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Research Article

The Prevalence of the Utilization of Forensic Services to Promote Livelihood Among Population Health Visiting the Rwanda Forensic Institute

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Abstract

Globally, forensic services have become integral in promoting justice, public safety, and community livelihoods. In Sub-Saharan Africa, including Rwanda, the utilization of these services remains uneven, with barriers including socio-cultural beliefs, limited awareness, and accessibility challenges. In Rwanda, the Rwanda Forensic Institute (RFI) has emerged as the central institution providing specialized forensic expertise; however, the prevalence of forensic service utilization among population health clients visiting the institute remains insufficient and undocumented. Thus, timely need to determine the prevalence of forensic service utilization and their knowledge attitude and practices to promote livelihoods among Population Health visiting RFI. A descriptive cross-sectional and triangulation designs, sampling technique was census, purposive among population health visiting for forensic services. Quantitative data were collected by semi-structured questionnaires, while qualitative insights were by discussion of themes and subthemes using Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs) guides. Data was managing SPSS version 27 software and managed by cross tabulation of descriptive and inferential statistics, and visualized using figure. The results on demographic profile indicated that 58% of forensic service up utilization were female. Majority of age participants in utilization of forensic services were among 19 to 35 years with rate of 30% (61) and least age cohort that utilized forensic services was 15 to 18 Years with 21% (25). The prevalence of forensic services utilization by respondents only (11.27 %) 23, with significant P value of 0.99. majority 68.14 % (139) of respondents received health information forensic services, indicating strong community participation in forensic services. Thus, need to advocate for more health education to promote utilization of forensic services for timely forensic justice to victims and suspects in the society.

Keywords: Forensic Services; Utilization; Prevalence; Rwanda Forensic Institute; Livelihood; Population Health

Materials and Methods

Material

Introduction and Background Information

Forensic science the application of scientific disciplines such as biology, chemistry, and medicine to legal investigations plays a vital role in modern public health systems by transforming evidence into reliable, objective information for legal, health, and social outcomes [1] National Institute of Justice, 2025) [2]. Forensic services like DNA profiling, toxicological analysis, and medico-legal examinations help to clarify circumstances of injury and death, support justice, and inform preventative health strategies. Such integration of science and law contributes not only to criminal justice outcomes but also to broader population wellbeing by promoting accountability, reducing violence, and supporting victims in accessing legal redress and socioeconomic safeguards (Forensic Sciences Research, 2025; National Institute of Justice, 2025) [1,3].

In Rwanda, the evolution of forensic infrastructure reflects a national commitment to improving access to forensic analysis and strengthening links between health and justice systems. Initially established as the Kigali Forensic Laboratory in 2005, and later transformed into the Rwanda Forensic Laboratory in 2016,

the institution's mandate was expanded to create the Rwanda Forensic Institute (RFI) to address the growing demand for advanced forensic services and ensure fair administration of justice. RFI offers a wide range of services including forensic legal medicine, DNA analysis, toxicology, digital forensics, and questioned document examination, which are essential for medico-legal investigations and judicial decision-making. These services are requested by law enforcement, health institutions, and individual clients both nationally and regionally [4,5].

The utilization of forensic services can have direct and indirect implications for individuals' livelihoods. For example, DNA paternity testing may determine child support and inheritance rights, toxicology reports can influence workplace injury compensation, and comprehensive documentation of assault or abuse can support compensation claims and long-term health outcomes. By establishing clear, timely, and scientifically supported evidence, forensic services contribute to reducing socioeconomic insecurity and enhancing community trust in formal systems.

In sub-Saharan Africa, increased utilization of forensic services such photography at place of scene, forensic anthropology, paternity test, forensic finger prints, forensic toxicology and mortuary science is becoming evident despite systemic constraints [6]. A cross-country survey by found that Kenya, Uganda, and Ghana recorded a 32%, 28%, and 25% rise respectively in forensic medical cases processed between 2018 and 2022. Similarly, Kenya's National Crime and Health Interface Report (2022) revealed that 48% of sexual assault victims were referred to forensic services, up from 29% in 2015. In Uganda, 61% of healthcare workers in urban centers reported that they had received basic forensic training, compared to only 12% in 2010. Ghana's expansion of forensic capacity has led to a 36% increase in DNA testing requests for legal and familial disputes [2]. Furthermore, 70% of urban populations surveyed in East Africa in 2021 were aware of forensic services, with 43% having engaged with these services at least once in their lifetime. However, rural areas continue to lag, with awareness levels as low as 22%, and less than 15% of rural victims of violence seeking forensic examinations, largely due to accessibility and cultural stigma [7].

Rwanda's forensic services have not only expanded in scope but also in reach. Outreach campaigns have significantly increased the number of people accessing forensic examinations, with over 37,000 cases managed and substantial growth in service requests following institutional improvements [5]. More recently, decentralization efforts such as opening regional branches aim to improve accessibility and reduce physical and financial barriers to utilizing forensic services (New Times, 2025).

Despite this progress, empirical evidence remains limited on the prevalence of forensic service utilization specifically among population health clients, and on how such utilization tangibly contributes to livelihood promotion. Measuring prevalence is crucial to understand the extent of uptake and to identify barriers and facilitators to service access. It also provides foundational data to inform policy, prioritize resource allocation, and advocate for integrated approaches between health, legal, and social support sectors in Rwanda.

Prevalence of Utilization of Forensic Services to Promote Live Hoods among Population Health

Forensic services have emerged as critical tools in promoting justice, improving public health outcomes, and protecting livelihoods, particularly in low- and middle-income countries. However, several studies indicate that these services are significantly underutilized. For example, a 2023 cross-sectional study conducted in Western Kenya revealed that only 31% of victims of violence accessed forensic services at the scene of the crime, while 69% accessed forensic care in hospital settings. The disparity was linked to limited transportation means, lack of trained personnel at the community level, and poor public awareness [8]. Another Kenyan study found that female victims were 24% less likely than male counterparts to receive timely medico-legal care, illustrating gendered disparities in service uptake. This lack of access compromises the ability of victims to pursue justice, receive appropriate compensation, and reintegrate socially and economically, thereby affecting both individual livelihood and collective community health [9].

In Rwanda, the limited capacity in forensic pathology further constrains the country's ability to fully integrate forensic services into its public health system. As of 2024, Rwanda has fewer than 10 qualified forensic pathologists serving a population of over 13 million, with most services concentrated in Kigali. This workforce shortage has led to delays in post-mortem investigations, especially in rural districts, thereby weakening the legal-medical linkage needed to address cases of sudden or suspicious deaths. According to data from the Rwanda Forensic Institute (RFI), only 45% of unnatural deaths reported between 2020 and 2023 received a complete forensic examination. The remaining cases either lacked follow-up or were buried without post-mortem confirmation. Such gaps compromise not only judicial outcomes but also public health surveillance, especially in detecting emerging infectious diseases, child abuse, and domestic violence. A well-functioning forensic system could provide evidence that supports policy formulation, helps victims rebuild their lives, and prevents recurrent public health threats.

Furthermore, the role of forensic services in supporting mental health and institutional accountability remains largely under-leveraged. In Rwanda, mental health issues among genocide survivors remain a major concern, with a study published in BMC Public Health showing that 28% of survivors suffer from post-traumatic stress disorder (PTSD), yet only 11.5% had accessed formal mental health support through forensic psychiatric services [10]. Similarly, in a Canadian population with intellectual disabilities, over 17% of incarcerated individuals had forensic mental health diagnoses, yet many lacked appropriate rehabilitation services [11]. On another front, forensic auditing in Rwandan district hospitals revealed that misappropriation of health funds exceeded 12.6% of audited budgets in 2023, posing a threat to healthcare access and affordability. These examples show how forensic interventions whether in mental health or institutional oversight can preserve livelihoods, protect vulnerable populations, and promote transparency within health systems. Promoting widespread, equitable access to forensic services is thus essential for improving public trust, advancing health justice, and building resilient communities [12].

Types of Forensic Services Utilized to Promote Livelihood among Population Health

Globally, forensic services such as forensic pathology, forensic toxicology, and forensic epidemiology are increasingly used to support both justice and health systems. For instance, in the United States, forensic epidemiology helped reduce overdose deaths by combining legal data with public health interventions [13]. A study in North Carolina found that counties distributing over 100 naloxone kits per 100,000 people saw a 12% lower drug-related death rate, saving around 352 lives by 2016 and generating up to $4,800 in benefits per dollar spent. Similarly, forensic pathology is used to detect outbreaks and unnatural deaths early, supporting disease surveillance and guiding preventive measures that improve community health and productivity, [14].

In Africa, countries are recognizing the value of forensic services in promoting social justice, public safety, and health. For example, in South Africa's Limpopo Province, a study of 9,319 forensic autopsy cases showed an 8.1% decline in total referrals and a 10.7% drop in unnatural deaths during the COVID-19 pandemic, helping identify the impact of lockdowns and guiding public health responses [15]. Zambia, on the other hand, has prioritized forensic pathology to strengthen both justice and health systems. Their national plan includes training forensic professionals and setting up DNA and toxicology labs to investigate deaths due to diseases or violence key actions that support both justice and health-based livelihoods [16]. In East Africa, forensic medicine plays a major role in supporting victims of sexual and gender-based violence (SGBV), which significantly affects livelihoods, especially for women. In Kenya, forensic services such as medical examinations, DNA testing, and expert witness reporting have helped survivors get justice and medical care. A report estimated that SGBV costs the country over KES 46 billion (about USD 455 million) annually due to productivity losses and medical treatment. However, access remains a challenge due to high costs ranging from USD 20,000 to 60,000 for comprehensive forensic setup and lack of trained professionals in many rural areas [10]. Locally in Rwanda, forensic services are still developing but are gaining importance in promoting both justice and population health. A study on the forensic system in Rwanda showed that forensic autopsies, DNA testing, and clinical forensic medicine are increasingly used in cases of violence, sudden deaths, and child abuse. However, challenges remain, including a shortage of trained forensic pathologists and lack of formal specialization pathways. The Rwanda Forensic Institute (RFI) is working to address these gaps by offering training and collaborating with health institutions. These efforts aim to ensure that forensic services contribute not just to legal justice, but also to improving the health and livelihoods of communities by preventing violence, resolving disputes, and guiding health policies [17,18].

Forensic Health Education to Promote Livelihoods and Health Population

Globally, forensic health education plays a vital role in strengthening health systems and promoting community livelihoods by improving the quality and availability of forensic services. According to a World Health Organization report (2022) [19], countries with structured forensic education programs have demonstrated improved capacity to investigate causes of death, thereby enhancing disease surveillance and injury prevention efforts. For instance, the implementation of standardized forensic training in Europe and North America has led to a 15–20% increase in accurate medico-legal death investigations over the last decade. This enhanced capacity helps reduce wrongful convictions, supports victim justice, and contributes to broader public health through timely identification of epidemics and violence trends [20].

In Africa, forensic health education remains uneven, with significant disparities between countries. A 2023 review of forensic education programs across sub-Saharan Africa revealed that only 30% of countries had formal university-level forensic training courses, often limited to urban centers. For example, South Africa leads with several accredited forensic pathology and toxicology programs, yet reports indicate a shortage of trained forensic personnel, with a ratio of approximately 1 forensic pathologist per 1.3 million people. This gap limits the capacity to fully utilize forensic services for public health benefits, affecting livelihoods by delaying legal outcomes and reducing trust in health and justice systems [21].

In East Africa, countries such as Kenya and Uganda have recently expanded forensic health education through partnerships with international universities and local governments. A 2022 survey showed that Kenya increased its forensic health training programs by 40% over five years, resulting in a 25% rise in forensic evidence utilization in legal and health settings. Despite progress, challenges persist, including limited funding, outdated curricula, and insufficient practical training opportunities. These limitations impact the readiness of forensic professionals to respond effectively to public health issues like sexual violence, poisoning, and sudden deaths thus influencing community livelihoods and health outcomes [21].

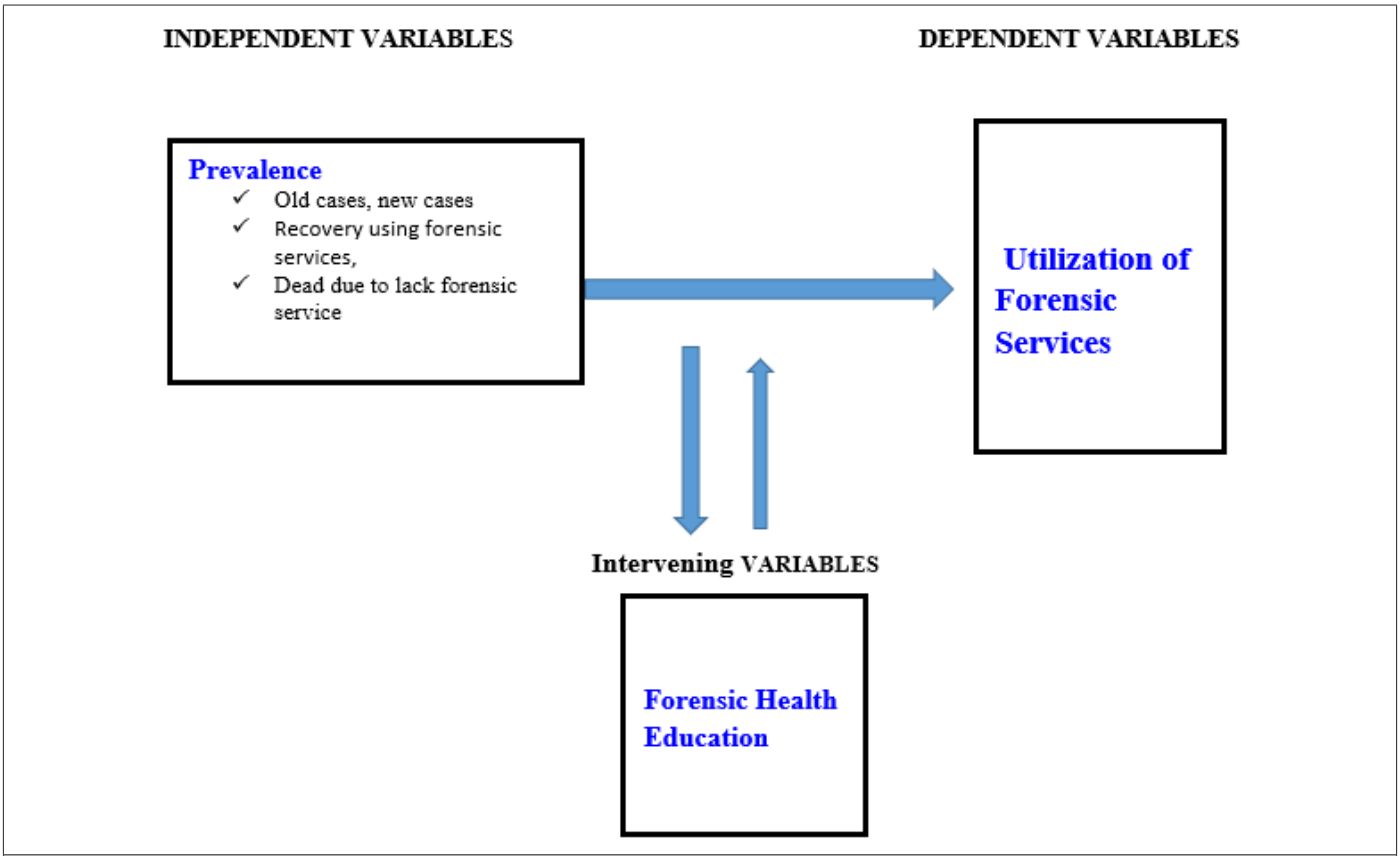

Figure 1: Conceptual Framework, Silali etal (2025).

Rwanda is at an emerging stage of developing forensic health education, with growing recognition of its importance for public health and socioeconomic development. Currently, formal forensic training is integrated within broader medical and legal education but lacks specialized programs focused on forensic pathology and forensic nursing. A recent assessment by the Rwanda Forensic Institute (2024) found that only 18% of healthcare professionals had received any formal forensic training, and there is a critical need to expand educational opportunities to meet national demand. Improving forensic health education in Rwanda is expected to enhance the quality of forensic investigations, thereby supporting justice delivery, reducing violence-related morbidity and mortality, and ultimately promoting community livelihoods through strengthened public health Figure 1.

Conceptual framework

Methods

Study Design

This study was descriptive cross-sectional and triangulation designs of mixed methods The quantitative component determined the prevalence and types of services utilized, while the qualitative component explored socio-cultural factors and the role of forensic health education. A descriptive cross-sectional design was appropriate as it provides a snapshot of utilization patterns and associated determinants at a specific point in time, complemented by a retrospective review of institutional records to enrich contextual understanding. Furthermore, triangulation enhanced the credibility and validity of findings by comparing and corroborating results across different data sources [22].

Study Area

Gasabo District, the largest and most populous of the three districts comprising Kigali City, Rwanda, spans approximately 430.3 square kilometers and is divided into 15 sectors: Rusororo, Rutunga, Kacyiru, Bumbogo, Gatsata, Nduba, Kimihurura, Kimironko, Jali, Gikomero, Gisozi, Jabana, Kinyinya, Ndera, and Remera. These sectors are further subdivided into 73 cells and 501 villages. As of 2020, Gasabo had a population of 879,505, representing about 51.7 percent of Kigali City's total population and approximately 6.7 percent of Rwanda's total population [23]. This demographic concentration is significant for this study, as a large proportion of residents utilize services at national institutions such as the Rwanda Forensic Institute (RFI), which is centrally located and accessible to urban and peri-urban populations within Gasabo District.

Women constitute 51.6 percent of the district's population, with a gender ratio of 106 females per 100 males lower than the national average of 111 ranking Gasabo among the five districts with the lowest gender ratio. This is particularly relevant given that gender-based violence (GBV) cases, predominantly affecting women, form a considerable portion of the forensic caseload at RFI. The average household size in Gasabo is 4.8 persons, similar to the national average, suggesting that even in urban settings, households tend to be large, a factor that may contribute to intra-household conflicts and potential demand for forensic intervention. Socioeconomical-

ly, 74 percent of residents are classified as non-poor, 12.8 percent as poor, and 13.2 percent as extremely poor. These variations are crucial for understanding forensic service accessibility, especially considering that lower-income groups often face limitations in reaching legal and health services.

Although it is part of Kigali City, Gasabo exhibits both urban and semi-rural characteristics. Housing data shows that 24 percent of homes are built with mud-covered tree trunks and 46.4 percent with mud bricks covered with cement. These figures indicate a gap in urban development standards and reflect potential barriers to accessing formal health and justice infrastructure, including forensic services. On average, residents walk 25.5 minutes to reach primary schools and 35 minutes to access health centres distances that may influence the timeliness of seeking forensic support, particularly in emergencies. Employment among individuals aged 16 and above stands at 78 percent, with an unemployment rate of 5.3 percent and economic inactivity at 17.7 percent. Such labour force dynamics may influence the nature of forensic cases, including work-related injuries and domestic disputes affecting household livelihood.

In terms of education, 89.6 percent of residents aged six and above have attended school, placing Gasabo among the top three districts nationally in educational attainment. This level of education is expected to enhance community awareness and acceptance of forensic services. Furthermore, 26 percent of households are headed by females, with an additional 4 percent being de facto female-headed due to the absence of a male head. This has implications for household decision-making and vulnerability, particularly in cases involving GBV or inheritance disputes that often require forensic documentation. As such, Gasabo District provides a relevant and dynamic setting for investigating the factors contributing to the increased utilization of forensic services in promoting livelihoods and improving population health outcomes in Rwanda.

Target population

The target population was all population health seeking forensic services at Rwanda forensic institute.

Sample size Determination

We calculated the sample size using Yamane's Formula [24]. As of mid-2024, the Rwanda Forensic Institute (RFI) had processed and submitted over 50,000 forensic reports which is proportional to cases during the first phase of the National Strategy for Transformation (NST1) period, which spans from 2018 to 2024. Therefore, RFI processes approximately 694 cases per month on average in 8 forensic services, that means each service or department receive around 86.75 case per months, in our study will be using only 4 services, therefore 86.75*4=347(population size)

Yamane's formula states:

$$n = \frac{N}{1 + N(e)}2$$

Where:

- n = sample size
- N = population size
- e = margin of error (level of precision)

$$n = \frac{347}{1 + 347(0.05)}2$$

=186, Therefore by adding 10% for non-response n=204

Inclusion and exclusion criteria

All population health seeking forensic services at Rwanda forensic institute

All population health seeking forensic services at Rwanda forensic institute who refuses to sign consent form, those with mental illness.

Sampling Technique

The sampling technique was simple random probability sampling for primary respondents in the 1 month of data collection to ensure that each individual in the population has an equal chance of selection, thereby minimizing bias and enhancing representativeness [25]. and retrospective form for secondary data collection for the last 5 years (January 2020 to December 2024). We were using non-probability sampling (purposive) for KII and FGD data collection.

Pilot Study

A pilot study to assess the reliability and validity of the instruments was conducted at Nyarugenge Isange One Stop Center (IOSC) [26]. This study involved recruiting 21 participants visiting Nyarugenge Isange One Stop Center, representing approximately 10% of the target sample size for the main study. Given the pilot study's limited scope and the need for quick recruitment, participants were selected using convenience sampling techniques [27]. The pilot study aimed to achieve several objectives: to assess the clarity and comprehensibility of the survey questionnaires, to test the reliability of the data collection methods, and to determine the feasibility of participant recruitment and retention [28]. Feedback from both participants and field researchers was used to refine the study tools, address any ambiguities or misunderstandings, and enhance data collection procedures.

Reliability and Validity of Instruments

The reliability of study results to be replicated and followed consistently across various instruments, sites, and investigators is known as reliability [29]. To test the reliability of the of the research instruments, the questionnaire and interview guide are developed in English then translated in Kinyarwanda using easy words to understand [30]. The instruments of data collections were settled to respond to the study objectives; supervisor checked and revised it before administrating them study participants.

Data Management and Analysis

Data was analyzed was done by cross tabulation of descriptive and inferential statistics of the the study specific objectives. Quantitative data will be will be edited, coded and entered in excel converted in SPSS version 27 by researcher for data management.

Then after, qualitative data was analyzed by discussion of themes to saturation via interviews. The coding process of the qualitative interviews was undertaken with the assistance of a qualitative data analysis software program. Ethical Considerations.

Ethical approval

The ethical approved by the Mount Kigali University postgraduate school. The letter requesting for authorization to collect data at Rwanda forensic institute (RFI) submitted to the Director General of Rwanda Forensic Institute (RFI) via the institute outlook.

Results and Findings

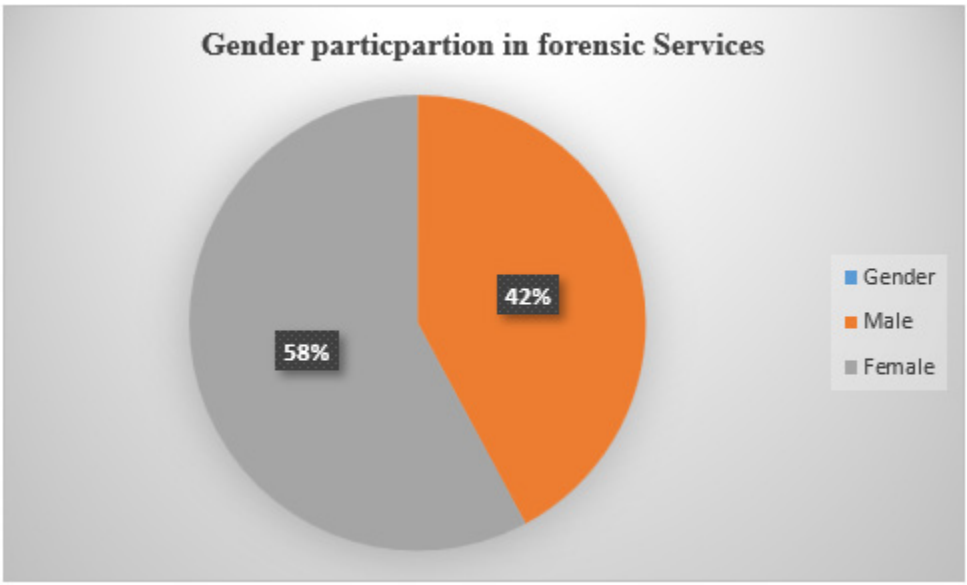

Figure 2: Gender participation in forensic Services.

Demographic Profile

- **Gender Participation**

This section outlines the demographic characteristics of the 204 participants who participated in the study at Rwanda forensic institute. The study opined that majority of the participants were majority,118 (58%) were females while males were only 42% (86) participated in the utilization of forensic services to promote live hood in the population health, with significant P values of 0.023, 95% CI Figure 2.

- **Distribution of Age Participation**

The prominent age cohort that participated in utilization of forensic services were among 19 to 35 years with rate of 30% (61) and least age cohort that utilized forensic services was 15 to 18 Years with 21% (25) respondents Figure 3.

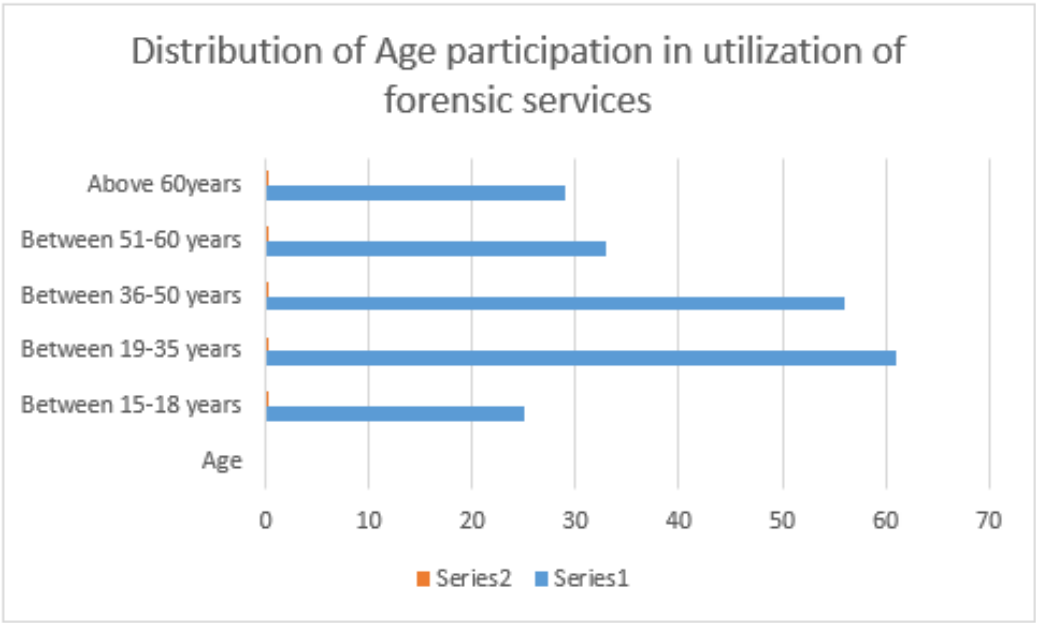

Figure 3: Distribution of Age participation in utilization of forensic services.

Prevalence of Utilization of Forensic Services to Promote Livelihood among Population Health

The results showed that the prevalence of forensic services utilization by respondents (11.27 %) 23 respondents reported utilizing forensic services, with significant P value of 0.99 Figure 4. Utilization is progressively improving, driven by growing awareness, accessibility, and recognition of the role of forensic services in enhancing livelihoods and public health outcomes.

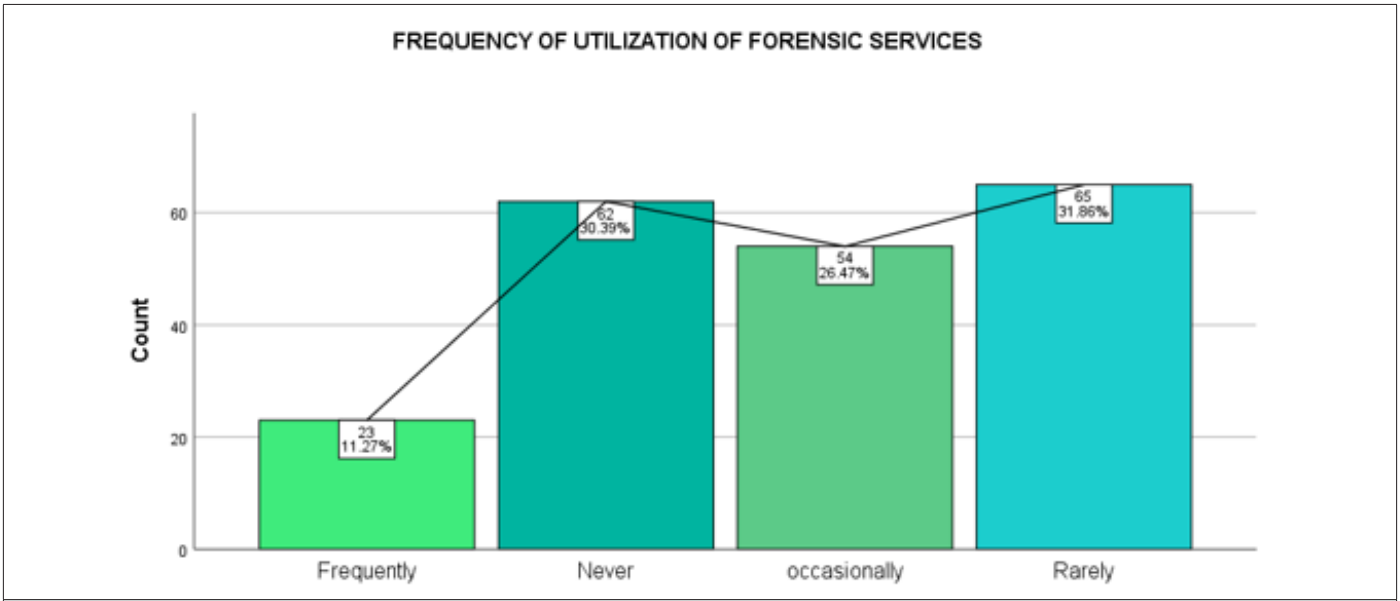

Figure 4: Prevalence in the utilization of forensic services among the Population health in the study area.

Level of Forensic Health Education in Promoting Livelihood among Population Health

The findings in figure 5 below reveal that 68.14% (139) of respondents received education or information about forensic services, indicating strong outreach and public engagement efforts by the Rwanda Forensic Institute, with the highest mean score of 1.40 and a relatively low standard deviation of 0.63 This high awareness level suggests that educational initiatives significantly enhance public understanding and trust, leading to increased utilization of forensic services. Conversely, the 24.02 % (49) who had not received information and the 7.84% (13) who were unsure highlight persistent gaps in information dissemination. Bridging these gaps through targeted community sensitization and media campaigns could further encourage service use. Overall, access to accurate forensic information emerges as a critical driver of utilization and livelihood promotion among populations seeking health and justice services. was also opined during KIIs discussion heled in facility.

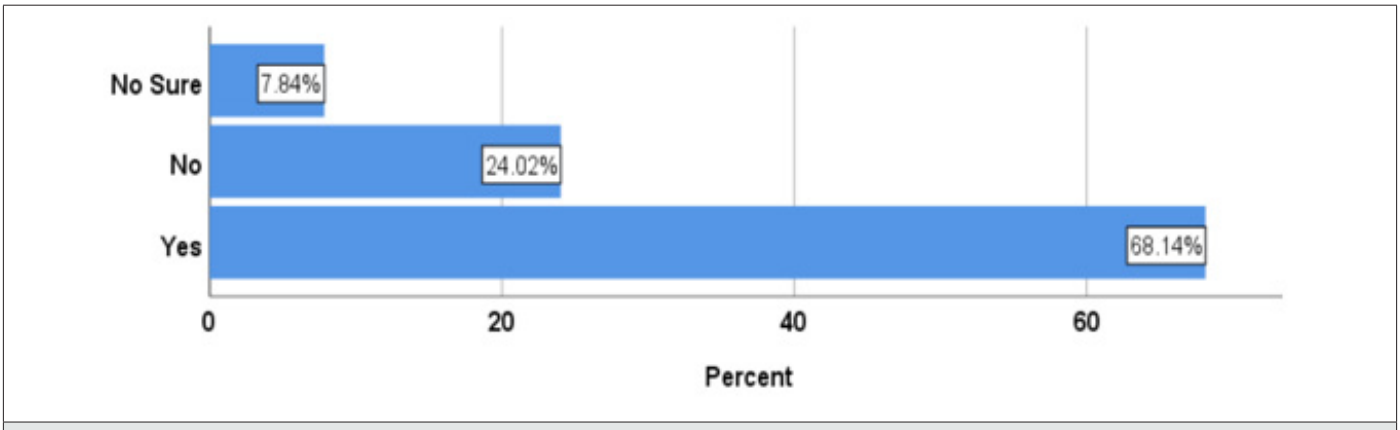

Figure 5: Received Health information on utilization Forensic Services.

KII said that "Many people now come to the Institute because they have received awareness through community outreach and media programs. When people understand the role of forensic services in justice and health, they are more willing to seek our help."9 October 2025.

Another KII said that "Education has played a big role; before, people feared or misunderstood forensic services, but now, after sensitization, the number of clients visiting the Rwanda Forensic Institute has increased noticeably." 9 October 2025.

"Before we got information about forensic services, many of us didn't know what they were for. After attending awareness sessions, we realized how they help in solving cases and protecting livelihoods, so more people are now willing to use them." FGD held on 8th October 2025.

The findings in figure 6 below show that schools and universities (33.33%)68, media (28.43%)58, and community outreach programs (27.45%)56 are the leading sources of information about forensic services, underscoring the critical role of education and public communication in influencing service uptake. (Mean score of 3.17 and standard deviation of 1.013). The low contribution from health institutions (2.45%)5 and religious/community leaders (8.33%)17 reveals a communication gap within health and faith-based platforms that could otherwise strengthen awareness and trust. Statistically, these variations suggest a strong association between exposure through structured educational and media platforms and the likelihood of utilizing forensic services. Academically, this implies that information dissemination through formal and mass communication channels enhances public literacy, trust, and accessibility, leading to greater utilization of forensic services that support justice, wellbeing, and livelihood improvement among populations visiting the Rwanda Forensic Institute.

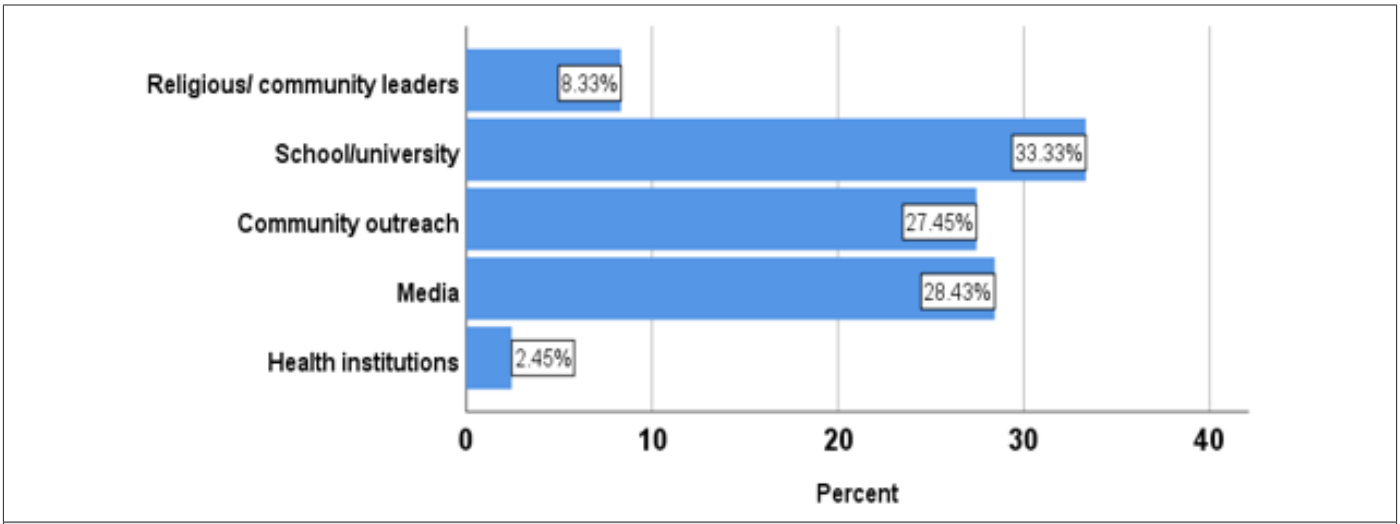

Figure 6: Sources of Information about Forensic Services among the Population Health.

Conclusion

The study revealed that forensic service utilization at the Rwanda Forensic Institute is predominantly driven by the 19–35-year age group, indicating a youthful demographic engagement. The significant forensic utilization of chi-square $\chi^2 = 8.325$, and P vales 0.016 of the forensic services utilization, likely due to greater awareness, exposure to media campaigns, and higher mobility.

Recommendations

To strengthen the utilization of forensic services and their contribution to community livelihoods, the Rwanda Forensic Institute (RFI) and relevant policymakers should prioritize comprehensive awareness and education initiatives. Sustained community sensitization campaigns and integration of forensic literacy into public health and justice programs are essential to demystify forensic science and promote trust in its value.

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