Forensic Biology Capacity Building: Challenges and Opportunities in Northern Uganda

Humanitarian and Human Rights Resource Center

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ABSTRACT

As part of a long term forensic capacity-building project in northern Uganda, an American forensic biologist/chemist facilitated a collaboration with the Ugandan Directorate of Government Analytical Laboratory (DGAL) biologists for three months in 2019-2020. We identified challenges and cross-cultural differences in the scientific processes that inform capacity building efforts.

OBJECTIVES

1. Assess capability of wide-spread processing and tracking DNA samples and information, including the potential of a national database
2. Identify context-specific challenges to international forensic biology capacity building
3. Assess the cultural approaches to medico-legal procedures

INTRODUCTION

This is part of a multi-phase, longitudinal applied anthropology research project that began in 2011. Herein, we evaluate the potential for forensic human rights intervention to assist in the missing and unidentified and to address mass graves that resulted from the twenty-year war between the Lord's Resistance Army (LRA) and the Government of Uganda (GOU).

Introductory training in forensic anthropology and archaeology for stakeholders from medical, legal, governmental, and non-governmental agencies, has taken place in Uganda in December 2018 and June 2019. Subsequently, from November 2019 to February 2020, as part of capacity-building efforts, an American forensic biologist was sent to DGAL's forensic biology division to assist in development of methods and standard operating procedures. DGAL is one of six readily identifiable forensic biology laboratories on the African continent, and a logical option for centering forensic identification efforts.

METHODS

For the forensic biology field placement, observational data in the form of ethnographic field notes as well as interview data was collected and analyzed. This data built on a larger body of observational, interview, and survey data collected during 2018 and 2019 training workshops and meetings with forensic biologists, pathologists, medical officers, and government officials.

FINDINGS

1. Current Capabilities

- Analysts are using widely accepted equipment and processing techniques which have been validated in the forensic biology discipline. Extraction of DNA is primarily completed using PrepFiler™ kits. PCR and q-PCR utilize AmpFLSTR™ Identifiler™ and Yfiler™ GlobalFiler™, Quantifiler™ Duo and Trio. Some of the instruments include the ABI 7500 Real-Time PCR instrument and the Applied Biosystems 3500xL Genetic Analyzer.
- The staff is small with three individuals actively processing casework.
- There is currently a five year backlog of approximately 1000 cases, primarily classified as sexual assault and homicide, which use manual cataloguing and tracking.
- Forensic biology does not have temperature and humidity-controlled storage facilities for evidence.

With tens of thousands missing, the necessary infrastructure to store, collect, track, and process familial DNA would need to be created.

2. Context-Specific Challenges

- ***Education and Training.*** Diverse levels of education and science specialization are present. Scientists rely heavily on training provided by equipment manufacturers. This creates a highly specific knowledge based on equipment provider. Also, there is a lack of specialized majors available at regional universities. This also contributes to some of the procedural gaps that occur when applying general biology laboratory knowledge to a forensic laboratory process. Due to social dynamics, education level may not correlate to laboratory contributions. For example, one of the analysts with the Master-level education was not permitted to process case samples through to profiling as a result of social perceptions. DNA analysts are also responsible for domestic DNA evidence collection training for the national Ugandan Police Force.

- ***Supply Chain.*** Primary global suppliers such as Thermo Fisher Scientific, Promega, and Qiagen have created an expensive oligopoly in forensic biology. Not only is the purchasing power parity 1,153.9 UGX per $1 USD, but third party distributors drive the cost of scientific consumables up by at least 100%. Further, due to supply chain limitations, improvisation with available supplies creates noteworthy increase in manual calculation time of match frequencies and additional dilution steps, contributing to current domestic casework backlog.

3. Differences in Legal and Scientific Practice

- ***Government Structure.*** DGAL is under the Ministry of Public Service which has diverse and widely varied funding goals, creating barriers to directed funding for the laboratory. Similarly, the medical examiners are decentralized, and receive funding from different ministries depending on their primary employment (they do not receive budgetary line items for their forensic pathology work).

- ***Expectations for Evidence Collection.*** Chain of custody (COC) procedures in Uganda emphasize documenting details of the crime which may be perceived as creating bias in other contexts/cultures. Because of lab scarcity, evidence may also degrade due to storage in unsuitable packaging for prolonged amounts of time.

- ***Lab Procedures.*** Manufacturer instructions, which are limited in scope, are used as Standard Operating Procedures (SOPs), omitting typical SOP information for sample taking, documentation, and extraction. Limited lab space does not allow for sterile fields, significantly limiting number of samples that can be examined simultaneously.

- ***Manual Calculations and Documentation.*** DGAL currently uses a manual documentation system throughout case analysis, including COC and DNA profile match probability calculations, which requires large amounts of physical space and time to manage. Laboratory information management systems and software capable of statistical match calculations can perform these operations quickly. In addition, these systems can provide unbiased assessments for the inclusion/exclusion of data, and even support a national DNA database. However, they are expensive, require updated technology, and incur additional costs for training due to international locality, making accessibility difficult.

- ***All-Inclusive Kits.*** Common DNA extraction methods, including Phenol / Chloroform extraction, require the use of fume hoods, specialized storage for reagents, and shelf space for bulk supplies. Due to the lack of availability of these components, and ease of use, the analysts opt for all-inclusive, no refrigeration required kits which are more expensive than the bulk components in the long term.

- ***DNA Analysis Methods.*** Though many of the procedures, supplies, and instruments used are widely accepted in the discipline, there were processing/analysis differences. A significant example of this is the absence of controls throughout the numerous stages of DNA processing. Additionally, the population data used for calculation and match comparison is for African Americans, and therefore, is not an accurate representation of the Ugandan population. The forensic biology division teamed up with a statistician and analyzed relevant Bugandan Ugandan population data years ago, as per our collaborative recommendation started performing calculations with the Ugandan data. Staff reported they were uncertain if it was a validated change.

CONCLUSION

To build capacity, there are a number of recommendations to put forth. For example, free software, such as the ICMP's iDMS system could be utilized. Additional software options include those designed for calculation, but cultural barriers may need to be overcome; using spreadsheets or software for match calculations could also dramatically reduce processing time. This partnership provided a unique opportunity for collaboration/capacity building and could be used in other contexts.

Overall, to promote success in capacity building efforts, when possible, conduct a preliminary ethnographic investigation with the aim to understand how science is navigated in a particular cultural and political context. When time and resources make long-term research unfeasible, techniques such as rapid assessment could be utilized.

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