



## Making the Case for Development of Forensic Science in a Developing Country with Emphasis on Forensic Pharmacology: The Nigerian Perspective

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**ABSTRACT:** Forensic evidence has for long been accepted globally and is widely considered infallible in the investigation of crime and the procurement of justice; however its utilization and development still appear to lag behind in developing countries such as Nigeria. Online sources published between 2003 and 2023. Data obtained show that forensic pharmacology is at best rudimentary in Nigeria. The need for advancement of forensic science and by extension forensic pharmacology cannot be over-emphasized in Nigeria. Legislation, technology, infrastructure, training and capacity building are necessary tools for the advancement of forensic pharmacology.

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Forensic evidence has for long been accepted globally and is widely considered infallible in the investigation of crime and the procurement of justice; however its utilization and development still appear to lag behind in developing countries such as Nigeria. While many advanced countries worry about deteriorating standards as the science differentiates into more specialised tasks, the challenges in these developing countries are thus how to scale up the existing technology to meet up with the demand of justice as well as get existing legislature up to speed with the science. Developing countries face unique challenges in the advancement of forensic science. This article aims to identify the ideal, explore the existing situation in Nigeria and highlight possible solutions and strategies to promote the development of forensic science. It will also make a case for the *pari passu*

development of forensic pharmacology as one of the divisions of forensic science. Forensic science has since developed many subspecialties, including forensic pharmacology, toxicology, psychology, podiatry, pathology, optometry, odontology, linguistics, and psychiatry (Hemanth *et al.*, 2020). Digital forensics (DF), fingerprint examination and DNA analysis, and forensic anthropology (with the same overarching duty) are often relied upon to accurately interpret their respective evidence types in crime scene investigation, event reconstruction, criminal prosecution, and other related events (Page *et al.*, 2019; Baechler *et al.*, 2020). Worthy of note however is that forensic specialists, with more frequency, identify themselves with only one sub-discipline of forensic science which could have its advantages and disadvantages. Forensic anthropology

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for example is a field which has been used in the recovery and identification of unknown bodies and can be applied in cases of mass graves and human rights violations (Herrasti *et al.*, 2021). Critical attempts are being made in Europe and South Africa to regularise this field. This appears to be the case with many of the other sub divisions. A 2019 questionnaire by Obertova *et al.* examined the status and responsibilities of South African forensic anthropologists and those across Europe. The findings revealed that forensic anthropologists' functions differ by country, training, and status. Despite technological and legal framework advances, forensic anthropological training remained still limited to a few European graduate and postgraduate programmes (Obertova *et al.*, 2019). Investigation, intelligence, and evaluation are the main goals of forensic science, which studies the physical remnant of illegal activity (Jacquet and Champod, 2020). They further state that for every incident requiring police investigation, the first step is gathering of information (e.g. traces), to logically and sequentially arrange them in such a manner as to identify suspects or enable a better understanding of the events. Much of these information does not just go to the prosecution of suspects, but also to contribute to crime control, enhanced security database and improved overall security model and architecture.

While the term 'forensic pharmacology' is relatively new, the concept and tenets of the discipline have been around for a long time. Forensic science however has continued to give birth to many sub specialties including forensic sub-disciplines of psychology, podiatry, pathology, optometry, odontology and linguistics; each of them with their own sub specialties (Hemanth *et al.*, 2020). Early in the 19th century, forensic medicine became a specialisation, and two more subspecialties, forensic psychiatry (used to determine a defendant's mental health and guilt), and forensic toxicology, emerged (Prosono *et al.*, 2017). Today, the scope of forensic toxicology and by extension forensic science is very broad and has been exploited to great benefit in medical jurisprudence.

Forensic toxicology combines the disciplines of analytical chemistry and basic toxicological principles for the primary purpose of unraveling cases of human poisoning with medico-legal implications. The post-mortem examination, conducted by a certified medical examiner, involves taking biological samples, including tissue and body fluids, to identify harmful compounds that caused death (Singh *et al.*, 2022). Hence, the objective of this paper is to make a case for the development of forensic science with emphasis on forensic pharmacology in Nigeria.

## MATERIALS AND METHODS

An online search was carried out on published studies in PubMed, Scopus, Embase and ResearchGate between 2003 and 2045 where 73 articles were adapted for this article. The keywords that directed our literature search were: forensic science, DNA analysis, and fingerprinting, forensic pharmacology, practice of forensic science, and legislation and policy on forensic science.

## DISCUSSION

*Historical Perspectives:* The exact period in history at which forensic science became relevant in criminal investigation is difficult to pinpoint, however as early as 44BC, following the assassination of Julius Caesar, the attending physician and eventual medical examiner, Antistius declared that 'only one' of the 23 wounds inflicted, was fatal (Cowan *et al.*, 2015). Some authors report that during the 5th century, Germanic and Slavic nations were among the first to compel medical specialists to identify cause of death, especially in suspicious cases (Omo-Aghoja *et al.*, 2016). In 1247, a seminal textbook on forensic medicine was released in China. This pioneering work, authored by Lu and Needham (1988), provided comprehensive documentation of the protocols to be adhered to throughout the examination of a death under questionable circumstances. The emergence of medico-legal textbooks in the late 16th century can be attributed to the influence of anatomical studies. It is noteworthy that German-speaking Europe was the location where forensic pathology classes were taught on a regular basis. These classes were held in Freiburg in the middle of the 18th century and in Vienna in the year 1804. Auguste Ambroise Tardieu, Johann Ludwig Casper, and Carl Liman were among the scientists who made significant contributions to the development of forensic pathology into a science that is grounded on empirical evidence and medical jurisprudence. In 1807, the University of Edinburgh established a chair for the study of forensic pathology (Omo-Aghoja *et al.*, 2016).

In the early 20th century, forensic science in China faced challenges related to the investigation of homicides. Asen *et al.* (2021) explores the role played by forensic science in homicide investigations during this period and sheds light on the inherent problems faced by practitioners of forensic science. Omo-Aghoja *et al.*, (2016) provides additional details about the inception and advancement of forensic science. They explain that the 1877, the coroners act mandated that coroners play a crucial role in determining the circumstances and medical causes of sudden, violent, and unnatural deaths. Furthermore, in 1932, the chair

of legal medicine was established at Harvard University and forensic pathology was first certified by the American Board of Pathology in 1959 (Eckert *et al.*, 1988). However, in Canada, the regulations governing expert witnesses, including forensic specialists, are under the jurisdiction of the Canada Evidence Act. The Supreme Court of Canada ruled that for testimony to be classified as 'expert', it must relate to a subject topic that an ordinary person, without the guidance of a qualified expert, cannot understand well enough to make accurate judgements about the facts of the case (Holobinko *et al.*, 2012).

The study of the history of forensic science in Nigeria is not well-researched, although there are a few sources that offer information on the inception, growth, and use of forensic technology in the country. An essay of particular relevance is titled "Alcohol drinking and driving habit, specifically in Nigeria, and the potential role of forensic science." (Nwakobi *et al.*, 2022). This article discusses the issue of alcohol-related driving habits within Nigeria and emphasizes the potential role forensic science plays in mitigating the effects of this problem. It suggests that the government could employ forensic science and scientists to develop protocols, strategies and interventions to detect and combat drunk driving. In the present day Nigeria, no alcohol tests or breathalyzers are administered to drivers randomly or with probable cause, stopped by police or the Federal Road Safety Commission who are tasked with safety on Nigerian roads. Therefore, it is crucial to acknowledge that the sector is still in the early stages of development in the country.

*Forensic science in Nigeria:* The advancement and utilization of forensic technology in crime detection and litigation of criminal cases in many developing countries lags behind those in the west, however, much progress that has been made over time. Forensic odontology is a crucial component of forensic science in Nigeria, as it involves the use of dental concepts to address legal matters. (Nagare *et al.*, 2018). Dental evidence, such as bite marks and dental records, are used to identify individuals and provide valuable information in investigations into crime or disasters involving multiple deaths. This field has been used in cases of mass disasters, missing persons, and human rights abuses around the world. Nevertheless, during the tragic DANA flight crash in Lagos in 2012, the authorities sought the assistance of the Forensic pathology and dental teams for the first time to establish the identities of the 152 fatalities. Through the use of both forensic odontology and DNA analysis, a total of 148 victims were successfully identified. (Obafunwa *et al.*, 2015).

Worthy of note however is that knowledge and practice of DNA analysis and the setting up of a DNA database for crime detection is at an increasing rate in Nigeria as documented by Udogadi and Nkiruka (2020). This is at least in part due to increasing cases of suspected paternity fraud as well as the need for personal identification in theft and murder cases. The use of DNA analysis in paternity testing is now more common due to its accuracy and reliability, as the process enables the evaluation of genetic markers in the claimed father, kid, and mother to ascertain the probability of paternity (Lo *et al.*, 1998).

Forensic anthropology, which comprises the identification and analysis of remnants of human tissue, is also becoming more relevant in Nigeria. Additionally, forensic anthropology techniques, such as the measurement of finger, hand, and foot dimensions, have been used for sex determination and forensic identification in the Nigerian population and are the mainstay of much anatomical research (Iroanya *et al.*, 2020).

Forensic science in Nigeria has a wide-ranging and growing scope. Several sub-disciplines of forensic science, such as forensic odontology, forensic DNA analysis, and forensic anthropology, have been partially employed in criminal investigations, individual identification, financial fraud detection and prevention, and the retrieval and identification of human remains. Regrettably, the pace of scientific development in Nigeria is far slower compared to the western countries. Consequently, this has greatly hindered the effective use of science in detecting, investigating, and prosecuting crimes within the country.

*The scope and practice of forensic science in advanced societies:* Following the 2004 Madrid train bombing, the FBI mistakenly identified Brandon Mayfield due to an incorrect match of a fingerprint (Oig *et al.*, 2006). While this was subsequently corrected, it heralded a number of significant changes in the outlook of forensic science in the United States of America. Subsequently, there have been several alterations in policy, legislation, personnel training, capacity building, and oversight. These modifications established uniformity and authentication of forensic science in the field of medical law in the United States. Currently, the field of forensic anthropology is highly regulated, well-structured, and characterised by a high level of professionalism. Honourable Harry T Edwards, co-chair of the Committee on Identifying the Needs of the Forensic Science Community at the National Academy of Sciences, while appearing

before the United States Senate Committee on the Judiciary in 2009, identified several challenges preventing the optimal deployment of forensic science in criminal justice procurement (Edwards and Gotsonis, 2009). The factors contributing to these challenges encompassed subjective interpretations, embellished testimony, insufficient research, uneven practices in crime laboratories, the utilisation of a coroner system rather than a medical examiner system, and the absence of well-equipped governing organisations for the forensic science community.

Finger printing and DNA analysis are very critical aspects of forensic science and play a critical role in determination of justice in drug-related and sex crimes. In the context of drug-related offenses, forensic analysis can be employed to ascertain the chemical composition of a substance and therefore, determine whether or not an individual possessed illegal drugs using either presumptive (colorimetric testing) or confirmatory (instrumental analysis) testing (Esseiva *et al.*, 2007). In the event that the outcomes indicate the presence of illicit substances, the prosecution may employ these results as evidentiary support in order to get a conviction against an individual for offences ranging from possession of controlled substances to the production and or distribution of drugs. In cases involving fatalities resulting from poisoning, regardless of whether the corpses are discovered promptly or considerably later postmortem, forensic analysis can be employed to ascertain the specific substance responsible for the individual's demise. Additionally, this analytical approach can aid in the process of pruning down the pool of potential suspects by identifying those who would have had the means to acquire such toxic substances. The studies conducted by (Musshoff and Madea, 2009; Chopfi *et al.*, 2019) give evidence to these facts.

In cases involving sexual offenses, it is common practice to collect DNA samples from the victim, which can then be utilized as evidence to establish the guilt of the offender. Numerous cases have been decided because of forensic evidence as documented by Briody (2004) who carried out a review of 150 solved and completed cases in Australia. Curiously, the initial documented use of DNA profiling was employed in a civil disagreement to establish a biological connection. This occurred when a Ghanaian kid was denied admission into the United Kingdom due to a lack of evidence proving that he was the offspring of a lady with the legal right to reside in the United Kingdom (Goswami and Goswami, 2018). A DNA test confirmed a high likelihood of a biological tie between the mother and son, and the UK

government granted him permission to immigrate. Since then however, there have been numerous incidences where DNA has been used to resolve paternity suits and similar issues. Furthermore, DNA has also been in use since the 1980s to solve crime of all sorts and convict criminals (Goswami and Goswami *et al.*, 2018).

Baraybar and Blackwell (2014) discuss the importance of forensic anthropology in addressing the problems of missing and unidentified persons. Investigators assert that forced disappearances are of a dualistic nature, like to a thread with two distinct origins. At one end of the thread lies the occurrence of disappearance itself, encompassing the actual occurrence, precise moment, specific circumstances, and exact location in which an individual is apprehended, kidnapped, or seized by a third party. The opposite side of the thread represents the phenomenological manifestation of the event, specifically the burial site (often hidden) where the individual's body was ultimately disposed of. Forensic anthropologists utilise investigations of transitional justice processes to generate evidence-based deductions regarding identity and the cause of death. Additionally, they employ this information to construct cross-cultural narratives that demonstrate the replication of human tendencies across various countries (Baraybar and Blackwell, 2014).

*The case for forensic pharmacology:* Among the rapidly developing sub-disciplines of forensic science, the term "forensic pharmacology" is relatively new, however the concept and tenets of the discipline have been around for a long time. Forensic pharmacology, according to Malve (2016), provides answers to the questions related to the role of drugs in an individual's behaviour, illness, injury or death. Forensic pharmacology is an interdisciplinary domain that integrates pharmacology, toxicology, and forensic science to examine the impact of drugs on the human body, analyse drugs and toxins in biological samples, and aid in criminal investigations and forensic psychiatry. It has a vital function in the identification and measurement of pharmaceuticals in biological materials, comprehending the pharmacological characteristics of medications, and assessing the effectiveness and safety of pharmacological treatments in forensic patients. As new drugs and substances continue to emerge, forensic pharmacologists must stay updated on the latest trends and develop new analytical methods to address the challenges posed by these substances. Forensic law encompasses numerous criminal and civil actions that pertain to the utilisation of drugs and other compounds; and as such a forensic pharmacologist will need a specific recognition or have a high index

of suspicion for these cases and consequently needs to develop the requisite skill, expertise and experience (Malve, 2016). It further describes the role played by these drugs or chemicals in cases with medico legal importance such as cause or time of death, drug rape or other related cases which could be civil or criminal. An area of particular emphasis inherent in forensic pharmacology is the analysis and evaluation of drugs and toxic chemicals present in biological specimen. The process entails the application of analytical methodologies, such as mass spectrometry and chromatography, to ascertain the presence and measure the concentration of pharmaceutical substances and their byproducts in bodily fluids such as blood, urine, and other biological fluids (Boxler *et al.*, 2019). The aforementioned analyses play an important role in ascertaining the existence of substances inside an individual's physiological framework, as well as establishing a correlation between drug consumption and unlawful behavior or the underlying cause of demise. An additional significant facet in the field of forensic pharmacology pertains to the examination and analysis of the pharmacological and toxicological impacts induced by various medications. This encompasses comprehending the manner in which medications interact with the human body, the underlying mechanisms via which they exert their effects, and the potential negative consequences they may induce (Busardò and Jones, 2015). Understanding this information is of utmost importance in evaluating the impact of medications on persons and evaluating their capacity to induce damage or impairment. The field of forensic pharmacology is also involved in the examination of drug-related offenses, including the illegal production and distribution of drugs. Forensic pharmacologists contribute significant insights to law enforcement authorities by examining the chemical composition and pharmacological characteristics of illicit substances, thereby aiding in the identification of the origins and dissemination networks associated with these substances (Cole *et al.*, 2011). Moreover, forensic pharmacologists may partake in the examination of drug adulterants and cutting agents, so offering valuable insights into the operational methods employed by illicit drug manufacturers and distributors. According to the study conducted by Cole *et al.* (2011), in addition to the aforementioned drug adulterants, forensic pharmacology has encountered fresh obstacles in recent times due to the introduction of novel psychoactive substances (NPS) and synthetic opioids. The identification, investigation, and comprehension of the pharmacological features of these drugs, which are frequently engineered to imitate the impacts of regulated medicines, pose distinctive difficulties (Baumann *et al.*, 2020; Kumar *et al.*,

2023). The role of forensic pharmacologists is highly significant in ensuring the currency of information pertaining to emerging patterns in new psychoactive substances (NPS) and synthetic opioids. Furthermore, their responsibilities encompass the advancement of innovative analytical methodologies designed to detect and identify these chemicals. (Baumann *et al.*, 2020; Kumar *et al.*, 2023). Numerous instances exist when a forensic pharmacologist possesses the capacity to furnish specialized testimony, encompassing scenarios involving the deployment of drugs or poisons as weapons, the manifestation of cognitive impairment resulting from medication-induced effects, or the identification of a particular drug as a causal factor in instances of criminal violence. According to Ferner (1996), the utilization of illicit substances and their impact on those involved contribute significantly to the occurrence of several criminal incidents. According to de Souza *et al.* (2020), substances such as flunitrazepam, alcohol, gamma-hydroxybutyrate, and ketamine are commonly employed in suicide attempts and as means to facilitate acts of homicide or sexual assault. Drug abuse is a problem of significant public health importance that has led to a substantial increase in mortality rates. Several studies have examined the statistics of deaths due to drug abuse and have provided valuable insights into this problem. Approximately 450,000 individuals worldwide lost their lives due to drug misuse in 2015, while approximately 275 million individuals between the ages of 15 and 65 were estimated to have engaged in drug abuse at least once in 2016. About 800,000 individuals perish annually as a consequence of suicide, with 20% (equivalent to 160,000) of these deaths being attributed to the consumption of pesticides.(Chophi *et al.*, 2019). In a prospective research work undertaken by Gossop *et al.* (2002), the focus was on examining mortality rates among individuals who sought treatment for drug dependence. Between 1974 and 1992, there was a significant increase of nine times in opiate-related deaths in England and Wales. In Australia, the number of drug overdose deaths increased by a factor of 55 between 1964 and 1997. These data emphasise the concerning increase in fatalities caused by drug use throughout the years.

Lee and Singh (2022) investigated drug overdose mortality among individuals aged 15-34 years in the United States from 2018 to 2021 confirming the findings of Gossop *et al.*, (2002) above. They observed a 36.5% increase in deaths secondary to drug overdose among this age group from 2019 to 2020. This significant rise in drug overdose deaths indicates the impact of drug abuse on young individuals. Singh *et al.*, (2019) examined the opioid crisis in the United

States and pinpointed the states with the greatest mortality rates for drug overdose. West Virginia, Ohio, New Hampshire, Pennsylvania, and the District of Columbia exhibited the highest fatality rates for drug overdose. These findings highlight the regional disparities in drug-related deaths and the need for targeted interventions in high-risk areas.

Koehler *et al.*, (2019) conducted a study on drug misuse in Isfahan area, Iran, and discovered that drug-related mortality ranked as the second most common cause of non-natural deaths in the area. In addition, substance misuse accounted for 5% of the total number of unnatural fatalities among children and adolescents in the province. These findings emphasise the influence of substance misuse on young individuals and the necessity for programmes aimed at preventing and treating it.

Slavova *et al.*, (2015) emphasized the underestimation of opioid analgesic and heroin-related deaths in national statistics. A study revealed that approximately 25% of overdose deaths in the United States did not have any substances indicated on the death certificate. This indicates that the official national statistics underestimate the actual number of drug overdose deaths. This underscores the necessity for precise and thorough documentation of fatalities associated with drug use. The data and statistics demonstrate a significant number of fatalities resulting from substance usage, with instances when deceased individuals are found several weeks to months later. These deaths have been observed in various populations, including drug misusers, youth, individuals experiencing homelessness, and different regions. The underreporting of drug-related deaths and the impact on health disparities further emphasize the need for comprehensive surveillance and targeted interventions to address this public health crisis.

The forensic pharmacologist possesses a comprehensive understanding of pharmacokinetics, pharmacodynamics, medication interactions, and adverse responses. He possesses the highest level of suitability to examine the obtained data and render educated conclusions in support of or against a legal case. The forensic pharmacologist possesses the ability to analyze and evaluate the levels of alcohol present in blood samples, as well as the corresponding physiological and psychological effects commonly associated with such concentrations. Pharmacokinetics is utilized to assess the concentration of alcohol in the bloodstream during the purported criminal incident. The forensic pharmacologist plays a crucial role in assessing drug interactions, specifically the synergistic, additive or

antagonistic effects that occur when different medications interact with alcohol during absorption, distribution or metabolism. Additionally, the presence of a disease condition in an individual may also be examined by the forensic pharmacologist. These assessments provide valuable assistance to the medico-legal and judicial system (Malve, 2016).

No developing country needs this more than Nigeria. Substance abuse and trafficking are significant issues in Nigeria, with various studies highlighting the prevalence and consequences of these problems (Ajibade *et al.*, 2015; Dic-Ijiewere and Osadolor, 2023). The illicit use of drugs such as tramadol has been found to be prevalent among school children in urban communities (Ofiaeli *et al.*, 2022). The use and abuse of narcotic drugs and psychotropic substances have been linked to drug trafficking in Nigeria (Ajibade *et al.*, 2015). The trafficking of pharmaceutical opioids, particularly tramadol, has raised concerns about its abuse (Dic-Ijiewere and Osadolor, 2023).

*Challenges of developing forensic science: Legislation and policy:* In Nigeria, the task of crime prevention, investigation and in some cases, prosecution is placed on the Nigerian police force, amongst others as documented in the 1999 constitution and the Police Act 2020 as amended (Ekhaton, 2021; Effiong *et al.*, 2022). The Constitution's fifth chapter encompasses the essential human rights and freedoms of individuals. The principal rights associated with a police inquiry encompass the entitlement to personal freedom and a just hearing, as outlined in Article 35 and 36. Forensic science, which involves the utilisation of scientific knowledge and techniques to analyse crimes and solve complex criminal puzzles, is a common practice in industrialised countries. In Nigeria, the use of forensic investigation techniques and procedures is still considered new, despite the fact that forensic sciences are widely recognised as essential tools for criminal investigators (Ladapo, 2011).

The Ghanaian constitution, specifically Chapter 5 article 19, includes provisions for the "fair" handling and disclosure of evidence in criminal trials. These provisions can significantly influence the proceedings of a court hearing. They additionally assert that the processing and utilisation of evidence, including forensic evidence, must adhere to the principles of legality, legitimacy, proportionality, need, and transparency (Amankwaa *et al.*, 2019).

Statutorily, forensic pathology evidence is admissible in Nigerian court as enshrined in section 55 of the Evidence Act 74 and section 257 of the Administration



of Criminal Justice Act 75, however these statutes did not expressly prescribe the modality and application of such evidence. A potential backdoor however exists in the Police Act of 2020 which states in Chapter 5 (General Administration) Section 18, sub section 9 that “Professionals from the relevant fields, including engineering, medicine, pathology, aviation, law, psychology, accountancy and forensic science, shall be appointed into the Nigeria Police Force as specialists; and (b) practise their professions and use their expertise in the advancement of the objectives of the Police Force” (Nwogu and Nwakoby, 2021). Furthermore and fortuitously so, Nigeria operates a federal system where each and every state of the Federation can also legislate on the inclusion and implementation of forensics in jurisprudence, although the law provides for a unitary Nigerian Police Force (Obi-Obiora and Onah, 2022). In line with the aforementioned, the bill for the establishment of the Lagos State Deoxyribo-Nucleic Acid (DNA) and Forensic Centre was enacted by the Lagos state government in 2022. The main aim of this legislation is to offer assistance for criminal investigations, law enforcement, the safeguarding of evidence for the legal system, and other associated objectives. It is worth noting, however, that the centre has been operational since 2017 (Udogadi, 2021). Based on operationalization and functionality, Udogadi (2021) further states that the Lagos State DNA and Forensic Center (LSDFC) laboratory is the only fully accredited and operational Forensic DNA Laboratory in Nigeria. Up until 2019, LSDFC was reported to have assisted in 85 criminal investigations and 191 relationship cases including disaster victim identification and paternity and maternity disputes (Olayinka, 2019). Rivers state also has a coroner law which is complied with to a high degree. According to the legislation in Rivers state, it is mandated that individuals who have passed away due to violent or unnatural circumstances, or in a sudden and unexplained manner, must be promptly reported to the coroner. This responsibility falls upon any individual who discovers the deceased body or becomes aware of the death, and it is required that they notify the coroner through the police without delay (Obiorah and Amakiri, 2013). The primary objective of a forensic autopsy is to determine the cause, time, and manner of death, as well as the circumstances leading up to and surrounding the death. In addition to conducting a postmortem examination, a medico-legal autopsy may also involve inspecting the location where the body was discovered. In anticipation of prospective legal proceedings, the forensic pathologist must be summoned to present evidence collected at the site and perform the autopsy (Amankwaa *et al.*, 2019).

*Lack of a database:* Currently, Nigeria does not possess a comprehensive national forensic information database, including a national DNA and fingerprint database, for the purpose of criminal investigation and intelligence. This is supported by the findings of the 2019 Interpol Global DNA Profiling Survey, which revealed that out of the 11 African countries that reported using DNA profiling in police investigations, only 7 acknowledged having a DNA database. Furthermore, South Africa was the only country that admitted to having a specialised DNA database for missing persons (Global DNA Profiling Survey Results, 2019).

The Police Act 2020 allows for capturing of finger prints of those in lawful custody and these records may be stored in a retrievable form. However, the database of such fingerprints is still basic at best (Udogadi, 2021). The role of a database in criminal detection and prosecution, especially for repeat offenders, cannot be overemphasized.

*Forensic science facilities/ infrastructure, training, careers:* The Nigerian Police currently possesses two forensic laboratories: one was constructed in Lagos in 1986, which exhibits substandard functionality and capabilities, and the other is a more recently commissioned laboratory at the Nigerian Police headquarters in Abuja, established in 2016 (Sarki and Saat, 2020). These two laboratories are obviously not sufficient to meet up with the teeming needs of the entire country. The legislation approved by the Lagos State House of Assembly endeavors to tackle the aforementioned scarcity of infrastructure; yet, it is also insufficient in its efforts.

According to Sarki and Saat (2020), there is a paucity of available data concerning the forensic skills and technological capacity of Nigerian police personnel. Specifically, there is a lack of data on their proficiency in crime scene investigation and their ability to maintain the chain of custody when handling evidence. Additionally, there is a lack of data on the perception of forensic science among the police force. Alemika (2009) also emphasizes the significance of forensic expertise for the Nigerian Police and draws the anecdotal conclusion that Nigerian Police Personnel were not trained in handwriting analysis, ballistics, and fingerprinting studies.

It is obvious that the road ahead is long and fraught with many challenges with regards to bringing Nigeria up to speed with the global standards as regards utilization of forensic technology in criminal and civil justice and political will is critical if any progress will be made.

**Conclusion:** Whereas it must be borne in mind, that if the cost of justice is considered exorbitant, the cost of injustice is more prohibitive. As countries develop, challenges with insecurity, crime and paternity suits in civil courts also appear to increase and they must thus develop capacity in personnel, technology, legislation and administration/management to meet up with these challenges. This article highlights the dire need for the advancement of forensic science and forensic pharmacology in developing countries like Nigeria by juxtaposing the technological advancements achieved by developed nations. Developing nations such as Nigeria, should prioritize establishing clear guidelines and protocols for the collection, protection, transport, analysis, interpretation and utilization of forensic evidence. This can ensure that forensics is effectively utilized in all manner of criminal and civil investigations and court proceedings.

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