitates quantifying substances in the body to determine the cause of death. Although quantity is not necessarily an indicator, it nonetheless could point to the intent. The other key aspect that toxicology test would reveal is the lethargy of the chemical taken. Lethal chemicals are not easily available and therefore, their use could raise suspicions.

Thoroughness and Completeness of Investigations

The mean score of 4.49 and standard deviation of 0.839 indicate that running different toxicological screenings, give admissible evidence, which ensures the thoroughness and completeness of investigations, leaving no aspect overlooked in closing cases.

Comprehensive Screening; In investigation of homicide cases, cause of death is very key. Toxicology, which is the study of poisons and how they affect the body (Wilde, 2011), allows for samples to be screened thoroughly and comprehensively in order to point out possible poisonous substances of whichever form and the damage caused on body tissues. Comprehensive Screening ensures that the chemical content of bodily tissues and their cause effect relationships is established, a pillar that is very key when it comes to providing admissible evidence in a court of law.

Multifaceted Approach; Going by the data in Table 3 above, it is notable that homicide investigators within Kisumu County rely on toxicological techniques to ensure that investigations are thorough and complete, in order to yield admissible evidence. On the same line, empirical evidence from Taylor and Anderson (2021) shows that cases with extensive toxicological screenings have higher resolution rates and fewer unsolved cases, demonstrating the effectiveness of thorough toxicological investigations. This empirical validation highlights the practical benefits of comprehensive toxicological approaches in resolving complex cases.

Interpretation and Skill within Departments

Among the skills needed are advanced analytical techniques, such as mass spectrometry and high-performance liquid chromatography (HPLC), which requires specialized knowledge and skills to ensure that the results are well interpreted and proper conclusions made, an ingredient that helps in providing admissible evidence. As seen from the data, the toxicologists in Kisumu have skills suggesting regular training for them to remain competent. Therefore, there is need for specialized training for homicide investigators in order to address the same as seen in Kisumu County. This resonates with studies carried out by Essig (2012) and Candia et al. (2022), who highlighted the importance of specialized training in forensic toxicology to ensure accurate analysis and interpretation of findings.

Advanced analytical techniques: Proper interpretation and drawing of meaningful conclusions is also necessitated by advanced analytical techniques which help in analysis of complex body liquids with suspected poisonous substances, to get their effects on body tissues and the extent of the damage caused. The use of advanced analytical techniques, such as mass spectrometry and high-performance liquid chromatography (HPLC), requires specialized knowledge and skills to ensure that the results are well interpreted and proper conclusions made, an ingredient that helps in providing admissible evidence. According to Roberts et al. (2022), proficiency in these techniques is essential for accurate and reliable toxicological analysis.

Reduction of Unsolved Homicide Cases

The utilization of toxicology has yielded admissible evidence which has led to conclusion of homicide cases hence significantly contributed to the reduction of unsolved homicide cases in Kisumu County, with a mean score of 3.85 and a higher standard deviation of 1.039.

Assembly of Evidence for Cold homicide Cases

The assembly of evidence for cold cases which have remained unresolved for many years within the county is greatly facilitated by the extremely useful application of toxicological techniques, further bolstering the admissibility of evidence, as indicated by the mean score of 4.15 and standard deviation of 1.102. Traditional methods of investigation of homicide are most likely to leave most cases unresolved because of lack of the forensic eye which sees that which cannot be seen by a naked eye, especially in complex crimes like homicides, where perpetrators put up spirited efforts to thwart any possible efforts of being arrested, and this helps in assembling of evidence which is admissible, and which corroboratively helps in resolving cold homicide cases. The data in table 3 above, results show that respondents agree that toxicology helps in

assembly of evidence which helps in resolving of cold case with a mean of 4.15. This high mean supports the power of toxicology in providing admissible evidence in homicide investigations in Kisumu County. However, the higher standard deviation of 1.102 leaves further room to find out more about the use of toxicology.

Fingerprinting Efficacy and Evidence Quality

In this section, we aim to examine the impact of Fingerprinting Efficacy on Evidence Quality. The findings are presented in Table 4.11: 1-Strongly Disagree [SD]; 2-Disagree [D]; 3-Neutral [N]; 4-Agree [A]; 5-Strongly Agree [SA]. [SA]. The results are summarized in Table 4

Table 4: Fingerprinting Efficacy and Evidence Quality

	Mean	Std. Deviation
The impact of fingerprinting techniques on admissible evidence is significant, as they play a key role in solving homicides and prosecuting the right person.	3.971	.8939
The availability of a fingerprint database has had a substantial impact on the admissibility of evidence by greatly improving the rate of solving homicides.	4.00	.861
The infusion of ICT into forensics through fingerprinting procedures has had a notable impact on the admissibility of evidence by making the department more efficient.	4.10	.846
The centralization of data through data centralization used in fingerprinting procedures has a direct impact on the admissibility of evidence, as departments will have more access to a criminal's information.	4.07	.848
In the structure of evidence in homicide cases, fingerprinting serves as a pillar highlighting its crucial impact on the admissibility of evidence, especially in complex cases where identification of parties relies heavily on fingerprinting.	3.909	.901

Source: Research Data, (2023)

Analysis and Implications

Impact of Fingerprinting Techniques

The significant impact of fingerprinting techniques on admissible evidence, with a mean score of 3.971 and a standard deviation of 0.8939, underscores their importance in solving homicides and ensuring the prosecution of the right individual. Finger prints are useful in forensic science for they help investigators to link one crime scene to another, which may involve the same person or link a person to a scene of crime; a key component to investigators of homicide, who must realize admissible evidence by linking a perpetrator to a scene of homicide and eventually sustaining a conviction on the same. The following attributes of fingerprinting as a forensic technique have since contributed to the same yielding admissible evidence; a key pillar in investigation of homicide cases.

Uniqueness and Reliability: For the longest time, fingerprints have been and still remain the gold standard for personal identification in forensic science field, despite the discovery of DNA. It has evolved from its earliest use to seal business transactions, to biometric security devices and now, to courts as scientific evidence, a key pillar in homicide investigations. Human fingerprints are detailed, unique, difficult to alter and immutable over the life of an individual making them the most appropriate markers of human identification. This is very important to investigators of homicide, since nobody is able to alter the prints lifted from the scene of homicide and so, when they are properly analyzed, they definitely lead to positive identification of the perpetrator(s) and this in itself, is admissible evidence in a court of law. In Kisumu County, it is worth noting that investigators of homicides rely on the uniqueness and reliability aspect of fingerprinting to connect perpetrators to scenes of homicides, by lifting all the prints found at the scene, analyze and eliminate them then be able to positively identify and arrest such perpetrators.

Availability of Fingerprint Databases

The availability of a fingerprint database significantly impacts the admissibility of evidence by improving the rate of solving homicides, with a mean score of 4.00 and a standard deviation of 0.861. A fingerprint database is a store house of structured collection of fingerprint data which can help either in evaluation or recognition purposes. Investigators of homicide can therefore maximize the use of such fingerprint database to run and compare fingerprints lifted from a scene of crime in order to get the perpetrators of homicide. It is worth noting that in the absence of a fingerprint database, homicide investigators will have no meaningful value for the latent prints lifted from a crime scene since they must be compared with the available ones first in order to get the real perpetrator.

The database is resourceful to investigators of homicides as discussed below, **in providing prints for comparison against those lifted from a scene of crime.** Usually, the fingerprints found in the database are those drawn from other scenes of crime or live scan sensors or digitized from inked fingerprints on paper are always for comparison or matching to help on identification of the perpetrators. They are available for researcher identification purposes. This collection of fingerprints makes it easier for investigators of homicide to run comparisons from time to time in order to get hold of perpetrators or even help identify unknown dead bodies. The fact that fingerprint database is available 24/7 makes the investigation process of investigators of homicides in Kisumu County efficient since they are readily available for comparisons and possible matches and identification hence a quick and sure link of perpetrators to a scene of crime. Saferstein (2015) emphasizes that computerized databases for fingerprint identification have enhanced investigation efficiency, leading to increased positive identifications and links between individuals and physical evidence at crime scenes. These databases allow for quick comparisons and matches, reducing the time needed to identify suspects or unknown dead bodies.

Infusion of ICT into Fingerprinting Forensics

The infusion of ICT into forensics through fingerprinting procedures has notably impacted the admissibility of evidence by enhancing departmental efficiency, as evidenced by the mean score of 4.10 and a standard deviation of 0.846. The infusion of ICT into fingerprinting techniques has been very instrumental to investigators of homicides within Kisumu County. Fingerprint technology utilizes the fingerprint patterns; ridges, whorls and loops found on the fingertips of humans in a clear and objective way. These patterns which remain unchanged throughout an individual's life are the ones which serve as unique and distinct identifiers for individuals. Use of ICT in fingerprinting therefore utilizes these unique patterns to authenticate and verify a number of identities. When it comes to investigation of homicide cases, identification is key; in the event that the deceased is unknown, he/she must be identified and equally, the killers must be identified as well, for possible arrest and conviction. ICT integration into fingerprinting as a technique ensures accuracy and efficiency by streamlining the fingerprinting processes, leading to more efficient data management and analysis. This technological integration facilitates timely investigations, allowing forensic departments to process more cases by giving admissible evidence with higher accuracy as seen by Park and Simpson, (2020). Equally, the use of cloud-based platforms for data storage and analysis has further enhanced the efficiency of forensic investigations which heavily dwell on identification like homicide cases as depicted by (Kim and Lee, 2019). Equally, the use of automated fingerprint identification systems (AFIS) and other ICT tools speeds up the matching process and reduces human error providing evidential threshold admissible in court.

Centralization of Data

The centralization of data through fingerprinting procedures directly impacts the admissibility of evidence by providing departments with more access to a criminal's information, as indicated by the mean score of 4.07 and a standard deviation of 0.848. When fingerprint data is scattered, it becomes very hard for investigators to run through the latent prints found at scenes of homicides and be able to compare the matches. When fingerprints are lifted from a scene of crime like homicide, they can only be of evidential value if they are run

against other fingerprints stored in a data base. In Kisumu County, investigators of homicide do agree that indeed, the centralized data of fingerprints remains instrumental to them when it comes to application of fingerprinting as a technique to homicide investigations in that, the centralized data systems allow for comprehensive background checks, enabling forensic departments to access a suspect's complete criminal history quickly. This comprehensive access enhances the ability to build strong cases by linking the suspects to a scene of crime and their subsequent arrest (Williams and Brown, 2022).

Fingerprinting as a Pillar in Homicide Cases

In the structure of evidence in homicide cases, fingerprinting serves as a pillar, underscoring its crucial impact on the admissibility of evidence, especially in complex cases where identification relies heavily on fingerprinting, as indicated by the mean score of 3.909 and a standard deviation of 0.901. Fingerprinting as a technique when applied accurately to homicide investigation is able to play a pivotal role in speaking on behalf of the deceased. A positive match of fingerprints lifted from a crime scene and run through fingerprints database automatically leads to positive identification and arrest of suspects, hence bringing life to cold homicide cases. The success stories of fingerprint analysis in solving cold murder cases, such as the one detailed by Smith et al. (2010), demonstrate the importance of fingerprints in providing admissible evidence. Fingerprint re-analysis in cold cases often leads to breakthroughs that were not possible with the technology available at the time of the original investigation. Studies by Nguyen et al. (2019) highlight the role of advanced fingerprinting techniques in revisiting and solving long-standing cold cases by giving admissible evidence. Similarly, in complex cases where identification of parties relies heavily on fingerprinting, the accuracy and reliability of fingerprint evidence are paramount, a role that is perfectly played by fingerprinting technique which uses patterns on the fingertips which are unique and distinct to an individual. Wilson and Garcia (2020) highlight that in cases with multiple suspects or victims, fingerprints can provide clear and incontrovertible links that other evidence types might not offer because of its uniqueness and accuracy since no two human beings share the same fingerprint pattern. The ability to match partial prints and reconstruct incomplete fingerprint patterns has been crucial in solving complex cases (Kumar and Mehra, 2020), an entity that investigators of homicide cases within Kisumu County utilize in order to realize admissible evidence. Corroboratively, Fingerprint evidence often complements other types of evidence, such as DNA or eyewitness testimony. Oral evidence given in homicide cases cannot warrant a conviction on their own and so, there is need for a forensic touch like application of forensic technique, to make the evidence strong and also to meet the evidential threshold and also be admissible in court, to be able to sustain a conviction. This multi-evidence approach strengthens the overall case and enhances the likelihood of securing convictions; given the admissible evidence as discovered by (Harris et al., 2022).

Forensic Challenges

The last objective of the study was to establish the challenges faced by forensic investigators in homicide cases. The results were presented in Table 5.

1-Strongly Disagree [SD]; 2-Disagree [D]; 3-Neutral [N]; 4-Agree [A]; 5-Strongly Agree [SA]. The results are summarized in Table 5.

Table 5: Forensic Challenges

	Mean	Std. Deviation
Lack of proper equipment hinders DCI investigators' effective collection of evidence from scenes of homicides, impacting negatively on the admissibility of evidence.	4.09	.803
The DCI investigators lack expertise in applying forensic techniques to homicide investigations, hence a negative influence on the admissibility of evidence.	3.84	.999
Lack of frequent In-service trainings to investigators of homicide cases contribute to redundancy of their forensic investigative skills, thereby impacting negatively on the admissibility of evidence in homicide cases.	3.90	1.039
Lack of a clear and streamlined internal policy and SOP's governing forensic investigations in Kenya impacts negatively on the admissibility of evidence in homicide cases.	4.09	.803
Lack of Continuous guidance and advice from management creates a gap in investigation of homicide cases, thereby influencing the admissibility of evidence.	3.90	1.039

Source: Research Data, (2023)

Analysis and Implications

Lack of Proper Equipment

The lack of proper equipment hindering DCI investigators' collection of evidence from scenes of homicides, with a mean score of 4.09 and a standard deviation of 0.803, presents a significant challenge to the admissibility of evidence.

Inadequate resources Each and every homicide scene of crime comes on its own merit and no crime scene is the same as the other. The perpetrator(s) could be the same, or it could be a continuation of events from another scene of crime but the needs for an investigator on that particular scene of crime will always be different. When it comes to finding, collecting, packaging and transporting evidential material from a scene of homicide, an investigator needs different and appropriate equipment for the same, as the case may be, so that he/she doesn't leave out crucial evidence, or contaminate the collected evidence in the course of picking, packaging or even transporting the same. There are those evidential materials at a scene of crime which cannot be seen with a naked eye, and so, the investigator need special goggles with enhanced lenses to helps him/her to scan through a scene of crime to be able to see such minute but crucial evidential materials. Similarly, availability of special equipment like swabs for picking already dried up evidential material like saliva, sweat and blood are very important to an investigator since such evidence cannot be handpicked. Proper packaging bags specified for different evidential material are equally crucial to investigators of homicides. This ensures that wet evidential material are packaged in paper containers to avoid degrading while dry evidence goes into dry plastic containers. All evidential material which is most likely to be cross contaminated must be packaged separately. This therefore, calls for enough and proper equipment to help an investigator to efficiently collect, package and transport evidential material with ease and take it for analysis so that the same can yield admissible evidence. Failure for an investigator to do the right thing right from the scene of crime due to lack of proper equipment will definitely tamper with the integrity of the evidence collected, hence, a gap in realizing admissible evidence, despite application of forensic techniques to investigation of homicides. In Kisumu county, the findings of the study reveal that investigators are faced with the challenge of inadequate and proper equipment for managing crime scenes all the way from identifying, collecting, packaging and transporting evidential material for either DNA, Toxicology or fingerprint analysis in order to yield admissible evidence in investigation of homicides. However, the standard deviation of 0.0803 gives hope that there is some flickering light on the same and that is the try as much as possible to manage with the available

resources yet it is very crucial that such equipment are made available for them to enable them work efficiently.

Lack of Expertise of DCI Investigators

Lack of expertise by DCI investigators in applying forensic techniques to homicide investigations, as reflected in the mean score of 3.84 with a standard deviation of 0.999, negatively influences the admissibility of evidence in homicide cases. A detailed forensic investigation follows a structured process, which includes but not limited to; collection of evidence, examination of the evidence, analysis of the evidence and then, reporting. This detailed process demands given expertise for one to be able to effectively run through the whole process and even be able to correctly analyze the results and give admissible evidence as cited by (Somo Group Intelligence, 2024). According to the findings in table 4.9 above, respondents agree that as investigators of homicide, they lack the expertise required skills to apply forensic techniques like DNA sampling, fingerprinting as well as toxicology and therefore, they have to rely on other experts for the services required.

Lack of In-Service Trainings

Lack of In-service trainings to investigators of homicide cases; a challenge that hinders enhancement of their forensic investigation skills, posted a mean score of 3.90 and a standard deviation of 1.039, holding a potential to impact negatively on the admissibility of evidence in homicide cases. Forensic evidence has since become an undisputable tool for both law enforcement agencies and other private investigation firms not only in Kenya but worldwide. However, technology is ever evolving and there is need for continuous training.

The in-service trainings are supposed to build the capacity of investigators so that they can conduct effective and conclusive investigations in a timely manner. However, this is not the case in the findings of this study, which shows the unavailability of such courses in Kisumu County as revealed by a mean of 3.90, suggests skepticism in the ability of the officers to collect admissible evidence in homicide cases. Respondents do agree, with that they lack frequent in-service trainings to help them in being efficient in their investigation mandate and also, to keep themselves updated with the rapid growth of the demands of the forensic world. Nevertheless, the high standard deviation of 1.039 gives us an implication that there could be some training yes, but not adequate enough for the investigators of homicide cases, to help them realize admissible evidence with application of forensic techniques to homicide investigations.

Lack of Internal Policy and SOPs

The DCI officers investigating homicide cases in Kisumu County, agree that there is Lack of a clear and streamlined internal policy and SOP's governing forensic investigations in Kenya, with a mean score of 4.09 and a standard deviation of 0.803, and this is most likely to interfere with the admissibility of evidence in homicide cases. SOP's and internal policies are very crucial to investigators homicide cases for they help in streamlining the investigation process and also ensure that all those routine tasks entailing the investigation process are carried out efficiently and this reduces the time taken to thoroughly complete such investigations. There is dire need for SOP's and internal guidelines to govern investigators not only in Kisumu County but across the country and even worldwide. It is important for investigators of homicides to be on the same wave length across the board, irrespective of where they are and this can only be made possible if we have clear SOP's and guidelines.

Lack of Continuous Review and Management Guidance;

Continuous guidance and advice from management, influences the performance of forensic investigators, however, homicide investigators within Kisumu County agreed with a mean score of 3.90 and a standard deviation of 1.039, that in as much as it plays a critical a role in ensuring the admissibility of evidence, the same is lacking. With the growth in the forensic science and also, the dynamic investigative needs today, the management of investigators has a crucial role to play when it comes to giving insights and guidance to investigators of complex crimes like homicides. Some cases can be so complex that even with the presence of

the forensic techniques to help link perpetrators to scenes of crime and even help in giving admissible evidence, the management still need to sit down with their investigators and give them guidelines on what to do. This helps in addressing some of the challenges that could be hindering an investigator from completing his/her investigations on time.

Looking at the ranks across the investigators in Kisumu County, it is important to note that majority are of junior ranks yet they are the ones majorly carrying out investigations unlike their senior counterparts who mostly play leadership roles and other administrative duties, other than investigations. The findings of the study reveal that the management does not guide their juniors from time to time on matters investigations and are mostly left on their own, to carry out investigations, a factor that could impact negatively on the admissibility of evidence realized in the course of their investigation of homicide cases. However, the standard deviation of 1.039 shows that there could be some guidance from the management but not as much as it is expected.

Correlation Analysis

The study applied the Pearson product moment correlation coefficient which is a measure of the strength of linear association between two variables. It was used to measure the degree of association between variables under consideration. Where the Pearson coefficient is less than 0.3, the correlation is weak and 0.5 implies a strong correlation.

Multiple Regression Analysis

The significance of the link between the dependent variable and all of the independent factors was determined using multivariate regression analysis. This study shows how the independent variables influence the dependent variable collectively, as well as how much each independent variable affects the dependent variable individually. Table 6 shows the model summary with the findings.

Table 6: Multiple Linear Regression Analysis Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.783 ^a	.613	.606	2.685

a. Predictors: (Constant), DNA Sampling Procedures, Use of Toxicology, Fingerprinting Efficacy, Forensic Challenges

The Multiple Linear Regression Analysis, as summarized in Table 6, provides valuable insights into the relationships between several key predictors—DNA Sampling Procedures, Use of Toxicology, Fingerprinting Efficacy, and Forensic Challenges—and their influence on the likelihood of evidence being admitted in court. The model demonstrates a strong fit to the data, with an R-squared value of 0.613, signifying that approximately 61.3% of the variability in evidence admissibility can be accounted for by these predictors. Even when considering the complexity of multiple predictors in the model, the adjusted R-squared value of 0.606 remains high, indicating a substantial explanatory power. Moreover, the model's low Standard Error of the Estimate (2.685) suggests a close alignment between the predicted and observed values. Overall, these findings affirm the significant roles that DNA sampling procedures, the use of toxicology, fingerprinting efficacy, and the presence of forensic challenges play in determining the admissibility of evidence within the context of forensic practices, thereby contributing to a deeper understanding of this critical aspect of the criminal justice system. Studies by Field (2013) confirm that an R-squared value above 0.6 indicates a substantial explanatory power in social science research.

Adjusted R-Squared: Even when considering the complexity of multiple predictors in the model, the adjusted R-squared value of 0.606 remains high, indicating substantial explanatory power. This suggests that the model is robust and reliable in predicting the dependent variable.

The model's low Standard Error of the Estimate (2.685) suggests a close alignment between the predicted and observed values. This low standard error indicates that the model's predictions are precise, reducing the likelihood of significant deviations. Overall, these findings affirm the significant roles that DNA sampling procedures, the use of toxicology, fingerprinting efficacy, and the presence of forensic challenges play in determining the admissibility of evidence within the context of forensic practices. This contributes to a deeper understanding of this critical aspect of the criminal justice system and underscores the importance of these factors in ensuring high-quality forensic evidence.

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The model demonstrates a strong fit to the data, with an R-squared value of 0.613, signifying that approximately 61.3% of the variability in evidence admissibility can be accounted for by these predictors. Even when considering the complexity of multiple predictors in the model, the adjusted R-squared value of 0.606 remains high, indicating substantial explanatory power. This suggests that the model is robust and reliable in predicting the dependent variable.

The model's low Standard Error of the Estimate (2.685) suggests a close alignment between the predicted and observed values. This low standard error indicates that the model's predictions are precise, reducing the likelihood of significant deviations.

Overall, these findings affirm the significant roles that DNA sampling procedures, the use of toxicology, fingerprinting efficacy, and the presence of forensic challenges play in determining the admissibility of evidence within the context of forensic practices. This contributes to a deeper understanding of this critical aspect of the criminal justice system and underscores the importance of these factors in ensuring high-quality forensic evidence.

Analysis of Variance

The Analysis of Variance (ANOVA) indicates how well the model fits. The data and the results were presented on table 7 as shown.

Table 7: Analysis of Variance (ANOVA)

	Sum of Squares	Df	Mean Square	F	Sig.
Regression	433.790	5	108.448	27.965	.002 ^b
Residual	853.151	109	3.878		
Total	1288.941	114			

a. Dependent Variable: Admissible Evidence

b. Predictors: (Constant) DNA Sampling Procedures, Use of Toxicology, Fingerprinting Efficacy, Forensic Challenges

The Analysis of Variance (ANOVA) results presented in Table 7 offer critical insights into the effectiveness of the regression model, where "admissible evidence" serves as the dependent variable, and predictors include "DNA Sampling Procedures," "Use of Toxicology," "Fingerprinting Efficacy," and "Forensic Challenges." The regression model accounts for a substantial portion of the variation in Admissible Evidence, as indicated by the regression sum of squares (433.790) and the highly significant F-statistic (27.965) with a p-value of less than 0.01. This signifies that the model, with its selected predictors, is statistically significant and provides valuable explanatory power regarding evidence quality. Additionally, the residual sum of squares (853.151) represents the unexplained variation, and when combined with the regression sum of squares, it equals the total sum of squares (1288.941). These findings underscore the crucial roles of the chosen

predictors in understanding and predicting the admissibility of evidence within forensic practices, confirming their statistical significance and contribution to enhancing our comprehension of this vital aspect within the criminal justice system.

Regression Coefficients

Table 8: Regression Coefficients results

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	1.512	2.091		0.723	.002
DNA Sampling Procedures, Use of Toxicology, Fingerprinting Efficacy Forensic Challenges	.304	.112	.413	2.714	.002
	.299	.143	.202	2.090	.001
	.354	.157	.414	2.254	.002
	.374	.177	.404	2.213	.002

a. Dependent Variable: Admissible Evidence

From the analyzed data in table 8 the established regression equation was:

$$Y = 1.512 + 0.374X_4 + 0.354X_3 + 0.304X_1 + 0.299X_2$$

The regression coefficients outlined in Table 8 hold significant implications for understanding the relationship between the dependent variable, "Admissible Evidence," and several crucial independent variables. The constant (B = 1.512) signifies the estimated value of admissible evidence quality when all independent variables are set to zero. Notably, DNA Sampling Procedures (B = 0.304), the Use of Toxicology (B = 0.299), and Fingerprinting Efficacy (B = 0.354) all demonstrate positive coefficients, indicating that improvements in these aspects lead to higher quality admissible evidence. On the other hand, Forensic Challenges (B = 0.374) carries a positive coefficient, suggesting that an increase in challenges faced during forensic practices corresponds to a decrease in the quality of admissible evidence. The established regression equation, $Y = 1.512 + 0.374X_4 + 0.354X_3 + 0.304X_1 + 0.299X_2$, provides a practical tool for predicting admissible evidence quality based on the values of these independent variables. This equation underscores the significant influence of these factors on evidence admissibility within forensic practices, aiding in the enhancement of evidence quality within the criminal justice system.

CONCLUSIONS AND RECOMMENDATIONS

Based on the findings, it is evident that DNA analysis, Use of Toxicology, and Finger printing techniques have the capacity of yielding admissible evidence in homicide investigations. Specifically, the uniqueness of DNA Samples, provides unparalleled way of validating evidence collected from a homicide crime scene highlighting its reliability in securing convictions and preventing wrongful ones, by giving admissible evidence. In addition, the finding of this study affirms the use of Toxicology understanding the cause of death in an objective way through identification of poisonous substances in the body and the impact thus providing compelling evidence that is admissible in law. The positive assessment of fingerprinting technique, which has the most accurate ability of identification, especially regarding their role in solving homicides and ensuring accurate prosecutions, is also affirmed by the findings of the study. Overall the three forensic tools examined in this study, that is; DNA analysis, Toxicology and Finger print analysis were all found to be effective in providing admissible evidence for homicide cases. However, the efficacy of these forensic tools is seen to be limited by the presence of forensic challenges persisting within the investigative process. DCI investigators in

Kisumu County, according to the findings of the study are faced with challenges such as proper equipment Deficiencies, limited number of experts and low level of in-service training. This is further complicated by Interconnected Nature of Forensic Practices that required modern investigative processes among other challenges. These factors were found to compromise or limit the chances of obtaining admissible evidence for homicide cases in Kisumu County hence negatively affecting the efficacy of the forensic tools in yielding admissible evidence in homicide investigations in Kisumu County.

The NPS which is charged with the mandate to prevent and investigate crimes, arrest perpetrators and ensure that they secure convictions by producing admissible evidence in courts, should invest in modern and adequate equipment to help investigators when it comes to collection, packaging and transportation of evidential material to avoid contamination. It should also train DCI officers as experts of forensic science so that they don't have to over rely on the few experts who are already overwhelmed. Frequent In-service trainings on investigative courses should also be looked into so that to help investigators to keep up with the advancing forensic world. Last but not least, the senior officers should keep offering investigations' related guidance to junior officers using forensic techniques in investigation of complex crimes like homicide just to make sure that they keep on the right track and any new challenges are addressed immediately. When these challenges are addressed timely and accordingly, the forensic techniques will be more effective in yielding admissible evidence not only in homicide investigations but also, in other complex crimes as the case may be. This will ensure that homicide cases are cleared in a timely manner and justice is served to the victims, their families and the society as a whole.

Policy makers could also use the findings of this study as a point of reference and be able to allocate more resources in forensic investigations in Kenya since data informs policy making and formulation. They could also use this data to review and streamline guidelines in forensic practice and also ensure that the same cuts across all investigative agencies.

Recommendations for Further Research Study

This research study was carried out in Kisumu County and so, the findings of the same only apply to Kisumu County. To get the whole picture countrywide, the researcher recommends that the same could be carried out countrywide, to find out more on the topic of discussion.

The Current study was an ex post facto which means that more recent data was used providing limited evidence for the efficacy of forensic techniques in homicide investigation. Therefore, the researcher recommends further research in a longitudinal analysis spanning several years to provide invaluable insights into the evolution of forensic science and its impact on admissible evidence over time.

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