Ghana J. Sci. **62** (2), 2021, 44 - 57 https://dx.doi.org/10.4314/gjs.v62i2.5

ASSESSING THE STATE OF FORENSIC SUPPORT TO CRIMINAL INVESTIGATIONS IN GHANA: A CASE STUDY IN THE GREATER ACCRA REGION

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ABSTRACT

The study assessed the state of forensic support to criminal investigations by measuring public awareness, knowledge and perception of forensic science in Ghana. A simple random technique was employed to elicit information from 200 consented respondents in selected neighbourhoods in Accra through face to face interviews, questionnaire responses, and random phone calls. The study identified forensic science education as a key challenge among others in the forensic sector. The state of forensics support to criminal investigations in Ghana was rated on the scale of good (10.5%), bad (81.5%) and very bad (8%) indicating that forensic science in Ghana has "gone dark". The study's findings call for respective stakeholders and policymakers of Ghana to prioritize forensic support to criminal investigations to promote safety, security, and sustainable economic development.

Keywords: Criminal investigations, criminal justice system, education, forensic science, forensic support, Ghana.

Introduction

Forensic science is the application of scientific methods to investigate crime and solve social and environmental issues involving justice and the court of law, (Siegel & Saukko, 2012). Elements of forensics have been in existence for over a century, however, it has become very popular over the last few decades as a result of the evolution of science and technology (Nam *et al.*, 2014). Criminal activities are inevitable situations in our societies however they can be explained and solved based on different perspectives and worldviews. The use of forensics to solve contemporary crimes, social and environmental issues has caused a great revolution in global justice systems. The world presents a very great population of advocates of the use of forensics in solving crimes.

Forensic science practice in Ghana can be dated back to 1922 where fingerprinting was mainly used to solve crimes through the Criminal Investigations Department (CID) and also render services concerning the identification of individuals (Amankwaa *et al.*, 2019) for other sectors such as the immigration and military of the country. The present population of Ghana and the expansion of the country's economy and commercialization has led to more urban crime trends. Consequently, there has also been a resurgence of historic crimes such as human trafficking and kidnapping in Ghana (Dziwornu, 2021).

Notwithstanding, current and emerging crimes comprising burglary, various forms of cyber-crimes, corruption, document fraud, murder, environmental crimes and injustice, food crimes, sexual assault, familial and litigious issues and other civil and commercial issues are all on the rise in Ghana. The Ghana Police Service which is the main law enforcement agency in Ghana has helped in the combat against crimes in the country. The challenge in this fight is that mainly conventional approaches including eyewitness, victims and suspects testimony, tip-offs and other forms of unscientific approaches are still used to manage the new breeds of sophisticated crime scenes and evidence in the country (Amankwaa *et al.*, 2019).

In the last decade, the importance of forensic evidence and investigations has been raised in Ghana on several occasions in the eyes of the public. In 2011 the Ghana Government through a £3 Million European Union funding refurbished the Forensic Science Laboratory (FSL) which is located at "Kawo Kudi" in the capital city, Accra (Amankwaa *et al.*, 2019). This facility is operated by the Ghana Police Service and it is the only forensic laboratory serving 32 million Ghanaians with the help of about 651 police stations across its 16 regions. The facility is ultramodern with five different units making it the first of its kind in West Africa.

Major findings from the Ghana Police Service and available literature informs us about the rate at which crimes have increased in Ghana. It, however, appears that most citizens still find forensic science as an underutilized field in Ghana even though the adversarial criminal justice system approves of forensic support to criminal investigations. It is well noted that in sexual assault case situations, there is some form of forensic support however it is mostly dependent on the status of victims and suspects for the case to be given adequate attention.

In 2018, Ghanaians were overwhelmed with headlines of the exoneration of a convicted suspect, Mr Emmanuel Asante through a further forensic analysis at the FSL after several years. He had already served 12 out of 15 years of his sentence for a wrongful accusation of raping and impregnating a student in Tamale in 2006 (GHASC, 2017). The headlines made by this popular case informed the public about the importance of forensic investigation to justice delivery in Ghana. On the contrary, Ghana has become the home of cybercriminals in the past few decades. Nowadays, spams, scams, cyber fraud, mobile-money fraud, hacking, "romance fraud" and many other novel crimes with the help of computer devices and the internet have increased in Ghana and anybody at all can fall victim. Most of these crimes are establishing roots because the actual perpetrators are mostly not identified as a result of poor forensic support and cyber scene management.

Ghana Standards Authority runs a forensic lab that helps in running analysis of confiscated drugs, cosmetics, medical samples, tissues and other substances across the country (Amankwaa *et al*., 2019). Meanwhile, food fraud, especially adulteration is gradually gaining ground in Ghana (Sulley & Amankwa, 2020) basically because of consumer taste and preference, globalization and technology and the producer's intent to gain undue profit. Most of these producers get away with the crimes they commit because of the inadequate forensic technology available to investigate the details of these cases. Notwithstanding, environmental injustice is also an underreported crime in Ghana (Agyemang *et al.*, 2020; Bempong, 2019) while the production, distribution and

use of psychoactive drugs are on the rise. Aside from the use of illicit drugs to facilitate sexual assault, orchestrate delinquencies and satisfy addiction which is all crimes, people are now unprofessionally mixing drug concoctions in the streets of Ghana (Andoh-Arthur *et al.*, 2020; Asante & Nefale, 2021). This is eventually indicating the insurgence of the use of novel psychoactive drugs as a result of inadequate drug network identification and detection methods.

Presently one way to bridge the gap between the public and the expert is by feeding the public with research-based and empirical information due to the limited scholarly research concerning forensic science and criminal investigations in Ghana. Therefore, the objective of the study was to assess public knowledge and awareness of forensic science and use it to ascertain the state of forensic support to criminal investigations in Ghana. The study further answered questions about the factors that influence people's knowledge and awareness of forensic science. Finally, the study assessed respondents' perceptions of forensic science in Ghana to present a clear picture of the present situation and what is anticipated of the future.

Experimental

Study area

The research focused on the Ashaiman, Accra, Tema and Kpone Katamanso in the Greater Accra region of Ghana. This is as a result of characteristics such as the pace of economic and social development, the diversity, economic and industrial activities, the nature of contemporary social and environmental issues that give rise to crimes and finally police activities in these areas.

Study design, sampling method, and data collection

The study considered 400 randomly selected respondents across the selected locations. A questionnaire-based cross-sectional study was designed to describe the support given to criminal investigations in two modes (paper-based and online or electronic). Respondents were interviewed through a random survey with face to face, online questionnaire and random phone calls over a period of five months from December 2018 to May 2019. The voluntary paper-based and online surveys were conducted among ordinary Ghanaians on the street, schools, workplaces and homes, considering both males and females with different demographic characteristics randomly. The same questionnaires were sent to professionals working in academia, research, forensic science industry and other relevant industries to elicit data. A total of 200 randomly selected cross-sectional responses were collected. The research targeted 180 delegates who voluntarily participated in the survey. Similarly, a total of 20 randomly selected professionals were targeted for the study. The study achieved a response rate of 100% due to respondents' interest in the subject of research while taking into consideration nonresponse bias.

Sample size determination

Slovin's formula (Ellen, 2018) was adopted to set the limit for the study. Slovin's formula mathematically states that;

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

Where: n = the sample size,

N= the target population

e = degree of freedom with a margin error of 0.05 indicating a confidence level of 95%. The total number of respondents assumed for

the study was 400.

Mathematically $n = \frac{400}{[1+400\ (0.05^2)]} = 200$;

Ethical consideration

Ethical consideration was granted by the CID Headquarters of Ghana to elicit accurate information from personnel at the FSL and the general public. This was done after three days of semi-structured interviews with personnel at the Forensic Science Laboratory (FSL) to acquire accurate information about the subject of the research.

Data processing and analysis

The data were coded, analysed, and transcribed with Microsoft Office 16 version. The data was further subjected to Excel to be visually represented in pie charts and bar graphs for proper illustration of the relationships in the data obtained from the survey. Multinomial logistic regression analysis was used to explain the observations made on the predicted multiple independent variables of the study and the effect it had on the two categorical dependent variables using the IBM SPSS Statistics 20 package.

Results

Socio-demographic characteristics of respondents

The sociodemographic characteristics of respondents had a great impact on the data gathered throughout the survey. Throughout the interview process, it was realized that respondents from the selected neighbourhoods had different mindsets based on their present location at the time of the study. Respondents who participated in the study fell within ages ranging from 15 - 50 years with a male majority of 123 (61.50%) and the remaining being females. The study made strides to avoid ethnicity or tribal biases by taking into consideration responses from different ethnicities across Ghana including transborder tribes. Devoid of stereotypes and discrimination based on previous experiences or criminal records or history, respondents from every religion were considered for the study. The study recorded responses from 136 (68%) Christians, followed by 44 (22%) Muslims while 20 (10%) were considered as those from other religions.

Respondent's level of exposure was measured by how far respondents have reached in terms of education or their career experience. Out of the total population, 165 (82%) were found to have attained formal education either at the basic level or higher-level education while 35 (17.5%) had been either engaged in informal education i.e. (apprenticeship) or other occupations. The extent of neighbourhood disorder was measured considering what respondents perceived about their neighbourhood. Instruments used to identify neighbourhood disorder included rates of vandalism, state of abandoned houses, state of delinquent gangs, state of drug dealing and drug abuse, and nature of the neighbourhood (presence or absence of street lights, slums, and well-demarcated streets) as a whole. A few 12 (6%) respondents who lived in more secured locations gave good accounts about the GPS and this was based on their sense of security, past or personal experiences with personnel in GPS. Aside from the positive remarks about the GPS, only 11 (5.5%) respondents reported having ever contacted for forensic support or seen the GPS applying forensic support to solve a crime in reality. The remaining 189 (94.5%) were respondents who had not sought forensic support or experienced forensic applications by the GPS before the time of the study.

Public awareness, knowledge and perception of forensic science in Ghana

The data (Tables 1 & 2) shows that forensic science is very unpopular in the country because about 141 (70.5%) of the respondents were not aware of forensic science and its procedures while on the other hand 179 (89.5%) were not having a satisfactory knowledge level of forensic science until the researcher's brief introduction before the interview. This category of the research population was not even aware that forensic procedures included assessing fingerprints through their biometric ID cards for forensic analysis in crime labs. For those who had an idea or knowledge about forensics, most of them had their knowledge mainly from television series and documentaries with only a few acquiring the knowledge from academic papers, seminars and classroom or formal education. It was however realized that, across the study population, respondents' area of interest in terms of education had a great influence on their understanding of the subject of research previously or just before the interview.

Upon carefully analysing this category of the population, 34 (17%) respondents were identified as either practising or interested in law programs. The results of the study showed that 3 respondents had a fair knowledge about forensics while the remaining 31 had limited or no idea. On the other hand, 77 (38.5%) respondents were either involved or interested in science-related programs and the majority of these respondents were identified as undergraduates or doing postgraduate studies or research. It was revealed that 38 out of the 77 respondents had a fair knowledge about forensic science and its importance in crime-solving either from movies, documentaries or scholarly literature while 39 had their knowledge about forensics enhanced by the researcher's brief discussion.

Specific questions were used to ascertain the respondent's perceptions about the GPS. Without hesitation, all the 200 (100%) respondents answered positively to the question *"Are you aware that GPS is responsible for law enforcement in Ghana?"*. Even though all respondents were aware of the great responsibility shouldered by the GPS, 188 (94%) had a bad perception about GPS and most of the responses were allegedly attributed to prejudice, ineffectiveness caused by bribery and corruption assumed poor level of education in the police department, poor police training and other issues regarding institutional trust. However, some groups were optimistic about the fact that things will change for the better in one way or the other with time hence they had no reason to respond based on their negative perception of GPS.

Even though most respondents had little or no knowledge about forensic, in the course of the study they were able to tell and distinguish normal police investigative procedures from forensic procedures and make judgments to create a distinction based on their experiences and encounters with criminal investigations conducted by GPS as shown (Table 1). Respondents upon realizing the need for prioritizing forensic science in the country, most of them were generally impressed about forensics science and linked it with the crime-solving situation in Ghana. All respondents agreed that forensic science is a crime-solving tool and forensic evidence can help prevent the delay in justice delivery and justice miscarriage.

However, the study identified 26 (13%) of the selected population agreeing that forensic science does not or will not always provide

positive results as they kept emphasizing professionalism, privacy, and ethical issues relating to the handling of evidence samples and manipulation of results. Most of the respondents linked their responses to the fact that there are numerous unsolved crimes in Ghana which will continue to remain the same simply because of some "untouchables" in society. Based on the respondent's own experiences, perspectives, and education acquired during the study, respondents made their general impressions about the state of forensic support to criminal investigations in Ghana (Fig. 1). Their ratings were based on a Likert scale as follows; good 21 (10%), bad 163 (82%), and very bad 16 (8%).

TABLE 1

Respondents Awareness about forensics science

Forensic awareness	Frequency	Percentage %	Cumm.
Yes	141	70.50	70.50
No	59	29.50	100.00
Total	200	100.00	

TABLE 2

Respondent's knowledge of forensics before the interview

Forensic knowledge	Frequency	Percentage %	Cumm.
Yes	21	10.50	10.50
No	179	89.50	100.00
Total	200	100.00	

TABLE 3

Respondents view on criminal investigative procedures

Forensic procedures	Frequency	Percentage %	Cumm.
Yes	11	11.50	11.50
No	189	94.50	100.00
Total	200	100.00	

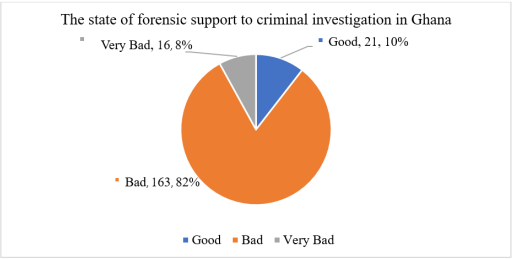

Fig. 1: Respondents general rating on the state of forensic support to criminal investigations in Ghana. Source: Field survey, January 2019.

Discussion

Multinomial logistic regression analysis

It was hypothesized that level of education, area of interest and occupation, awareness of police investigative methods and the experience of police operations will predict whether a person had knowledge about forensic science or was aware of its application in crime-solving in Ghana. The data gathered across the selected neighbourhoods was used to understand the social reality by subjecting the qualitative data to a multinomial logistic regression analysis as shown (Tables 4 & 5). In terms of likelihood ratios of each independent variable's overall contribution to the model, considering the conventional threshold of (0.05) 95% confidence interval, it was seen that level of education, awareness of investigative methods, gender and experience of criminal investigative operations were significant predictors (Tables 4 & 5). While occupation and area of interest and awareness of investigative methods tend to be near significant (Tables 4 & 5).

In the model, the coefficient -0.0286 indicates that there is less likelihood of respondents to either have knowledge or awareness of forensic science if they did not have an interest in science-related careers or

were working or studying in a science field. On the other hand, -0.277 indicates the less likelihood of respondents to either have knowledge or awareness of forensic science if they never witness a forensic investigation conducted by the Ghana Police. The module predicts this occurrence for every increase in the occupation and area of interest or experience of the criminal investigative operation variable. This is because not everyone will be privileged to get access to scientific literature, take a forensic science course or watch CSI movies to improve their knowledge of forensic science.

Based on the multinomial logistic regression model, a predictive relationship between one or more independent variables and a categorical dependent variable can be found. Responses were coded as variables that influenced each other and were explained based on how strong the relationship between the dependent variables and the independent variables were. The analysis conducted gave estimates of how the awareness and knowledge of forensic science (dependent variables) change as the predicted independent variables change with time. The analysis was measured based on a good explanatory power of; (Prob > F = 0.002) with R-squared of 86.15% and (Prob > F = 0.000) with R-squared of 85.88% for public knowledge and awareness about respectively. This model fitting information compared the full model with the predictors against the constants and the statistical significance indicates that the full model represents a significant improvement in fit for the constants or over the null hypothesis.

To develop and maintain progressiveness in terms of solving crime in Ghana, the study attempted a bigger problem by breaking it into smaller pieces with intentions to scale up in the future. Responses collected across the study area explained respondents' understanding of the reality surrounding them indicating that they are the right people to solicit information from (Rogan, 2021). Upon analysing the data in (Table 4) the perception of respondents tends to be increased positively as all the independent variables increase positively with time. The model (Table 4), showed significant levels of p = 0.038 in education, p = 0.073 in respondent occupation and area of interest, p = 0.047 in the experience of GPS criminal investigations as run against respondents' level of knowledge in forensics. On the other hand, (Table 5) shows significant levels of p = 0.069 in the level of education, p = 0.001 in respondents who experience GPS criminal investigative procedures against the independent variable level of awareness. Respondent's awareness of criminal investigative strategies however recorded p = 0.400 near significance for respondents' awareness of forensic science as shown in (Table 5).

All independent variables (knowledge and awareness) were found to significantly influence the perception people had about forensic science (Table 4) at the time of the study. Comprehensibly, respondents who were having a satisfactory level of forensic science knowledge and awareness were found to be within the ranges of 15 - 25 years. Generally, this result in correlation with their level of education explained that younger respondents tend to have positive perceptions about forensic science. This was understood from the data that younger respondents tend to be attracted to CSI movies and documentaries across the study area. This explains the likelihood that the CSI-education effect had come into force one way or the other.

Perception about forensic science is a very important aspect of understanding the concept of forensic science (Edmond *et al.,*

2017) as in some cases forensics science has done a great deal of serving social justice (Roux *et al.,* 2012) while denying others in one way or the other (Amankwaa et al., 2019) elsewhere. According to the Encyclopaedia of Criminology and Criminal justice, people may derive their conclusive perceptions whether negative or positive based on the outcomes of forensic procedures and what they might have heard about forensic science (Justice, 2014). Other people have their perceptions about forensic science which in most cases tends to be positive based on what they normally see on TV and documentaries commonly known as the Crime Scene Investigation (CSI) effect (Cole & Porter, 2017). Forensic science has brought tremendous effect to the area of crime-solving but, what most people do not know is that some issues or situations go beyond forensic science. There is no doubt that elsewhere people's perceptions about forensic science are based on unsupported assumptions and exaggerated claims which do not exist anywhere in forensic science. The study population however stood a better chance of acquiring forensic knowledge and awareness with the slightest exposure to these movies or CSI education.

In Ghana, issues of institutional trust concerning the Ghana Police Service (GPS) and the general public have been addressed on several occasions (Boateng, 2018) and it is considered a very sensitive issue that needs redress. The extent of this sensitivity was felt as respondents were informed that GPS operates the state's forensic unit. The negative sentiments about the GPS are a reality on the grounds due to individual experiences with the state's main law enforcement agency. Most of the respondents chose not to respond to questions from this section while a few others expressed their lack of trust as a result of external influence, poor and under-resourced criminal investigations in Ghana.

The Managing Editor of the Insight Newspaper Kwesi Pratt Jnr proclaimed after his office was burgled *"With all the unsolved crimes in Ghana what would mine do? I don't want to waste my time...It's not a question of trust, it's a question about track records with investigations if you want, I can give you the long list of unsolved crimes..."*. These situations are not so new in the world as De'lemont mentioned in 2014 that forensic science and crime-solving procedures are influenced by many actors which include physical, intermediate and criminal environments. In that regard, social actors will likely be involved in the final decision making. Positive perceptions about forensic science practice in Ghana can be achieved if the public is positive about the GPS and their operations. The reality on the grounds was that respondents felt that the operations of the FSL were going to be a reflection of the services of the GPS which was presumed to be questionable based on respondents' point of view.

Forensic knowledge and awareness are significantly influenced by respondents' level of education (Tables 4 & 5) and it is very clear and explainable that education tends to expand the human faculties (Lance, 2011). As it stands there is presumably a higher chance of individual respondents coming across information regarding forensic science as they climb higher the ladder of education. There is no doubt that people's level of knowledge and awareness about a phenomenon can be measured based on the level of education they have about it (Simons, 2000).

Another influential factor is that in Ghana, students at the tertiary level are allowed to use mobile phones and laptops to facilitate learning. Based on the data collected a good

number of those who had an idea about forensic science were tertiary students and most of them had their knowledge of forensics science from social media, movies and documentaries. The findings further assert that an improvement in watching crime-related movies and documentaries will expose more people to forensic science and forensic procedures. As it was clear that the number of respondents who accessed forensic science knowledge from published literature, conferences, seminars or webinars, crime laboratories and the court of law where the cycle of criminal justice ends was discouraging.

While focusing on the effect of level of education and its influence on respondents, it was realized that respondent's occupation and area of interest significantly influenced their responses. Respondents who were interested in science careers were seen to have some ideas about the subject of research because it related to what they might have been doing already. Those interested in business, arts and humanities were found to be less informed about forensic science. Most fascinatingly a few respondents interested in law programmes had limited or no knowledge about forensic science. It wasn't so surprising as a respondent who had been through the premier centre for legal education in Ghana (University of Ghana School of Law) and now ready as a legal professionall stated that *"I was not taken through any forensic science module at the Ghana School of Law, ... I am aware of forensic science because of my level of exposure and what I read and watch"*.

The respondent's awareness of the state of forensic support through their experience of criminal investigative procedures and their ability to distinguish them from forensic science investigations in Ghana were found to have significantly impacted respondents' knowledge (Tables 4 & 5). The study described forensic support to criminal investigations as a force that will contribute to the massive reduction of numerous blanketed crimes, wrongful convictions and exonerations, and emerging and existing crimes such as kidnapping (Sulley, 2020a), rocketed rate of cybercrime (Warner, 2011), misled court decisions regarding sexual assault (GHASC, 2016), the list of unsolved murders (Adinkrah, 2014), and many other social and environmental crimes in Ghana. Generally, a good state of forensic support to criminal investigations significantly influences respondents' knowledge about forensics as clearly presented in the data (Table 5). It was however more surprising to find respondents who were very much aware of the rate of cybercrime in the country (Warner, 2011) however clueless about measures of apprehending cyber fraudsters (Baylon & Antwi-Boasiako, 2016) until they were educated about the importance of forensic science in cybercrime and security.

While interviewing respondents, they were probed further for their views on how they see crime-solving and the impact of forensic science based on their perspectives. The views came from different angles with religious, cultural, and contemporary perspectives. Comments recorded from respondents include *"I would willingly give out my biological sample if I know the purpose"*. A respondent who was a renowned Islamic scholar at the time of the study also said *"our sacred scriptures teach us about serving justice even if it is against ourselves, I do not want to be a part of justice miscarriage because justice denied is an offence. Any authorized personnel from the Ghana Police Service will be allowed to collect my biological data for DNA extraction, analyse it to solve a crime situation, and grant justice"*. Some respondents were very keen on

how cultural beliefs influenced the shaping and direction of their views on crime. A specific comment passed by a respondent was *"there should be no compelling reason for me to take such an action because in the first place I will not involve myself in any crime"*. Others had doubts about the success of forensic operations and claimed that the professionalism and credibility of practitioners have been greatly affected by political influence in Ghana so how different is forensic science? Justice (2014) asserted that for the general populace to get a better understanding of forensics science, then the elementary actions of investigation and processing of evidence as well as judicial processes must be improved.

TABLE 4
Odds of analysis of predictor variables against forensic knowledge

Predictors	N=200		
	Coefficient	Std. Err	P> [t]
Level of Education	0.375	0.182	0.038
Occupation and Area of Interest	-0.286	0.158	0.073
Experience of investigations	0.694	0.349	0.047
Constants	1.468	0.599	0.014

Prob > F = 0.002; R-squared = 0.8615

Source: Field survey, 2019.

TABLE 5
Odds of analysis of predictor variables against forensic awareness

Predictors	N=200		
	Coefficient	Std. Err	P> [t]
Level of Education	0.322	0.177	0.069
Awareness of Investigative methods	1.757	0.855	0.400
Experience of investigations	-1.006	0.292	0.001
Constant	1.553	1.25	0.000

Prob > F = 0.000; R-squared = 0.8588

Source: Field survey, 2019.

Forensic science as an effective tool to achieve the sustainable development goals

In 2015 the United Nations General Assembly agreed for 17 goals to be incorporated into each other towards achieving a better and more sustainable future agenda by 2030. Sustainable development goal (SDG) 16 promotes democratic governance for peace, security and rule of law, protection of fundamental human rights and inclusive societies. It has a strong link with all SDGs and it is a vital precursor for economic development (Malone, 2018). The findings of the study and available

literature show that there are vulnerable people in Ghana who have been denied their fundamental human rights in one way or the other (Odartey-Wellington et al., 2020).

Over the years there has been a very poor relationship between delivering justice and solving crimes even though Ghana's adversarial system has adopted forensic science in its mode of operation. Real perpetrators of crime mostly walk on the streets of Ghana freely because of inadequate resources or substantial evidence to put them to justice (Odartey-Wellington et al., 2020). That tends to put the next innocent victims at risk. Increased crime rates in Ghanaian societies have instigated fear, stress, trust issues and unpeaceful environments. The daunting effect of this poor system is seen in the underdevelopment occurring in various sectors of the state's economic growth and progress even though strides and prudent measures are being implemented continuously. The burden of social justice should not be forgotten by respective bodies and stakeholders, hence people involved in criminal activities should be brought to justice. As Ghana intends to achieve SDG 16, it is imperative to enforce forensic science which is globally known as an effective tool for justice delivery (Sulley, 2020b).

Conclusion

The cost of security might be overwhelmingly outrageous in a developing country like Ghana and it might not seem so easy shifting from the old methods of doing things. However, it is worth spending more Ghana cedis on improving forensic science if we still believe in the fundamentals of freedom and justice. Based on the findings of this study, the state of forensics in Ghana is deplorable and that may present particular difficulties in the future looking at the unpredictable increase of crime rate in the country. Crime in Ghana nowadays is being committed in sophisticated ways. This study makes it obvious that if perpetrators of such crimes are not identified and brought to justice through forensic science then they are being rewarded.

The study identified the lack of awareness of forensic science amongst the Ghanaian population including the elite and non-elite of the society and more fascinatingly, some security personnel notably private security guards and Motto Traffic & Transport Department (MTTD) of the GPS. The study mentions that education is a vital precursor of knowledge acquisition and it must be leveraged to tackle the issue of advocacy and awareness about forensics in the country.

The study makes it clear that as part of maintaining law and order, forensic science must be used to curb impunity in Ghana so that criminals will know that they cannot commit a crime and go free. Practically, the findings of this study can serve as a springboard for the Government of Ghana and respective stakeholders to make improvements in forensics, general policing practices and strategies. This will go a long way to protect the lives of people and ensure that justice is served because the opportunity cost of forgoing investment in the forensic sector is detrimental to the economic development of the state.

Policy recommendation

It is paramount that the Government of Ghana, GPS, and all respective stakeholders should consider their involvement in ensuring national security because it is key. The study recommends firstly that law and order must be heavily enforced in Ghana. Similar comparative and relative studies in order words a national survey must be conducted in different regions

of the country to update the general public about the status quo of forensic support to criminal investigations. The recidivism effect is very real hence, the creation of specific forensic databases will be a great step to identify and apprehend perpetrators of specific crimes with hopes of a national database in the future. Funding of forensic research, offering scholarships and academic grants to students interested in forensic careers to carry out research, collaborations and partnership, the establishment of forensic education and outreach programs, instituting a government recognized forensic society of Ghana, and media advocacy are all excellent suggestions for a progressive change in the area of forensic science in Ghana.

The inclusion of aspects of forensic science in the educational curriculum from basic school to the higher-level education of Ghana will enhance the awareness and knowledge about forensic science. Forensic science modules should be incorporated into the curriculum of Law schools in Ghana to better equip the next generation of law professionals with diverse knowledge and forensic investigative protocols for effective justice delivery. Hospitals and research laboratories that are of a good standard must be refurbished and equipped with resources that will aid in forensic analysis to serve as a means to fast-track forensic operations in Ghana. This will minimize the case backlog due to the overreliance on only one forensic laboratory. Ghana needs a local forensic science and criminology institution to groom people interested in crime-solving careers with both local and exotic crime-solving techniques to help solve crime in our Ghanaian setting and beyond. Furthermore, the establishment of forensics programs in more of Ghana's tertiary institutions will not only be a cutting-edge innovation but as a problem-solving initiative by increasing the number of forensic expertise nationwide. The Ministry of Interior should make efforts to maximize the autonomy within the GPS and FSL with the call for an independent forensic science laboratory in Ghana being considered as a major priority. Forensic science should be considered a priority because a nation without peace and justice institutions, human rights, and effective governance through the rule of law cannot boast of proper security, sustainability, and prosperity.

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Received 03 Dec 20; revised 17 Nov 21.