Multidisciplinary approach towards training of the next generation of forensic DNA analysts in Africa; a Kenyan perspective

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ABSTRACT

The uptake of forensic DNA testing technologies in Africa has been slow despite the revolutionary technology being discovered and adopted 3 decades ago. African governments and partners have invested in construction and equipping of forensic laboratories in Africa but the benefits are yet to be realised as the laboratories are still faced with the challenge of shortage of adequately trained personnel.

This paper describes an innovative multidisciplinary training approach that was developed and used to train officers from the Directorate of Criminal Investigations Kenya.

We report on the structure, implementation and effectiveness of the training. It is expected that with the increased number of trained forensic DNA analysts, there will be an improvement in quality of forensic DNA evidence presented in courts and a reduction in backlog in the forensic biology laboratories in Kenya.

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1. Introduction

The perception that automation will address the challenge of inadequacies in forensic biology laboratories in Africa is overrated [1]. There is a rush to construct and equip forensic laboratories in the East African region but for there to be meaningful impact, the forensic DNA analyst must be adequately trained and equipped with the necessary skills. The ideal analyst certainly needs to be competent in running laboratory assays but also needs to be knowledgeable in quality management systems,laboratory safety, professional ethics, statistical analysis, report writing and law of evidence.

2. Skill based training in forensic DNA analysis in Africa

Most skill based trainings in forensic DNA analysis are based in South Africa where significant gains have been made in the area of forensic DNA analysis [2,3]. These training programs include; The

Africa forensic DNA training school that offers a two week training on Human Identification workflows using commercial kits from Thermofisher [4], the DNA project that offers a post graduate qualification in forensic DNA analysis [5] and forensics4Africa that offers a National certificate in forensic biology. In other African countries where forensic laboratories are established but there are no skill based trainings, graduate students gain skills during industrial attachment and internship. Where there are no established laboratories, the newly commissioned laboratories rely on training and technical support offered by the commercial companies that supply the instrumentation and reagents used in forensic DNA analysis. Some countries in the search for skilled based training have attempted to outsource training through tendering procedures [6].

Until recently, provision of forensic DNA testing services in Kenya was solely the mandate of the Government Chemist. Over the years there has been an increased demand for DNA testing services in order to establish paternity, identify missing persons following mass fatalities and solve violent crimes. The Government Chemist was often overwhelmed and in most cases unable to complete analysis in a timely manner due to case work backlog. In order to address this, a second public laboratory was commissioned

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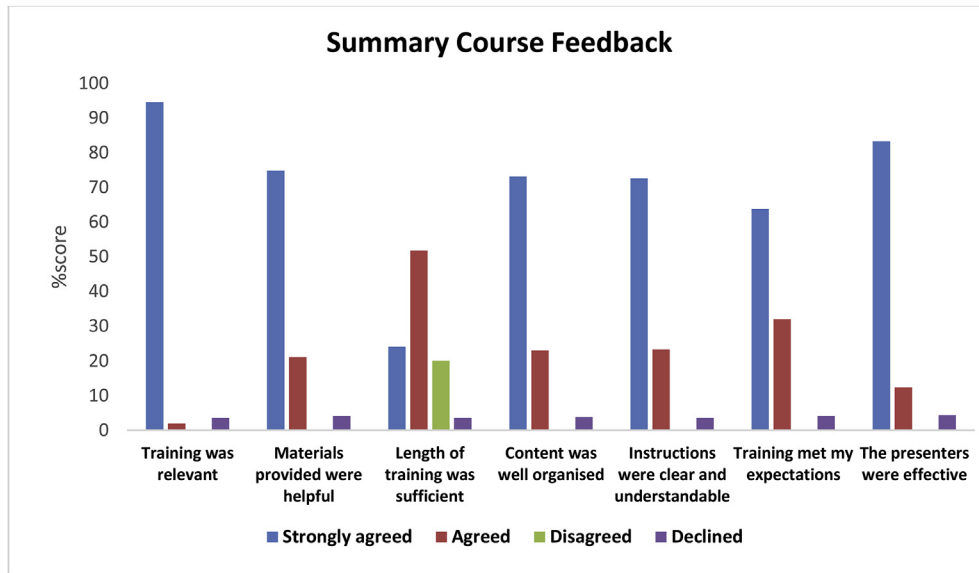E-mail addresses: ealuvaala@kemri.org, ealuvaala@gmail.com (E.A. Nambati).

Fig. 1. Overall feedback from trainees (n = 30).

94.5% (n = 27) of the trainees strongly agreed that the training was relevant, 1.9% (n = 1) agreed that the training was relevant, 3.5% (n = 2) did not respond 74.8% (n = 22) of the trainees strongly agreed that the training materials provided were helpful, 21% (n = 6) agreed that the training materials provided were helpful, 4% (n = 2) did not respond. 24% (n = 7) of the trainees strongly agreed that the length of the training was sufficient, 52% (n = 16) agreed that the length of the training was sufficient, 20% (n = 6) of the trainees thought that the training length was insufficient, 3.5% (n = 1) did not respond.73% (n = 21)of the trainees strongly agreed that the training content was well organised, 23% (n = 8) agreed that the training content was well organised, 3.8% (n =) did not respond 73% (n = 21) of the trainees strongly agreed that the training instructions were clear and understandable, 23% (n = 7) agreed that the training instructions were clear and understandable, 4% (n = 2) did not respond. 64% (n = 19) of the trainees strongly agreed that the training met their expectations, 32% (n = 9) agreed that the training met their expectations, 4% [2] did not respond.

83% (n = 24) of the trainees strongly agreed that the presenters were effective, 12.3% (n = 4) agreed that the presenters were effective, 4.4% (n = 2) did not respond.
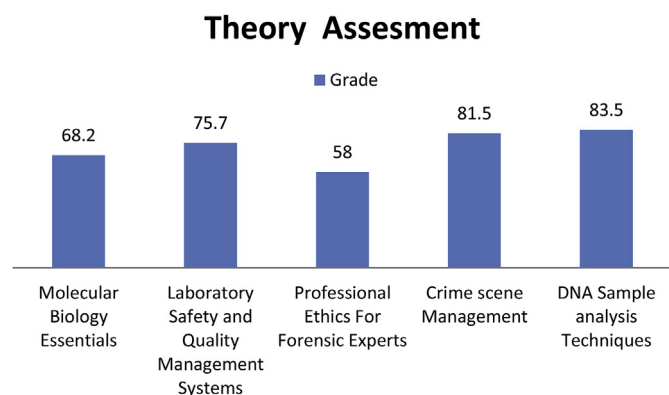

Fig. 2. Theory Assessment (n = 30).

The trainee understanding of the taught topics was tested. The average score was 73.4% for the 5 topics covered. The topic with the highest score was DNA sample analysis techniques while the topic with the lowest score was professional ethics.
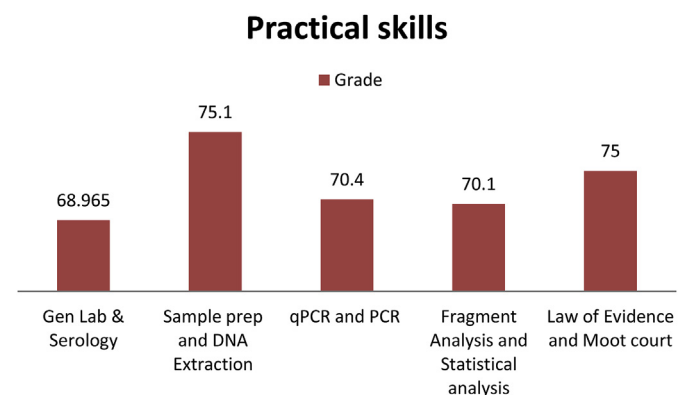

Fig. 3. Practical Skills Assesment (n = 30).

The trainee's laboratory skills and competency was tested. The average score for the practical skills was 72.4%. The highest score was sample preparation and DNA extraction. While the lowest score was general laboratory and serology.

at the Kenya Medical Research Institute with the aim of supplementing the government chemists' efforts and offering specialised short courses that would contribute towards human resource capacity building.

Here we outline the rationale for developing a skill based training curriculum on forensics DNA analysis, the effectiveness of the course and perception of the course by the trainees.

3. Customized skill based training on forensic serology and DNA analysis for DCI Kenya

A customised training on forensic serology and DNA analysis was developed for officers from the Directorate of Criminal Investigations. A multidisciplinary approach was used to develop a training curriculum that would ensure that the trainees gain skills that would enable them to immediately take up responsibilities as forensic DNA analysts. Experts were drawn from academia and industry; these included university professors with expertise in molecular biology, biochemistry and law. Experienced Forensic DNA analysts, QA/QC managers, biosafety experts, Medical Legal lawyers and crime scene management experts were drawn from industry. The curriculum took into consideration that the trainees were graduates with no prior experience working in a forensic biology laboratory. The curriculum was organised to cover 1 month of theory and 2 months of intense laboratory practicals'. The topics covered in theory included molecular biology essentials, laboratory safety and quality management systems, professional ethics for forensic experts, crime scene management, law of evidence for

forensic experts, DNA sample analysis techniques and forensic gynaecology The practical's covered in the laboratory included general lab and serology, evidence examination, DNA extraction, qPCR in quantification and quality assessment of forensic DNA samples, autosomal normalisation and Y normalisation, PCR set up for reference samples and case work samples, capillary electrophoresis, fragment analysis, statistical analysis and report write up. In addition,a crime scene and Moot court were simulated. The trainees perception of the course was evaluated (Fig. 1) and their undersatnding of course content and skills gained assesed (Figs. 2—3).

4. Discussion and conclusion

A majority of the trainees strongly agreed that the training was relevant to them and their expectations were met. A significant number 20% thought that the training duration should have been longer than the three months. An average score of 73.4% in theory and 72.4% in practical indicates that the trainees gained knowledge and the expected skills that would enable them to take up responsibilities as forensic DNA analysts. The fact that 83.3% of the trainees strongly agreed that the facilitators were effective in teaching and the materials provided during training was adequate demonstrates that the East African region has the capacity to train its next generation of forensic DNA experts.

Other forensic biology laboratories in the region struggling with inadequacies in the competency and numbers of their analysts can adapt this approach. A Forensic DNA expert needs knowledge and skills beyond analysis of samples in the laboratory.This multidisciplinary training approach has produced all rounded analysts with good theoretical understanding of concepts in forensic DNA analysis, knowledge in quality management systems, laboratory safety, proffessional ethics and law of evidence. Going forward we expect that the new generation of forensic DNA analysts will contribute towards reduction of backlogs in the forensic biology laboratories in Kenya and presentation of quality Forensic DNA evidence in courts.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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