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Factors That Affect The Retention Of Forensic Scientists At The National Forensic Authority In Zambia

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Abstract
Forensic science services in Zambia are regulated by the National Forensic Authority (NFA), established under the National Forensic Act No. 2 of 2020. Despite this mandate, the country faces a critical shortage of forensic professionals, which undermines service delivery and impacts justice, public health, and security systems. Currently, Zambia has only two forensic scientists, two forensic pathologists, four trainee forensic pathologists, five pathology assistants, and eight forensic scientists undergoing facility-based training, demonstrating a severe human resource gap.
A descriptive mixed-methods study was conducted to examine workforce retention challenges among forensic practitioners. Data were collected using structured questionnaires and focus group discussions, with a total of 40 participants recruited from the NFA practitioner database. Analysis was performed using Epi Info™ Version 7.2. Findings revealed that over three-quarters of respondents were considering leaving their current positions, citing poor working conditions, unfavourable remuneration, unattractive work locations, and limited career progression opportunities. The majority (84.62%) specifically attributed their intention to leave to poor work environment and low pay.
These findings highlight the urgent need for NFA to strengthen retention through competitive compensation, improved working conditions, and structured career development programmes to build and sustain forensic capacity in Zambia.
Keywords: *Forensic Science, Forensic Scientist, Forensic Pathologist, Retention, Forensic Personnel*
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I. Introduction

In a contemporary economy characterized by rapid technological progress, where knowledge is a critical organizational asset, the imperative to retain competent employees intensifies (Narayanan et al., 2019; Khan et al., 2021). In this environment, firms consistently strive to retain their workforce and minimize high turnover rates (Kim et al., 2020). The persistent depletion of intellectual capital can severely undermine any organization, particularly in an environment characterized by perpetual change and instability.

Forensic science is an intriguing discipline; although the science is rigorous, the term forensic imparts a certain attraction. Practitioners of forensic science often find that the general public has elevated expectations about the contributions of forensic science to investigations and legal proceedings. Forensic science pertains to crime scene investigation and forensic methodologies, encompassing scene and laboratory analyses, digital technologies, pathology, and various other related disciplines.

In 2008, the Home Office forensic science regulator (FSR) of the United Kingdom (UK) defined forensic science as the application of scientific and technical knowledge to crime investigation and evidence evaluation, aiding courts in resolving factual questions. A recent UK Home Office study on Research and Development provided an alternative definition: the application of science and technology to an inquiry to identify a crime perpetrator or exonerate an individual within a legal framework. The application and delivery of forensic science are continually evolving, leading to a broader use of the terms. Forensic practice or forensic science practice encompasses the utilization of science in criminal investigations by law enforcement and as evidence in judicial proceedings (Forensic Practice, 2016).

In Zambia, forensic science services are governed and administered by the National Forensic Authority (NFA), with service delivery being carried out by the Office of the State Forensic Pathologist (OSFP) and the National Forensic Science and Biometrics Department (NFSBD). These three entities were established after the enactment of the National Forensic Act No. 2 of 2020 (National Assembly, 2020). The OSFP is responsible for conducting medicolegal death investigations in Zambia, whilst the National Forensic Science and Biometrics Department is tasked with analysing forensic evidence from crime scenes. Before the implementation of the National Forensic Act, medicolegal death investigations were conducted by a forensic unit within the Police Service. The OSFP performs forensic postmortems with the help of Forensic Pathologists, General Pathologists,

and designated General Medical Officers. Whereas the NFSBD provides various sample analyses conducted by molecular biologists, physical scientists, chemical scientists, toxicologists, and information technology specialists (National Forensic Act, 2020). The available scientists do not meet the criteria for a forensic expert, as the Act stipulates a post-graduate qualification as part of the definition (National Forensic Act, 2020).

The issue of providing Forensic Science services, notwithstanding limited data, is acknowledged in practice due to insufficient capacity to deliver the service (Mudenda et al., 2020). The retention of human resources impacts not only Zambia but also several low- and middle-income nations (Wilson et al., 2018). Bridging the human resource gap requires investment through several strategies, which will take considerable time to realize.

The service requires support professionals for the laboratories and autopsy suite who prepare the laboratory, autopsy, and instruments prior to the forensic scientists or designated individuals doing laboratory analyses or conducting post-mortems. The responsibilities are carried out by police personnel possessing limited laboratory and medical expertise. This is a barrier due to their lack of understanding of fundamental infection prevention protocols, laboratory management, instrument care, and the disposal of sharp equipment.

Background

Forensic science plays a vital role in contemporary criminal justice systems by offering scientific analysis and expert testimony that support evidence-based investigations and prosecutions (Houck, 2015). The effectiveness of forensic services relies significantly on the availability, expertise, and continuity of forensic professionals. The retention of forensic scientists, especially in resource-limited environments, presents a considerable challenge. The National Forensic Authority (NFA) in Zambia serves as the primary agency responsible for regulating forensic science services to ensure quality services are provided to law enforcement agencies and the judiciary. Despite the rising demand for forensic services due to escalating crime rates the NFA continues to encounter challenges in retaining qualified forensic personnel.

Retention challenges in forensic science are complex, involving factors such as inadequate compensation, restricted career advancement, excessive workload, psychological stress from exposure to traumatic evidence, and lack of institutional support (Bell et al., 2008; McCarty & Skogan, 2013). In low- and middle-income countries, resource limitations, insufficient investment in forensic infrastructure, and inadequate human resource policies exacerbate these issues (United Nations Office on Drugs and Crime [UNODC], 2016).

Anecdotal reports and internal reviews in Zambia indicate that forensic scientists often express dissatisfaction with their working conditions, limited training opportunities, and ambiguous promotion pathways, which contribute to their pursuit of alternative employment in academia, private sector laboratories, or international agencies.

A preliminary internal survey conducted by the NFA in 2021 revealed that more than 35% of its staff contemplated leaving within the subsequent two years, mainly due to perceived deficiencies in career development and uncompetitive salaries (National Forensic Authority Human Resource Unit [NFA HRU], 2021). Research indicates that effective retention strategies, including structured career progression, performance-based incentives, continuous professional development, and supportive work environments, can markedly enhance staff retention in forensic institutions (Griffeth & Hom, 2001; Kramar, 2014). Nevertheless, empirical research specific to the Zambian context or the broader Southern African region remains limited. The absence of context-specific data impedes the formulation of targeted interventions aimed at addressing the fundamental causes of turnover.

This study aims to analyse the factors affecting the retention of forensic scientists at the National Forensic Authority (NFA) in Zambia. The study aims to identify and analyse intrinsic and extrinsic motivators, as well as challenges, that influence forensic scientists' decisions to remain employed within the institution. The study seeks to examine the influence of organizational policies, workplace environment, remuneration, career development opportunities, and psychosocial factors on staff turnover and long-term commitment.

Significance

The retention of qualified forensic scientists is crucial for the effective administration of justice and law enforcement in Zambia. Forensic evidence plays a critical role in criminal investigations and legal proceedings; however, a lack of skilled personnel undermines the quality, efficiency, and credibility of forensic operations (Houck, 2015). The forensic science sector in Zambia plays a critical role; however, it remains understudied, especially concerning workforce dynamics like staff retention.

This study holds importance for multiple reasons:

1. Policy Development: The findings will offer evidence-based insights to guide the formulation of human resource policies within the NFA and other relevant government institutions. Enhanced policies can increase job satisfaction, decrease turnover, and strengthen institutional capacity.

2. Organizational Improvement: Understanding the challenges faced by forensic scientists enables the NFA to implement targeted interventions that foster a more supportive and sustainable working environment.
3. Contribution to Literature: Empirical literature on the retention of forensic scientists in Sub-Saharan Africa is limited. This study addresses the existing gap by providing a contextualized understanding that may serve as a basis for future regional research.
4. Justice System Enhancement: Strengthening the forensic workforce will directly improve the criminal justice system by providing timely and accurate forensic services, thereby enhancing public trust and upholding the rule of law.

The study seeks to address these issues, contributing both academically and practically by providing recommendations relevant to the Zambian context, which may also be applicable to other developing countries encountering similar challenges.

Problem Statement

The importance of having skilled personnel to provide forensic services has been recognized since the time forensic practice was identified as a specialized field. Zambia's population is twenty million, accompanied by a growing prevalence of crime, sexual offenses, gender-based violence, and violent or mysterious deaths correlated with population growth. Incidents resulting in mass casualties are increasing and the nation has also had fatalities due to human trafficking.

The country currently has four forensic scientists: two forensic biologists and two forensic pathologists, while four other pathologists are undergoing training to qualify as forensic pathologists. Five pathology assistants are receiving facility-based training at the University Teaching Hospital autopsy suite, while six biomedical scientists are receiving facility-based training at the National Forensic Laboratory. This shortfall indicates that the population has restricted access to forensic services. Lusaka, with a population of more than two million, reports nearly 10,000 pathological cases annually, many of which are forensic in character (Zambia Police Report, 2023).

A study is necessary to determine the factors contributing to the low retention of practitioners in forensic science, despite the country's investment in training numerous scientists and pathologists in this field. The country has trained numerous biomedical technologists who can be transitioned into pathology assistants and laboratory assistants.

Research Questions

1. What accounts for the scarcity of skilled professionals providing forensic science services in Zambia?
2. How many establishments provide Forensic Science Services in Zambia?
3. What strategies may be implemented to expand the availability of Forensic Science Services providers?

Research Objectives

General Objective

Determine the factors that affect the retention of forensic scientists at the National Forensic Authority in Zambia.

Specific Objectives

1. Establish the factors that contribute to the scarcity of skilled professionals providing forensic science services in Zambia.
2. Determine the number of establishments providing forensic science services in Zambia.
3. To propose strategies for retaining the human resource pool in the supply of forensic science services.

Scope of the study.

This study examines the National Forensic Authority (NFA) in Zambia, specifically analysing factors that influence the retention of forensic scientists currently or recently employed by the institution. The study focuses on full-time forensic science professionals, encompassing experts in biology, chemistry, toxicology, ballistics, and digital forensics. The geographical scope is confined to Zambia, focusing on operational centres that provide forensic services.

The study excludes forensic scientists employed in the private sector, academic institutions, or international agencies within Zambia. The focus is confined to retention issues and does not encompass recruitment, training curriculum design, or job performance evaluation.

Study variables

The research is structured around independent and dependent variables to evaluate retention dynamics within the NFA.

Dependent Variable:
Retention of forensic scientists is assessed through tenure duration, intention to remain, and turnover rates.

Independent variables:
Organizational factors - salary levels, promotion opportunities, workload, leadership support, and recognition.
Professional development - access to training, scholarships, and opportunities for continuing education.
The work environment - physical working conditions, the availability of tools and resources, and interpersonal relationships within the workplace.
Psychosocial factors - stress levels, emotional exhaustion, work-life balance, and job satisfaction.
The policy framework - clarity and fairness in human resource policies concerning promotion, appraisal, and grievance redressal.
The relationship and influence of each independent variable on the dependent variable (retention) will be analysed.

Study Limitations

This research may be limited in terms of generalizing the findings and depth due to several factors. The study is limited to the NFA and excludes other institutions or private forensic laboratories. Consequently, the findings may lack representation of the wider forensic science context in Zambia or the surrounding region. The study utilizes self-reported questionnaires and interviews, which may lead to response bias stemming from social desirability or fear of reprisal, even with guarantees of anonymity.

Time and budget constraints, may restrict the sample size, the extent of fieldwork, and the thoroughness of statistical analysis. The aftermath of COVID-19 may have temporarily influenced employment behaviour and institutional policies, potentially distorting findings relative to pre-pandemic standards.

Despite these limitations, the study aims to deliver a valid, context-sensitive analysis that can affectively inform organizational and policy-level enhancements.

Summary

Chapter One presents the investigation into the retention of forensic scientists at the National Forensic Authority (NFA) in Zambia. This emphasizes the significance of forensic science within the criminal justice system and delineates the nation's forensic infrastructure, which is inadequately funded and staffed, even as crime rates rise.

This chapter addresses the issue of low retention, identifying poor working conditions, limited career advancement opportunities, and insufficient support systems as contributing factors. This study seeks to identify and analyse the intrinsic and extrinsic factors influencing workforce retention at the NFA.

The study outlines specific objectives and research questions, accompanied by a well-defined scope that encompasses forensic scientists currently or recently affiliated with the NFA. The study acknowledges its limitations, including budgetary constraints, time restrictions, and potential biases. Chapter One establishes the groundwork for a targeted investigation into enhancing workforce sustainability within Zambia's forensic science sector.

II. Literature Review

Introduction

Holt et al. (2016) assert that the criminal justice system has increasingly emphasized the importance of forensic evidence collection and scientific analysis, especially in aiding investigations and prosecutions. Forensic scientists and laboratories must respond to increasing requests for their services, despite a persistent shortage of resources for training, equipment, personnel and, in certain cases, a deficiency in scientific standards for analysis. The training sessions elucidated the reasons behind the understaffing of the American forensic team. These constraints immediately impede laboratories' capacity to recruit and train scientists essential for enhancing the efficiency and speed of evidence processing (Holt et al., 2016). The investigation revealed the need to create policies and methods to enhance the overall productivity of existing laboratory professionals, as well as to understand the aspects influencing their work experiences. The survey findings revealed that the levels of stress and satisfaction of forensic scientists are comparable to those of other employees within the criminal justice system. Laboratory managers can influence employee experiences by implementing clear procedures that improve flexible scheduling. Furthermore, equitably allocate overtime, foster communication with supervisors, and improve contacts with court personnel and prosecutors (Holt et al., 2016).

Contemporary public forensic science laboratories must adopt cutting-edge human resource management techniques. A rationale is to enhance the retention of laboratory personnel. Elevated personnel turnover hinders the mitigation of the DNA processing backlog (Rondeaux, 2003). Laboratory managers can improve employee retention by employing innovative human resource strategies, often at no cost. Staffing

problems that can be mitigated by effective human resource planning, recruitment, and retention techniques for forensic science professionals.

Implementing higher compensation for new and existing staff, improving facilities, and increasing technology utilization is necessary. However, these modifications incur significant taxpayer expenses and require time and resources for implementation. Despite the fact that government leaders recognize the importance of increasing forensic resources, securing additional funding proves challenging when national, state and local budgets are already constrained.

Although greater funding is required for additional resources, existing technology in human resource management can be immediately utilized for tangible improvements in public laboratories. Various strategies are proposed for human resource planning, recruitment, and retention. These ideas are derived from a national online survey of forensic science laboratory directors (Becker et al., 2003). Human resource management methods can directly influence the selection and retention of quality personnel.

Empirical Research

Empirical study denotes a systematic inquiry that depends on actual data, observation, or experimentation. This study employed empirical research to investigate the experiences and perspectives of forensic personnel in Zambia, concentrating on the factors that affect their retention or attrition in the profession. The research utilized a mixed-methods approach, integrating quantitative and qualitative techniques for data collection and analysis. This method facilitated a more thorough comprehension of the issue by merging quantitative patterns with qualitative observations.

Quantitative Data: Gathered using standardized questionnaires distributed to 40 forensic professionals from diverse specializations (e.g., forensic scientists, pathology assistants, ballistics experts). The data was processed with Epi Info 7.2, yielding statistical outputs like frequencies, percentages, and confidence intervals.

Qualitative Data: Collected via focus group discussions (FGDs) with a cohort of 10 forensic specialists. The conversations examined profound themes, encompassing workplace obstacles,

Empirical research is valuable due to its evidence-based foundation. It furnishes policymakers, administrators, and HR managers within Zambia's forensic science sector with reliable data to inform decisions regarding; resource allocation, such as augmenting salaries and enhancing work environments, program development, such as training and mentorship efforts, development of policies (e.g., retention tactics and workforce planning), motivation, and structural factors contributing to employee discontent or intentions to depart.

Theoretical framework

The research is based on multiple theories of employee retention and motivation:

Herzberg's Two-Factor Theory: distinguishes between hygiene factors (e.g., salary, job security) and motivators (e.g., recognition, career advancement). The results indicate that both hygienic considerations and motivators substantially influence employee retention in forensic science.

Maslow's Hierarchy of Needs: posits that fundamental requirements (e.g., secure working environments, equitable remuneration) must be satisfied prior to persons seeking higher-level aspirations such as esteem and self-actualization. This theory supports the examination of elements such as job satisfaction, acknowledgment, and career advancement.

Social Exchange Theory: postulates that employee retention is contingent upon reciprocal relationships between the employee and the employer. Employees are more inclined to remain with an organization when they perceive equity and recognition.

The resource-based theory (RBV): postulates that employees who perceive themselves as important to their organization are more inclined to exhibit loyalty. This hypothesis presumes that improving the employee's sense of value may mitigate retention challenges. Additional elements that can influence employee retention include:

1. Adaptable employment arrangements
2. Training and development
3. Leadership attributes
4. Mental health and wellness
5. Organizational mission and values

Conceptual framework

The primary assertion of this study is that employee retention is affected by three key aspects of the workplace. The explicit practices that organizations establish to oversee their human resources (HR Practices - tangible dimension). The overall working conditions, which constitute an integral aspect of daily employee experience (Working Conditions - intangible dimension). The mission and orientation of the organization, which may or may not align with the core values of its employees (Mission and orientation - dimension of strategic fit), (Inman and Hassan, 2015)

The conceptual framework suggested integrates findings from several previous studies, providing a comprehensive approach to improving the understanding of staff retention issues.

The framework connects theoretical viewpoints with actual events, employing previous empirical research as a basis and directing the interpretation of findings within the Zambian context.

Conceptual Connections

The conceptual framework presumes that retention is affected by a combination of extrinsic and intrinsic factors. The relationship may be understood as follows:

Retention = f(Job Satisfaction, Compensation, Work Environment, Career Development, Organizational Support, Intrinsic Motivation)

Where:

"f" represents a function.

Each independent variable influences the dependent variable (Retention) either directly or indirectly. The relationship was examined through descriptive statistics and thematic analysis derived from focus group discussions. The independent variables each play a distinct role in influencing forensic personnel's decisions to either continue in their positions or pursue other employment opportunities.

A total of sixteen (16) variables are included in the four dimensions of the conceptual framework proposed. The four dimensions are as follows;

(a) Human resource practices (five),
(b) working conditions (five),
(c) mission and orientation (two), and
(d) work attitudes (four).

The final dependent variable in the study is employee retention. See Table 4 on the next page;

Table 4:
Conceptual Framework

HR Practices	Working conditions	Mission and orientation	Work Attitudes	
▪ Training and development ▪ Remuneration and rewards ▪ Career opportunities ▪ Performance appraisal ▪ Empowerment	▪ Organizational climate ▪ Supervisor support ▪ Peer group interaction ▪ Work environment ▪ Workspace quality	▪ Mission, goals & direction ▪ Customer centeredness	▪ Organizational identification ▪ Employee engagement ▪ Employee commitment ▪ Job satisfaction	Employee retention **(Dependent variable)**
→	→	→	→	↑

Definitions

Human Resource Retention

Denotes the capacity of an organization to retain its workforce and minimize employee turnover. It encompasses policies and practices designed to enhance employee retention within an organization. Armstrong (2014)

Forensic Science Personnel

Individuals who utilize scientific methodologies and techniques in the context of criminal and civil investigations include forensic pathologists, scientists, technologists, and crime scene specialists. Houck (2015)

Employee turnover

The rate of employee turnover and replacement within a workforce. High turnover may signify employee dissatisfaction and adversely affect productivity and morale. (Mathis & Jackson, 2011)

Work Environment

The environmental, mental, and social factors influencing employee performance. This encompasses safety, resources, leadership approach, and interpersonal dynamics.
Robbins and Judge (2013)

Compensation and Benefits

Total rewards encompass the comprehensive compensation offered to employees, which includes salary, allowances, health benefits, bonuses, and non-monetary perks.
Milkovich, Newman, and Gerhart (2014)

Job Satisfaction

Job satisfaction is an indicator of an individual's contentment with their employment, influencing performance, commitment, and retention intentions.
Spector (1997)

Career Development

Organizational initiatives aimed at enhancing employee skills, acquiring new knowledge, and facilitating professional advancement.
Noe (2010)

Motivation

The internal and external factors that motivate individuals to maintain interest and commitment to a role or task. Herzberg (1968)

Organization Commitment

The psychological attachment and loyalty of an employee to their organization are associated with reduced turnover and increased engagement. Meyer and Allen (1991)

Analysis of research gaps

Forensic organizations pay little attention to retention challenges, despite the susceptibility of technical personnel during fluctuating employment cycles. Research was done in the USA to assess the challenges faced by a major state crime laboratory system in retaining newly appointed forensic experts. A novel staffing approach was developed to alleviate the backlog of DNA case backlog; the organization employed technicians to provide technical assistance to more specialized scientists. However, the staffing approach was ineffective due to the high turnover of employees. Non-competitive salaries compared to the private sector and the absence of advancement opportunities dissuaded prospective employees. The professional motivations of forensic scientists are not adequately understood. Strategies to enhance scientist retention encompassed realistic job previews, shadowing, and internship initiatives, elevation of roles and wage frameworks, and collaboration with institutions to develop new training programs (Dale & Becker, 2004).

Global Perspective

In some jurisdictions in the United States, the scarcity of forensic scientists exhibits an ethnic disparity; although there are numerous Caucasian forensic scientists, there is a notable deficiency of black forensic scientists (Bor et al., 2018). The situation in Canada is similar, although the United States has a greater prevalence. The estimated number of practicing forensic pathologists ranges from 550 to 600, with only 10% originating from Africa (Bor et al., 2018). Forensic science was acknowledged as a subspecialty by the American Board of Pathology in 1959; however, it was not until 1989 that the first black individual and the first black female were certified in this area. Before 1989, black individuals participated in autopsies in the capacity of pathology assistants.

Black forensic pathologists in the United States face difficulties in recruitment and retention due to racial stereotypes and discrimination, issues that their counterparts in other nations are less likely to face. In addition to navigating a system that has profited from unethical experimentation on Black individuals, they may face discriminatory conduct from colleagues (Bor et al, 2018). In some cases, a distinctly hostile work environment is evident that makes them uncomfortable and unwelcome (Obenson et al., 2017). Research has been undertaken to identify obstacles encountered by black forensic scientists in training, employment recruiting, and job satisfaction, as well as to propose methods to overcome these obstacles and broaden the training pipeline.

In the United States, the primary factors leading to significant job dissatisfaction among scientists in forensic laboratories are "the implementation of company policies" and "opportunities for promotional advancement" (Ballaro & Meade, 2021). Additionally, leadership is essential in laboratories to face formidable

challenges arising from resource limitations and constraints that impede progress toward critical objectives, thus affecting personnel morale. Business tools, methods, and tactics must be used to assist forensic executives in acquiring essential abilities. Leaders employ influence strategies to secure agreement for significant projects (Becker et al., 2010).

A study conducted in Europe indicated that a shortage of skilled personnel exerts pressure on the small staff required to reach unreasonable performance expectations (Camies, 2021). This type of work environment induces employee burnout, which can adversely impact a worker's emotional and physical health over time, ultimately affecting their performance.

In the United Kingdom, forensic pathologists receive a foundational training in histology followed by a specialized training in forensic science (Kolar et al., 2017). In October 2012, the Royal College of Pathologists released a program for specialty training in forensic histopathology. It outlines the qualifications and conditions necessary for certification as a forensic pathologist. The examinations are administered by the Royal College of Pathologists. According to the forensic science regulator in the UK, there were approximately 35 to 40 Home Office Registered Pathologists in the UK operating within group practices throughout England and Wales (Forensic Science Regulator, 2024). This figure is insufficient for the population of the United Kingdom.

In 2014, Saudi Arabia had 40 trained forensic pathologists, predominantly Saudi and Egyptian citizens, who had master's and doctorate degrees in forensic medicine (Al-Waheeb, 2015). The inaugural training program in this domain was established in the Kingdom of Saudi Arabia. However, training in forensic science has only recently begun in the Kingdom of Saudi Arabia following the implementation of the Saudi specialist certificate in forensic medicine. The Ministry of Health, the Ministry of Higher Education and the Department of Criminal Investigation collaborated to develop the program (Madani, 2012). Annual written, oral, and practical exams constitute the foundation for assessment and advancement. The training program lasts for four years. Successful candidates receive a certificate in forensic medicine. The project has allowed the Kingdom of Saudi Arabia to produce consistently forensic professionals. Graduates of this program have inadequate training in the analysis of microscopic and gross pathological material (Madani, 2012). They consistently refer pathological specimens to anatomical pathologists for examination, as they lack training in forensic pathology. Graduates have the skills necessary to examine crime scenes, assess evidence, and, when necessary, refer materials to toxicology or pathology laboratories. Furthermore, they analyse individuals who were present during forensic encounters, including victims of sexual assault (Madani, 2012).

Regional Perspective

Africa, as a continent, has faced numerous issues related to understaffing performance. Forensic science systems in Africa encounter significant challenges due to a shortage of human resources, inadequate infrastructure, and disjointed policies. Although certain countries have advanced in incorporating forensic technologies into criminal justice systems, persistent systemic challenges hinder workforce retention and professional growth in this domain.

In Ghana, significant progress began in 2011, encompassing the use of contemporary DNA profiling and the creation of an automated fingerprint identification system (Amankwaa et al., 2019). These advances have resulted in favourable outcomes in the administration of justice, including the exoneration of an unjustly imprisoned individual. An assessment of the policy-related dimensions of forensic science reveals deficiencies in legislation, governance, service delivery, quality assurance, accreditation, education, and research (Amankwaa et al., 2019).

Forensic science services in South Africa are comparatively advanced relative to numerous sub-Saharan nations. The South African Police Service (SAPS) manages one of Africa's most extensive forensic laboratories, encompassing areas such as DNA analysis, toxicology, and ballistics. High caseloads, slow turnaround times, and resource constraints significantly impact employee morale and performance (Mngomezulu & Dube, 2017). Furthermore, restricted professional development opportunities and inadequate career mobility have raised concerns regarding the long-term retention of skilled forensic personnel.

Forensic science development in Nigeria has encountered persistent challenges stemming from inadequate funding, insufficient standardized training, and the lack of a centralized forensic authority. Adeniyi (2020) found that the recruitment of forensic experts on an ad hoc basis leads to variability in service quality and elevated employee turnover. The lack of specialized forensic training institutions and limited academic pathways for forensic specialization hinder the professional development of practitioners.

Kenya has achieved significant progress through the establishment of the National Forensic Laboratory, aimed at centralizing forensic services. A report by the Kenya National Commission on Human Rights (KNCHR, 2021) identified ongoing deficiencies in staffing, especially in rural regions, where access to forensic expertise is notably limited. Retention is further hindered by relatively low compensation and insufficient mental health support for forensic professionals managing trauma-related cases.

The Directorate of Government Analytical Laboratory (DGAL) in Uganda serves as the primary institution for forensic services. The expansion of forensic sciences is impeded by inadequate funding, obsolete equipment, and a lack of sufficient personnel. Kizito and Musoke (2019) indicate that young forensic graduates frequently transition to higher-paying positions in the private sector or overseas, thereby intensifying the shortage of qualified professionals.

The examples illustrate that forensic science systems in Africa face similar retention issues, such as restricted career development opportunities, excessive workloads, inadequate compensation, and lack of institutional support. Emerging opportunities for regional cooperation exist, exemplified by the African Forensic Science Network (AFSN), which seeks to improve collaboration, training, and knowledge sharing among forensic institutions throughout the continent.

Rwanda has achieved notable advancements in the reform of its justice and law enforcement systems following the genocide, particularly through investments in forensic infrastructure. The Rwanda Forensic Laboratory (RFL) was established to enhance forensic services and has garnered significant government support. A 2020 report by the Rwanda National Commission for Human Rights identified retention challenges, especially among mid-career professionals. Identified issues included: restricted availability of specialized training and advanced forensic programs at the postgraduate level, insufficient staffing and excessive dependence on a limited number of senior specialists, forensic staff in a transitional justice environment face significant expectations. Rwanda has implemented capacity-building initiatives and regional training partnerships, with support from Interpol and East African Community institutions, to enhance retention.

Mauritius, a small island nation with a relatively advanced justice sector, has encountered various challenges. The Mauritius Forensic Science Laboratory (MFSL) experiences fewer staffing shortages than mainland African countries; however, it still faces: elevated stress levels resulting from a constrained workforce overseeing an extensive range of forensic casework, skill drain occurs when trained personnel relocate to seek higher-paying opportunities overseas, especially in Europe and Australia and there is a lack of adequate incentives for ongoing professional development, particularly for experts in DNA analysis and toxicology.

An internal review conducted by the Ministry of Health and Wellness in 2022 identified that insufficient autonomy, inadequate salaries, and restricted leadership opportunities were factors contributing to employee attrition. The government's response has involved international training programs and new legislation designed to acknowledge and enhance the role of forensic experts within public service frameworks.

In conclusion, although there is increasing recognition of the importance of forensic science in African justice systems, the development of a sustainable workforce continues to be a significant challenge. Addressing human resource challenges through policy reform, targeted investment, and regional capacity-building initiatives is crucial for the sustained success of forensic services in the region.

Local Perspective

Human Resource in Forensic Science Practice

There are one hundred and fort-four listed forensic medical officers, listed forensic medical officers are physicians that are on the ministry of home affairs list to conduct autopsies in the country, there are six forensic pathologists all based in Lusaka. There are 53 forensic scientists in different fields; forensic biology, forensic chemistry, ballistics, digital forensics and multimedia, handwriting and questioned documents experts, crime scene experts, and forensic biology (non-human). A desk review was done by searching the records at the National Forensic Authority, Zambia Police Service, Zambia Revenue Authority, Zambia Information Technology Authority, Central Veterinary Training Institute office of the state forensic pathologist and Anti-Corruption Commission. Table 1 shows the number of listed forensic medical officers per province;

Table 1: Listed forensic medical officers and forensic pathologists in Zambia

SN.	Name of Province	Number of Listed Forensic Medical Officers	Forensic Pathologists
1	Lusaka	22	6
2	Copperbelt	3	0
3	Central Province	6	0
4	North Western Province	15	0
5	Western Province	15	0
6	Luapula	13	0
7	Eastern Province	20	0
SN.	**Name of Province**	**Number of Listed Forensic Medical Officers**	**Forensic Pathologists**
8	Northern Province	17	0
9	Muchinga Province	10	0
10	Southern Province	13	0
	Total	**144**	**6**

Source: National Forensic Authority Database

Table 2 shows the number of forensic scientists in Zambia; the figures include the ones based at the National Forensic Authority;

Table 2: Number of forensic Scientists in Zambia

S/N	Specialty	Number of Forensic Scientists
1.	Forensic Biology	7
2.	Forensic Chemistry	2
3.	Digital and Multimedia Forensics	15
4.	Handwriting and Questioned Documents	9
5.	Ballistics	7
6.	Scenes of Crime	8
7.	Forensic Biology (Non-Human ID)	2
	Total	**50**

Source: National Forensic Authority Database

Forensic Facilities

Forensic facilities are laboratories or autopsy suites offering forensic services. All forensic facilities are supposed to be licensed by the National Forensic Authority. The autopsy suites are found throughout the country while forensic laboratories are found only in Lusaka and Copperbelt provinces. There is only one DNA forensic laboratory located in Lusaka of Lusaka Province (National Forensic Authority, 2023). A desk review was done by searching the records at the National Forensic Authority. The Table 3 shows the number forensic facilities per province;

Table 3: Forensic laboratories and autopsy suites

SN.	Name of Province	Forensic Laboratories	Forensic Autopsy Suites
1	Lusaka	8	6
2	Copperbelt	4	10
3	Central Province	0	11
4	North-Western Province	0	11
5	Western Province	0	16
6	Eastern Province	0	15
7	Northern Province	0	12
8	Muchinga Province	0	8
9	Southern Province	0	15
10	Luapula Province	0	12
	Total	**12**	**116**

Source: National Forensic Authority Database

Forensic DNA evidence from various regions is centralized for analysis, resulting in delays in investigations and increased pressure on laboratory staff. The logistical challenges, along with restricted career advancement opportunities, lead to job dissatisfaction and low retention rates (Chanda & Mwelwa, 2022). Zambia does not possess a national forensic training institution. The training of most forensic scientists occurs abroad or within non-specialized academic programs, resulting in variability in knowledge and skill levels. The lack of professional development pathways undermines long-term commitment to the profession and heightens the risk of talent migration to sectors or countries that provide superior compensation and growth opportunities (Sakala & Banda, 2021).

There is a deficiency in institutional support structures, including mental health services for professionals managing traumatic cases, mentorship programs, and well-defined promotion pathways. The identified deficits diminish the motivation of forensic personnel, thereby decreasing both efficiency and morale. This study addresses a significant gap by analysing the human resource challenges in Zambia's forensic science sector and suggesting retention strategies to strengthen the forensic workforce.

In Zambia, few studies have been conducted in forensic science, focusing mainly on investigating the cause and manner of death rather than addressing human resource concerns. This will be the first study to examine the retention of human resources in forensic practice, as previous research has focused solely on forensic pathology.

Conclusion

This chapter critically analyses the current literature regarding human resource challenges in forensic science, emphasizing the growing global demand for forensic services in the context of notable staffing, resource, and policy constraints. Research conducted in developed nations, including the United States, United Kingdom, Canada, and Saudi Arabia, highlights the urgent requirement for strategic human resource management to mitigate turnover, job dissatisfaction, and burnout among forensic personnel. Moreover, variations in training, ethnic

representation, and access to professional development opportunities exacerbate the retention issues encountered by forensic institutions.

African countries, such as Ghana and Zambia, have advanced in enhancing forensic capacity; however, significant deficiencies persist in workforce development, governance, and infrastructure. The forensic workforce in Zambia is limited in size, highly centralized, and lacks sufficient resources, resulting in inadequate provincial coverage. Current forensic research predominantly emphasizes pathology and post-mortem services, while human resource concerns, including recruitment, retention, and job satisfaction, have received insufficient attention.

This chapter presents the theoretical and conceptual frameworks that form the basis for comprehending the various factors affecting employee retention. This study seeks to address a significant research gap by integrating insights from resource-based theory and strategic human resource management literature, specifically concerning the retention of forensic science professionals in Zambia. The insights obtained will inform subsequent chapters in determining effective strategies for maintaining a skilled and motivated forensic workforce.

III. Research Methodology

Introduction

This chapter outlines the methodological framework utilized to examine the factors affecting human resource retention in forensic science practice in Zambia. Due to the exploratory nature of the study and the limited local literature on forensic workforce retention, a mixed-methods approach was utilized to obtain thorough insights. This chapter delineates the research design, target population, sampling procedures, data collection methods, research instruments, and ethical considerations.

This study aims to investigate the human resource dynamics in Zambia's forensic science institutions through an analysis of quantitative data, such as staff distribution, retention rates, and training levels, alongside qualitative insights, including employee experiences, perceptions of working conditions, and career development. The methodology aims to ensure reliability, validity, and ethical rigor, facilitating triangulation of findings from diverse sources to enhance the credibility and depth of the analysis.

This chapter comprises several sections: research design, study area, target population, sample size and sampling techniques, data collection instruments, data analysis procedures, and ethical considerations. Each section is designed to align with the distinct requirements of the research context and objectives.

Study Design

A descriptive cross-sectional study was conducted.

Research Approach

According to Collis and Hussey (2009), research philosophy refers to a researcher's perspective on the methods of acquiring, analysing, and applying information regarding a topic. Two primary research ideologies, interpretivism and positivism, are proposed.

Study Site

The study was conducted at the National Forensic Authority in the Ridgeway area. Ridgeway is in Lusaka in the region of Lusaka Province. Lusaka is the capital of Zambia, where all government ministries and state institutions are located. Ridgeway is approximately 5.8 km from the central business district (CBD).

Population of Study

The study population comprised personnel from the National Forensic Authority, the Crime Investigation Department, the Forensic Science and Biometrics Department, the State Forensic Pathologist's Office, the Drug Enforcement Commission and the Zambia Police Service. The Drug Enforcement Commission and the Zambia Police have forensic facilities regulated by the Authority. A total of 40 participants was enrolled in the study using non-probability purposive sampling method as the study targets a special population of interest.

Sample Size

The sample size was determined using an open-source epi-Info calculator (Epi-Info, 2024), the assumption was that the population frequency is not known, the population size is 50.

Sample Size for Frequency in a Population	
Population size (for finite population correction factor or (*N*):	50
Hypothesized % frequency of the outcome factor in the population (p):	50% +/-5
Confidence limits as % of 100 (absolute +/- %) (*d*):	5%
Design effect (for cluster surveys):	1

Sample size(n) for 95% confidence levels			
Confidence	**Level (%)**	**Sample Size**	
95%		45	

Inclusion Criteria
- The participant is willing and able to give their informed consent to participate in the study.
- Male or female aged 18 years or older.
- Practices forensic science

Exclusion Criteria
- The participant was unwilling and able to give his informed consent to participate in the study.
- Male or female under 18 years of age
- Does not practice forensic science.

Sample Design

The research utilized a purposive sampling technique, appropriate for studies focusing on a specific population possessing specialized knowledge or experiences (Creswell & Poth, 2018). The sample included professionals in forensic science, forensic pathologists, forensic medical officers, and administrative staff engaged in human resource management within Zambia's forensic science sector.

This sampling method was selected to guarantee that participants possessed direct and pertinent experience with the organizational, environmental, and operational factors affecting human resource retention. The targeted institutions comprised the National Forensic Authority, forensic units of the Zambia Police Service, and other pertinent regulatory bodies.

Data Collection

The study employed both primary and secondary data to achieve comprehensive coverage of the research objectives.

Primary Data

Data were obtained via structured questionnaires and semi-structured interviews. The questionnaires were administered to forensic scientists, forensic medical officers, and support personnel, aiming to collect quantitative data regarding job satisfaction, working conditions, remuneration, opportunities for advancement, and access to training.

Semi-structured interviews were performed with key informants, comprising senior forensic pathologists, laboratory managers, and government officials. The interviews aimed to obtain a deeper understanding of policy gaps, retention challenges, and strategic initiatives concerning workforce management. Interviews were recorded with consent and subsequently transcribed for analysis.

Secondary Data

Secondary data were collected via a comprehensive review of institutional reports, forensic staffing databases, academic publications, and government policy documents. The data sources offered insights into current staffing levels, forensic infrastructure, and prior human resource interventions.

Data Analysis

A mixed-methods analytical approach was employed to analyse both quantitative and qualitative data.

Quantitative Analysis

Quantitative data obtained from the questionnaires were coded and analysed utilizing the Statistical Package Epi Info™ Version 7.2. Frequencies, percentages, and mean scores were employed to summarize responses concerning retention factors. Inferential statistics, comprising cross-tabulations and chi-square tests, were employed to examine the relationships among variables including region, job category, and retention intent.

Qualitative Analysis

Thematic analysis was employed to analyse qualitative data from interviews, focusing on identifying patterns and recurring themes associated with retention challenges and strategies. Transcripts underwent manual review and coding, subsequently organized into thematic categories including "training and development," "leadership and supervision," and "workplace environment." This facilitated triangulation with quantitative

findings, enhancing the comprehension of the issues being examined. The combination of both methods enhanced the validity of the findings and facilitated the development of evidence-based recommendations.

Validity and Reliability

Validity and reliability were meticulously evaluated throughout the research process to ensure the credibility and trustworthiness of the findings.

Validity

Validity denotes the degree to which research instruments and findings accurately reflect the phenomenon under investigation (Creswell & Creswell, 2018). This study established content validity via expert review of the data collection instruments. Before data collection, professionals in forensic science, human resource management, and academic research reviewed the questionnaire and interview guide to ensure the items were relevant, comprehensive, and aligned with the research objectives.

A pilot test was conducted involving five forensic science professionals to evaluate the clarity, wording, and structure of the questionnaire. Revisions were made to enhance the quality and relevance of the instruments based on feedback from the pilot phase. This process ensured that the instruments accurately measured the key variables associated with employee retention within the Zambian forensic science context.

The triangulation of data from various sources, including questionnaires, interviews, and document reviews, improved construct validity and facilitated a more comprehensive understanding of the research problem.

Dependability

Reliability denotes the consistency and stability of data collection instruments across time (Saunders, Lewis, & Thornhill, 2019). The questionnaire was developed with standardized Likert-scale items to improve reliability for essential constructs, including job satisfaction, supervisory support, and career development. Clearly defined questions diminished the potential for misinterpretation and enhanced the internal consistency of responses.

The internal consistency of the questionnaire items was evaluated using the Cronbach's alpha coefficient. A reliability coefficient of 0.70 or above is deemed acceptable (Tavakol & Dennick, 2011). The reliability analysis demonstrated that the scale items employed in the questionnaire exhibited consistency and reliability for the study.

Ethical Considerations

This study adhered strictly to ethical principles to safeguard the rights, dignity, and confidentiality of all participants. This study followed ethical guidelines for social science research and secured the required approvals prior to the initiation of data collection.

Ethical Approval

Prior to commencing the study, ethical approval was secured from the University of Zambia Biomedical Research Committee. Approval to conduct the study was obtained from the National Forensic Authority of Zambia and other participating institutions.

Informed Consent

Participants received comprehensive information regarding the study's purpose, procedures, benefits, and risks. Participants were provided with an informed consent form detailing their voluntary participation, the right to withdraw at any time, and guarantees of confidentiality. Written consent was secured prior to the commencement of data collection.

Confidentiality and Anonymity

To protect participant privacy, all responses were maintained in confidence and utilized exclusively for academic purposes. Transcripts and datasets had identifying information removed to maintain anonymity. Data were stored securely in password-protected digital files, accessible solely to the researcher.

Reducing Harm

The study presented negligible risk to participants. Care was taken to ensure that discussions regarding workplace conditions or retention challenges did not expose participants to the risk of reprisal. Interviews were carried out in secure, private environments, allowing participants the option to refuse to answer any questions they deemed uncomfortable.

Summary

This chapter outlines the research methodology utilized to examine the retention of human resources in forensic science within Zambia. The research utilized a mixed-methods design, combining quantitative and qualitative approaches to achieve a thorough understanding of the topic. The target population included forensic scientists, forensic pathologists, and significant stakeholders in the forensic science field.

Data collection involved structured questionnaires and semi-structured interviews, with document reviews serving as supplementary sources of primary data. Quantitative data were subjected to descriptive and inferential statistical analysis, whereas qualitative data underwent thematic analysis to identify emerging patterns and insights.

This chapter discusses measures of validity and reliability to ensure the credibility of the findings, including expert reviews, pilot testing, and internal consistency checks through Cronbach's alpha. Ethical considerations such as informed consent, confidentiality, and ethical clearance were meticulously adhered to in order to maintain research integrity and safeguard participant protection. This methodology establishes a robust basis for the presentation and analysis of findings in the following chapter.

IV. Findings / Results

Introduction

This chapter is concerned with data presentation. Findings are presented in textural, tabular and in figures.

Demographic Characteristics

The study had a total of 40 respondents, 27 (67.5%) of the respondents were male while 13 (32.5%) were female, the median age was 33.5 (8.5). All participants were African in ethnicity, 25 (62.5%) of the respondents were married, 14 (35%) were single, while 1 (2.5%) did not disclose their marital status. Among the respondents, 16 (40%) were forensic scientists, 1 (2.5%) forensic technologist, 1 (2.5%) forensic technician, 13 (32.5%) pathology assistants, 6 (15%) experts in handwriting and 3 (7.5%) experts in ballistics. Figure 1 shows the distribution of the occupations of the respondents.

Figure 1: Distribution of occupation among participants

0 = forensic scientist, 1 = forensic technologist, 2 = forensic technician, 4 = pathology assistant, 5 = handwriting expert, 7 = ballistic expert

Factors Influencing Forensic Personnel Retention

In response to the question of why one would opt to work in forensic science, 35 (87.5%) of the respondents indicated that it was a passion for the profession, while 3 (12.5%) indicated that it was the only option available. On the question of whether spending time in the autopsy suite would have a negative effect on the practitioner, 9 (22.5%) of the respondents indicated that it would negatively affect them while 31 (77.5%) indicated that it would not affect them negatively. The respondents were also asked to explain how they would be negatively affected by spending time in an autopsy suite, the following were their responses; 1 (2.56%) indicated that it affects their breathing, 2 (5.2%) feared exposure to infection. Two (5.2%) had natural discomfort, while 1 (2.56%) indicated that they needed professional progression. On the question on being comfortable with conducting exhumations, 33 (82.5%) indicated that they were comfortable with conducting exhumations, while 7 (17.5%) indicated that they were uncomfortable.

The respondents were also asked to explain why they were uncomfortable with conducting exhumations and the following were the responses; 4 (12.92%) were uncomfortable handling dead bodies, 1 (3.23%) indicated that it was not their profession, while one (3.23%) gave no reason. The question on which factors would stop the respondents from working in an autopsy suite, the following were the responses; 4 (10%) indicated that they would stop working for religious reasons, 1 (2.5%) tradition, 7 (17.5%) widespread microaggressions toward individuals who profess interest in forensics as a specialty, 4 (10%) fear, 7 (17.5%) stigma. While 17 (42.5%) indicated that none of the issues raised in the question would make them stop working in an autopsy suite. On the

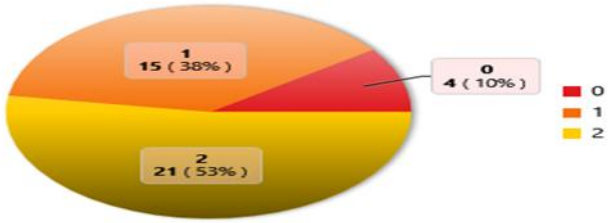
question of whether one was employed before current appointment, 24 (60%) indicated that they were employed, while 16 (40%) indicated that they were not employed. The remaining respondents were asked why they left their previous employment, the following were their responses; 9 (22.5%) indicated that it was due to unfavourable pay and benefits, 3 (7.5%) inadequate time, 8 (20%) job security. One (2.5%) poor work environment, 1 (2.5%) knowledge did not meet the job's need, 1 (2.5%) dim prospects, 15 (37.5%) there were few rewards while having cross-cutting issues. Table 5 shows the reasons why respondents left their previous employment.

Table 5: Factors that contribute to leaving previous employment

Reason left previous employment	Frequency	Percent	Cum. Percent	Exact 95% LCL	Exact 95% UCL
Unfavorable work conditions	9	22.50%	22.50%	10.84%	38.45%
Inadequate time	3	7.50%	30.00%	1.57%	20.39%
No job security	8	20.00%	50.00%	9.05%	35.65%
Poor work environment	1	2.50%	52.50%	0.06%	13.16%
Know did not meet job's needs	1	2.50%	55.00%	0.06%	13.16%
Dim Prospects	1	2.50%	57.50%	0.06%	13.16%
Challenge with professional progression	2	5.00%	62.50%	0.61%	16.92%
Cross-cutting issues	15	37.50%	100.00%	22.73%	54.20%
TOTAL	**40**	**100.00%**	**100.00%**		

Respondents were asked whether they expect to change jobs or have additional jobs, 4 (10%) were expecting to change jobs because they were unhappy with the current job. Fifteen (37.5%) expected to have additional jobs in order to have additional income or fully utilize their time. While 21 (52.5%) were not expecting to change or have additional jobs. The respondents were also asked if they planned to seek another job, 27 (67.5%) indicated that they were not seeking another job while 13 (32.5%) indicated that they were seeking other jobs. Figure 2 shows the responses of the respondents on the likely change of jobs.

Figure 2:
Respondents who changed jobs or had additional jobs



0 = changing jobs 1 = requires additional work 2 = no changing jobs

Respondents were asked why they are considering leaving the current job and the following were their responses; 9 (23.08%) indicated that they would leave employment because of unfavorable pay, 2 (5.13%) unfavorable work location, 24 (61.54%) poor work environment, 3 (7.69%) dim prospects. While 1 (2.56%) indicated that they would leave employment because of widespread microaggressions toward individuals who profess interest in forensics as a specialty.

The respondents' responses to the question whether they felt that their work was appreciated were as follows; 32 (80%) felt that their work was appreciated while 8 (20%) felt that their work was not appreciated. Those who gave a negative response were also asked if they would like to see recognition and appreciation from management; all the 8 (20%) of the respondents indicated that they would like to see appreciation and recognition from management. The respondents were also asked whether the performance evaluation provides them with meaningful information; 33 (82.5%) indicated that the evaluation gave them meaningful information. While 7 (17.5%) were of the view that the performance evaluation did not provide meaningful information. Respondents who gave negative responses were asked to explain why they felt the performance evaluation did not provide them with meaningful information, the following were their responses; 1 (2.5%) felt that the evaluation does not offer incentives. Two (5%) felt that the evaluation was not comprehensive while 4(10%) felt the performance evaluation was subjective.

Focus Group Discussion

A focus group discussion was conducted with 10 forensic personnel and issues that would make staff leave forensic practice were the following; low salaries, no forensic science programs to motivate staff and forensic science knowledge gap. Other issues were lack of productivity due to limited reagents, lack of job satisfaction, personal satisfaction, poor leadership, lack of security training for forensic scientists, lack of team work, lack of mentorship, lack of motivation, and incentives.

V. Findings / Results

Most of the respondents (87.5%) indicated that they are practicing in forensics because they have a passion for the profession, therefore most forensic personnel are in the profession because it is a calling for them. The expectation is for staff retention to be very high. In a study by Jerez-Jerez et al. (2020) it was shown that the passion and turnover have a direct relationship. This factor has been shown to influence the development of professional identity and increase employee retention rates.

The majority of the respondents were comfortable with spending time in an autopsy suite, hence the autopsy suite environment cannot contribute to the attrition and low retention rate of forensic scientists. Negative responses are not only unique to the forensic profession, it applies to other healthcare providers. In a study by Rakhra (2018) it was found that career opportunities posed a challenge at Sasol Nitro, as voluntary resignations attributed to career advancement factors were rising, evidenced by prior separations and turnover intentions from the pilot study.

Most of the respondents (82.5%) were comfortable with conducting exhumations, therefore conducting exhumation would not be a factor in staff retention. In a study by Colombo et al. (2019) it was found that some workers exposed to exhumation suffer secondary traumatic stress. This would not be the case in this group of employees and, therefore, not an important factor in staff retention.

Sixty per cent of the forensic personnel were employed before current employment and left previous employment because of unfavourable pay, job security and poor incentives. Most of the respondents had no intention of changing jobs. They preferred to have additional work to have additional income or to fully utilize their time. Research using focus groups and personal interviews revealed that supervision, benefits, work design, and work conditions are associated with employee satisfaction and retention (Rust et al., 1996). A research report on military personnel found that soldiers' contentment with military life correlates with retention, as understanding of various community initiatives raises satisfaction and subsequently improves retention (Etheridge, 1989). A further study on naval aviation officers revealed a significant correlation between satisfaction and retention, mostly linked to intrinsic outcomes (Mitchell & Albright, 1971). Employees require respect, recognition, and organizational commitment, which can be fulfilled by meeting their requirements (McGuire et al., 2003). Staff satisfaction influences staff retention within the service profit chain (Heskett et al., 1994). Insufficient job satisfaction contributes to inadequate retention (Dovlo, 2003). Therefore, the findings in this study are not different from those in other work environments.

More than three quarters of the forensic staff indicated that they would leave current employment because of poor work environment, unfavorable pay, unfavorable work location and dim prospects. The majority pointed at poor work environment and unfavorable pay. Employee turnover is partially attributed to remuneration (Nawab & Bhatti, 2011). Inadequate compensation is cited as a factor for leaving an organization. Merit-based remuneration improves employee retention. Compensation is typically rated fifth or sixth by employees when assessing retention factors (Sohail et al., 2011). Compensation is identified in research as a crucial component for the retention of knowledge workers in Malaysia (Ahsan et al., 2014). These findings from these studies are no different from the current study, they support the factors that would be affecting employee retention at the National Forensic Authority.

Most of the forensic personnel felt appreciated, while those who felt their work was not appreciated had problems with the recognition and appreciation of staff by management. A study of the personnel of Serena Hotel indicates that they have effectively retained employees over the years, with the primary reason cited by the employees being the respect they are afforded. The high-achieving people garnered significant respect from management, which motivated them to stay with the firm for years (Khan et al., 2011). In the healthcare sector, where labor shortages are prevalent, respect and appreciation are seen as crucial for employee retention (McGuire et al., 2003). Most of the employees appreciated the information contained in the performance evaluation, while some thought the performance evaluations were subjective and not comprehensive.

One hundred forty-four listed forensic medical officers and six forensic pathologists in a country of 20 million people with close to 10,000 cases of homicide every year in Lusaka alone is not adequate (ZPS, 2023). All forensic pathologists are based under the Ministry of Home Affairs, regulated by the National forensic Authority. This means that they have to travel to other provinces to perform autopsies that cannot be performed by listed forensic medical officers. There 53 forensic scientists in different fields; forensic biology, forensic chemistry, ballistics, digital forensic and multimedia, handwriting and questioned documents experts, crime scene

experts and forensic biology (non-human) scientists. Ten of the forensic scientists are in the Department of Forensic Science and Biometrics under the Ministry of Home Affairs and are regulated by the Authority. The ten are not sufficient to accommodate the whole country; hence the backlog of sample analysis.

The focus group discussion brought out similar findings; low salaries, no forensic science programs to motivate staff, forensic science knowledge gap, lack of productivity due to limited reagents, lack of job satisfaction, personal satisfaction, poor leadership, lack of security training for forensic scientists, lack of team work, lack of mentorship, lack of motivation and incentives.

VI. Summary, Conclusion And Recommendations

Summary of the Research

This research examined the determinants influencing human resource retention at the National Forensic Authority in Zambia. Data were collected using a descriptive research design, employing structured questionnaires, focus group discussions, and desk reviews. The quantitative analysis utilized Epi Info version 7.2, whereas qualitative data offered contextual insights.

The study identified that primary factors influencing staff attrition were inadequate compensation and an unsatisfactory work environment. The findings highlight the necessity for strategic human resource management practices in forensic science to enhance retention and organizational performance.

Main Findings of the Study

Of the 45 targeted participants, 40 completed and returned the questionnaires, resulting in an 89% response rate, which is considered acceptable in research and ensures a study power exceeding 80%. A gender imbalance was noted, characterized by a greater number of male respondents, reflecting male dominance within the profession. All respondents belonged to African ethnicity, rendering ethnicity a constant factor in this study. A substantial majority (87.5%) indicated that their involvement in forensic science stemmed from personal passion and commitment, highlighting intrinsic motivation as a primary factor. The majority of participants expressed comfort in working within autopsy suites and performing exhumations, suggesting that these aspects of the role did not contribute to attrition.

Sixty percent of respondents reported leaving prior employment due to adverse conditions, including inadequate compensation, job insecurity, and insufficient incentives. A considerable number of individuals did not indicate intentions to change jobs; however, factors such as suboptimal working conditions, inadequate salaries, undesirable job locations, and restricted career advancement opportunities could motivate them to depart.

The findings underscore the significance of organizational commitment, job satisfaction, and managerial support as essential factors influencing employee retention. The findings correspond with existing research, indicating that employees are more inclined to stay with organizations that promote a supportive, rewarding, and growth-oriented work environment.

Conclusions of the Study

1. Compensation and Benefits: Competitive compensation is a significant factor affecting employee retention. Institutions offering competitive compensation are more likely to retain employees.
2. Career growth and skill development are critical factors influencing employee retention, as individuals pursue positions that promote long-term advancement and ongoing professional enhancement.
3. Managerial Support: Supervisors and managers are essential in staff retention through the provision of feedback, recognition, and fostering a supportive work culture.
4. A safe, clean, and well-equipped work environment contributes to job satisfaction and improves staff retention rates.
5. Advancement Opportunities: Clear career paths and promotion prospects incentivize employee retention within an organization.

Contributions of the Study

This study adds to the existing literature on human resource retention in the field of forensic science in Zambia. The necessity for stable, experienced, and well-supported forensic personnel is underscored, as their specialized and technical work is critical. The evolution of forensic science, in conjunction with technological advancements, necessitates stable staffing to uphold justice and security systems. The findings provide practical insights that may assist the National Forensic Authority in formulating evidence-based retention strategies.

Recommendations of the Study

1. Innovative HR Retention Strategies: The Authority should consider alternative income-generating strategies to finance a supplementary remuneration scheme. The results indicate that inadequate compensation is a significant factor contributing to employee turnover. Exploring innovative ventures beyond core operations

enables the Authority to generate additional revenue for the implementation of performance-based rewards and allowances. Research indicates that financial incentives play a crucial role in retention, particularly in specialized areas such as forensic science (Ahsan et al., 2014).

2. Public-Private Partnerships: Collaborations with science-based industries can enhance benchmarking and the adoption of optimal HR practices. Collaboration with private institutions can assist the Authority in addressing the forensic science knowledge gap and suboptimal working conditions by enabling benchmarking against best practices and facilitating access to modern resources. Public-private partnerships (PPPs) have demonstrated the ability to improve both capacity and quality within public sector organizations (Kwak et al., 2009).
3. Research and Development (R&D): The establishment of an independent R&D unit would facilitate innovation and create supplementary income streams. The focus group discussion revealed insufficient motivation and limited career advancement opportunities. An R&D department fosters innovation, scholarly contributions, and career development, which are recognized motivators for knowledge-based professionals (McGuire et al., 2003).
4. Provide optimal compensation and benefits: The Authority must offer salaries and benefits that align with market rates to effectively attract and retain skilled personnel. The research indicated that more than 60% of participants terminated prior employment as a result of inadequate compensation and benefits. Competitive remuneration draws high-caliber talent and enhances job satisfaction, thereby decreasing turnover (Nawab & Bhatti, 2011).
5. Career Development Opportunities: It is essential to implement regular training programs and establish clear promotional pathways to facilitate employee growth. Numerous participants identified limited prospects and insufficient advancement as factors contributing to job dissatisfaction. Structured career development programs enhance direction and professional identity, thereby improving retention (Dovlo, 2003).
6. Employee Engagement: Implement wellness programs, recognition initiatives, and team-building activities to enhance morale and engagement. Respondents expressing feelings of unappreciation indicated a greater need for recognition. Recognition schemes and wellness programs enhance morale and organizational commitment, both of which are critical for employee retention (Khan et al., 2011).
7. Enhanced Work Environment: Upgrade laboratories and workspaces to comply with international safety and efficiency standards. The most commonly reported reason for contemplating job departure was a poor work environment. Improving safety, cleanliness, and ergonomic conditions can greatly enhance employee satisfaction (Heskett et al., 1994).
8. Job Satisfaction: Implement feedback mechanisms to assess and address employee needs, promoting a sense of value and inclusion. Facilitating staff expression of concerns and responsiveness to feedback enhances their perceived value and sense of belonging, which are critical factors in satisfaction and retention (Rust et al., 1996).
9. Clear Advancement Pathways: Clearly communicate growth opportunities and provide support for career progression. Establishing clear career trajectories mitigates concerns regarding limited professional advancement and uncertain prospects. Employees are more inclined to remain with an organization when they perceive opportunities for future advancement (Mitchell & Albright, 1971).
10. Conduct a systematic analysis of exit interviews to identify prevalent factors contributing to employee turnover and address these issues proactively. Analysing exit interviews systematically can reveal recurring themes and issues related to turnover, offering actionable insights for policy modifications (Sohail et al., 2011).
11. Review of the National Forensic Act: Amend the Act to expand the definition of forensic scientists to encompass all individuals utilizing scientific methods within the justice system. The existing Act's narrow definition of forensic scientists omits numerous professionals who utilize their scientific expertise within the justice system. Expanding the definition would encompass a greater number of personnel, thereby enhancing morale and professional identity, which in turn facilitates retention.

Suggestions for Future Research

Considering the study's limitations, including the small sample size and descriptive approach, future research should implement analytical designs with larger and more diverse samples. Longitudinal studies should be under taken, this research design is essential for examining changes and developments within a population or individual over time. A longitudinal research approach may be utilized to examine the evolution of retention drivers and deterrents over time, particularly in relation to policy changes, organizational reforms, or national development plans.

Future research may involve detailed case studies of particular forensic departments or agencies, employing qualitative methods to investigate the experiences of employees. This would facilitate a detailed comprehension of job satisfaction, organizational culture, and psychological safety.

Research should investigate the efficacy of existing training and career development programs on employee retention. Research may evaluate the impact of targeted capacity-building initiatives on job satisfaction, motivation, and turnover rates.

Empirical evaluation of government and organizational policies regarding forensic workforce management is necessary. This may involve evaluating the effects of remuneration reforms, work-life balance initiatives, and mentorship programs on employee retention.

Future studies should examine the mental health status and coping mechanisms of forensic personnel, considering the psychological strain linked to forensic work. This research would guide the development of psychosocial support systems aimed at enhancing retention.

Research may investigate how the adoption of technology, including digital forensics tools and case management systems, influences burnout reduction and enhances staff productivity, both of which are closely linked to employee retention.

Gender disparities in forensic staffing, particularly within male-dominated units, warrant further investigation into the specific challenges encountered by women in the field. Future research should also propose gender-sensitive strategies for retention.

A further area for investigation is the impact of ethical dilemmas and the perceived integrity of institutions on motivation and the intention to persist in the profession. Workforce Planning and Succession Management Research may also examine succession planning models and their impact on the sustainability of human capital in forensic institutions.

A comparative analysis of forensic personnel retention in Southern African countries, specifically focusing on Rwanda and Mauritius, which have made notable advancements in forensic capacity development should also be considered. This would enhance the understanding of retention patterns in comparable socio-economic and institutional contexts.

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