The ICRC AM/PM Database: Challenges in forensic data management in the humanitarian sphere

Ute Hofmeister[a,*], Shuala S. Martin[b], Carlos Villalobos[a], Juliana Padilla[b], Oran Finegan[b]

[a] International Committee of the Red Cross — ICRC, ICRC Mexico Delegation, Avenue de la Paix 20, 1202 Geneva, Switzerland
[b] International Committee of the Red Cross, 19, Avenue de la Paix, 1202 Geneva, Switzerland

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ABSTRACT

Large-scale forensic investigations should include a robust data management system with software capable of performing all tasks relevant to achieving the objectives of the investigation. Data management involves the collection, archiving, analysis and reporting of data. A successful data management system requires the development of protocols, procedures and policies, such as on data protection, as well as tools, including software. Adequate training for staff is also required, along with strict quality control and assurance regimens. In 2007, the ICRC launched its AM/PM Database to help fill a gap in readily available software to manage large quantities of data on missing persons and unidentified human remains. The database is now used in 14 countries around the world, including in Mexico and Central America where the ICRC advises the authorities on setting up search mechanisms and forensic data management systems, for addressing the issue of missing persons and the large number of unidentified dead, among them migrants that die in the region on route to the United States. The ICRC also works with various European nations to address the thousands of individuals who die annually while trying to cross the Mediterranean. The ICRC is currently working on the first major revision to the AM/PM Database, set for launch in 2018, based on challenges and lessons learned over the last decade in relation to forensic data management.

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1. Introduction

"*Data management is the [. . .] development, execution and supervision of plans, policies, programs and practices that control, protect, deliver and enhance the value of data and information assets.*" [1]

Forensic investigations produce different kinds of data that must be secured, processed, shared, analyzed, compared and reported. The search for missing persons and forensic identifications are often complex processes, with large quantities of varied data produced by a multitude of actors. The kind of information to be managed includes, but is not limited to: background information, including testimony from witnesses; excavation data; ante-mortem (AM) data about missing persons; and, post-mortem (PM) data from remains.

Forensic identification is based on the comparison of information about unknown human remains (PM data) with the AM information of missing persons. AM and PM data may originate from different sources and vary in specificity yet must be compatible for comparison purposes. The appropriate management of this information is crucial to the quality of any forensic investigation.

Forensic data management is often reliant on data management tools, particularly database software. However, data management should be understood as a much wider concept, not merely the use of data management tools; it is a holistic system that ensures the consistency, accessibility and safety of all relevant information.

2. Requirements in forensic data management

Crucial components of an effective forensic data management system include the following.

2.1. Policy development

For a forensic data management system to remain effective, its consistent use must be part of institutional or national policy to reinforce a long-term sustainable plan. The system must support

achieving the institution's or organization's objectives and uphold its mission and vision. Each institution must clearly understand the utility of the system and allocate appropriate human and financial resources.

2.2. Data protection

Information about missing persons and unidentified human remains is highly sensitive and includes personal data that should be protected to ensure the safety and privacy of the subjects of such data. High standards of data protection should be put in place, which should be a transversal requirement across all aspects of a forensic information management system.

"*Information (data and samples) is a powerful tool when used correctly and dangerous when misused. All those involved must therefore work within a framework established in compliance with the legal rules governing the protection of personal data and human remains, including genetic information.*" [2]

2.3. Protocols and procedures

Protocols and procedures provide the necessary guidance for centralization and standardization of information. Protocols, standard operating procedures (SOP's), guidelines and manuals clarify the roles, responsibilities and procedures of the entire system and staff working with it. In this respect, a good forensic data management system goes beyond the safeguarding, access and analysis of information as it also facilitates work processes and promotes better coordination amongst all parties towards greater efficiency and effectiveness.

2.4. Tools, including software

Appropriate tools are essential to any forensic data management system. Standardized forms for the collection of AM and PM information, as well as witness testimonies, information on gravesites, and all other relevant data, promote best practice through ensuring that collectors obtain all required information. Likewise, inconsistencies that arise due to varied practices in data entry (e.g. experts entering data directly vs. non-expert data entry staff) can be reduced with standardized forms and practices. This becomes even more important when multiple institutions participate in a single forensic data management system.

Technological tools such as database software can also support data management and promote standardization, along with automation, and are particularly useful when applied for large caseloads. As technology advances, so do the tools used to manage and analyze information and enhance analysis. There are a wide array of specialized software for various steps in the investigation process. Some are specialized and ready-made (e.g. geo-information systems and mapping tools, fingerprint matching software, DNA software), while others are custom made (e.g. missing persons registry, evidence management, Laboratory Information Management System — LIMS [3]). Typically, a complex data management system consists of various complementary software tools. In this respect, it is important that the different tools are compatible, with at least the basic possibility of data exchange in order to avoid duplication of tasks or data inconsistencies. Software should always be understood as merely one tool amongst many in forensic data management for facilitating identification processes, rather than a means of identification itself, which should only be carried out by experts. It is critical that all involved in the data management system understand this fact when starting the implementation of a data management system to avoid unrealistic expectations on the part of non-experts [4].

2.5. Training

Adequate training of staff involved in a forensic data management system is crucial to ensuring quality data collection, entry and analysis. Collectors must understand well the information they have been asked to collect and the purpose for its collection to maximize its use during analysis. Collectors of AM information should also be trained in the social skills required to interact and promote trust with those providing the data. Likewise, specialists involved in collection of PM information must be highly skilled and adhere to scientific best practice. Data entry staff must be well trained, including in technical terminology, to ensure that collected information is entered consistently and that software can be used to its fullest potential. Those involved in analysis of data must not only understand the data itself well, but also any tools employed within the data management system, in order to ensure that the data is used as intended and achieves the desired results of the system and the institution. They must also be able to generate required reports, carry out statistical analyses of the full complement of data, interpret data for a clearer understanding of the context, etc. [5].

2.6. Quality assurance and control

Underpinning any data management system is the need to ensure high quality data. Regular monitoring and quality assurance and control measures are therefore required to ensure that quality is maintained throughout the entire data management system. These help reduce incidences of human error and inconsistencies within the data.

Collected raw data must always be reviewed to ensure that all required data has been collected, that the information recorded is logical, and that inconsistencies are caught that should be clarified prior to data processing. Optimally, a multi-level quality control program should be implemented that includes, for example, self-review by the collector and blind review by a peer.

Data entry processes must also undergo strict quality control and assurance regimens to ensure that data entry practices by staff are consistent and meet the objectives of the data management system. Self-review and peer review are also helpful in these regimens. An appointed database administrator should have final control over data entry processes and make decisions when inconsistencies arise.

Refresher trainings for data collectors and data entry staff help to promote standardization and increase the quality of collected and entered data. A regular schedule of training, monitoring, self-reflection, and peer-to-peer reflection helps to bring training needs to light, inform managers of staff performance, highlight gaps within the data management system, and assist decision makers in refining strategies to ensure implementation of objectives.

Entered data must be regularly reviewed. Data "cleaning" is essential to avoiding duplication of data, ensuring data entry consistency so that data analysis is effective, and identifying potential software technical issues. Regular and methodical data cleaning practices must be implemented and should be frequent enough to account for the expectations of the data management system and the volume of data being entered. For large data management systems with high volumes of data, optimally, data review should occur daily. Automated data review measures integrated into software applications can be of assistance but should always complement, rather than replace, manual review.
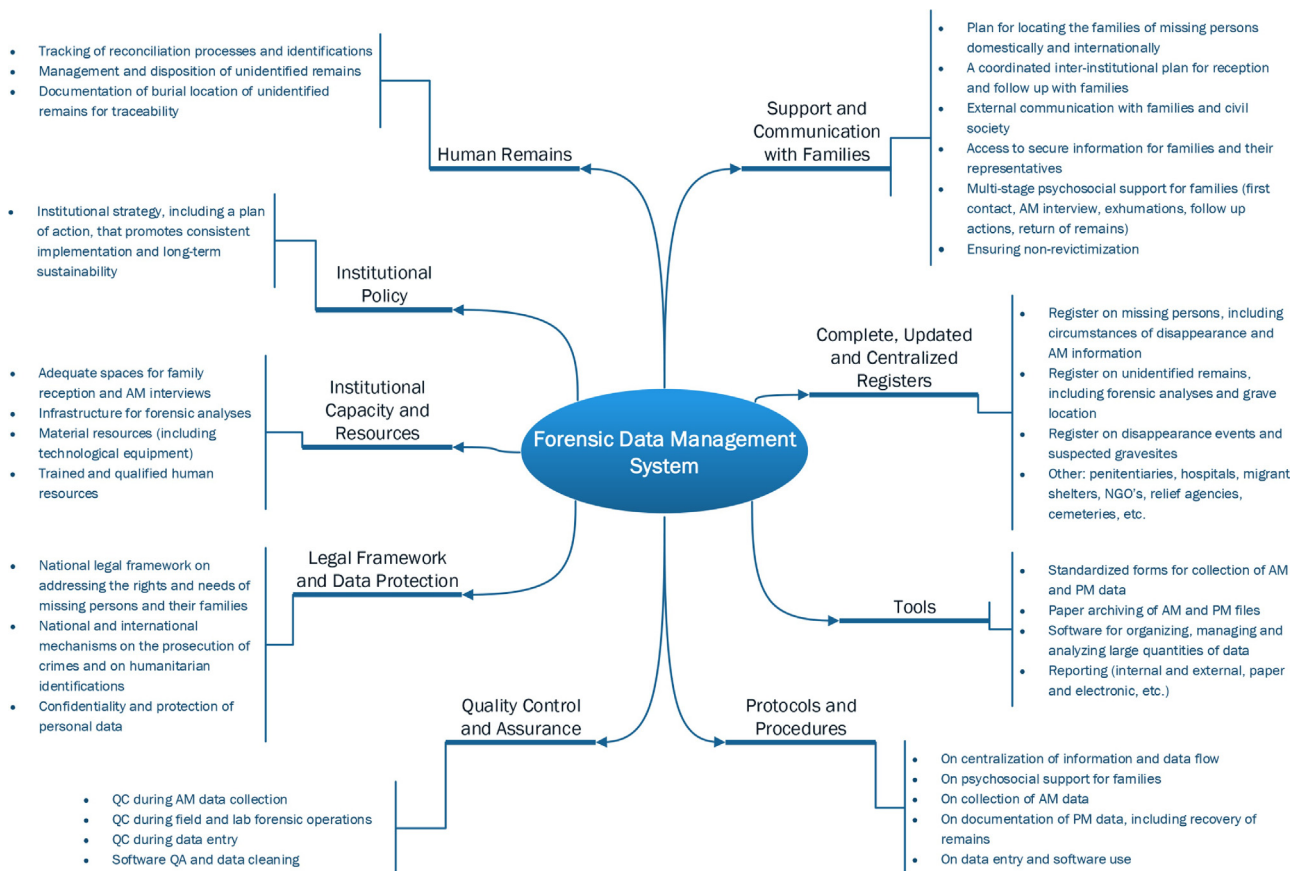
Finally, analysis, archiving, and reporting methods, both automated and manual, should be regularly reviewed to ensure

that they continue to meet the objectives of the data management system and evolve with changing needs [6].

DIAGRAM: The proceeding diagram illustrates these crucial components of a forensic data management system, as well as other important elements that factor into the effective search for missing persons and identification of human remains. As the diagram shows, establishing a forensic data management system implies considering a variety of complex elements, from building trust with the families of the missing, to strengthening institutional and professional capacity to search for and identify them, from collecting and organizing all relevant information in complete and updated registers, to acquiring, developing and applying proper tools to retrieve, use and analyze this information. The diagram is meant to provide guidance on the complexities involved in searching for missing persons and identifying human remains, and should not be considered a comprehensive blueprint for establishing a forensic data management system.

the identification of their remains [7]. In the absence of readily available and universally applicable models and software, those involved in the search for missing persons and forensic identification were often faced with the need to develop their own forms and electronic data management tools, while having only limited capacity to take into account the experience accumulated elsewhere, and often neither the time nor means to develop fully functional software. The existing systems and tools were either not freely available and/or not designed to address the often extensive but unspecific data (particularly AM data) managed in investigations into the fate and whereabouts of missing persons in conflict-related and other challenging contexts.

The ICRC embarked on the development of tools based on the recommendations of the Missing Conference developed through a number of different workshops and studies, involving academic institutions, experts and representatives of governmental, inter-

- Tracking of reconciliation processes and identifications
- Management and disposition of unidentified remains
- Documentation of burial location of unidentified remains for traceability

Human Remains

Support and Communication with Families

- Plan for locating the families of missing persons domestically and internationally
- A coordinated inter-institutional plan for reception and follow up with families
- External communication with families and civil society
- Access to secure information for families and their representatives
- Multi-stage psychosocial support for families (first contact, AM interview, exhumations, follow up actions, return of remains)
- Ensuring non-revictimization

- Institutional strategy, including a plan of action, that promotes consistent implementation and long-term sustainability

Institutional Policy

Complete, Updated and Centralized Registers

- Register on missing persons, including circumstances of disappearance and AM information
- Register on unidentified remains, including forensic analyses and grave location
- Register on disappearance events and suspected gravesites
- Other: penitentiaries, hospitals, migrant shelters, NGO's, relief agencies, cemeteries, etc.

- Adequate spaces for family reception and AM interviews
- Infrastructure for forensic analyses
- Material resources (including technological equipment)
- Trained and qualified human resources

Institutional Capacity and Resources

Forensic Data Management System

- National legal framework on addressing the rights and needs of missing persons and their families
- National and international mechanisms on the prosecution of crimes and on humanitarian identifications
- Confidentiality and protection of personal data

Legal Framework and Data Protection

Tools

- Standardized forms for collection of AM and PM data
- Paper archiving of AM and PM files
- Software for organizing, managing and analyzing large quantities of data
- Reporting (internal and external, paper and electronic, etc.)

Quality Control and Assurance

Protocols and Procedures

- On centralization of information and data flow
- On psychosocial support for families
- On collection of AM data
- On documentation of PM data, including recovery of remains
- On data entry and software use

- QC during AM data collection
- QC during field and lab forensic operations
- QC during data entry
- Software QA and data cleaning

3. The ICRC AM/PM Database

Following its initiative on Missing Persons and their families launched in 2002 and in response to recommendations which arose from it, the ICRC produced a set of data management tools to support forensic practitioners and others involved in investigations into the fate and whereabouts of missing persons and

governmental and non-governmental organizations from around the world. The tools are based on the accumulated experience of those working in the search for missing persons and identification of human remains. They consist of Standard Reporting Forms, which give guidance and serve as a means for standardizing and maximizing the quality of the data collection process, and a software application, the AM/PM Database, for the use, archiving, management and analysis of collected data.

AM/PM Database Objectives

The AM/PM Database is designed for external actors involved in the investigation into the fate and whereabouts of missing persons and the identification of human remains. It was designed to support the

- archiving,
- standardization,
- reporting,
- searching,
- analysis, and
- matching,

of forensic data, in order to

- manage information on missing persons and unidentified human remains,
- facilitate the identification process, and
- provide and promote good standards of data collection and use of scientifically sound methods.

The AM/PM Database can be used in single and multi-user environments, is translatable and can operate in two languages at once, and is configurable to meet the needs of a particular context. The AM/PM Database includes modules on:

- missing persons' ante-mortem (AM) data, including detailed circumstances of disappearance, which may lead to the discovery and identification of remains;
- recovery/field data, including data on preliminary investigations and detailed archaeological information;
- post-mortem (PM) examinations, including pathology, anthropology and odontology;
- a module for tracking hypotheses of identity and the identification process;
- a module on events related to disappearances or findings of human remains; and
- a contact management module for all persons involved in the investigation process.

Each module can manage multiple AM interviews, witness statements or PM examinations, respectively, and their consolidated information. All main entities have sections for tracking of artefacts and various forms of documents and samples. Personal roles and contact information can be managed contextually. Furthermore, the system provides case management and chain-of-custody tracking functions. Special software functions include built-in methods and formulae for automatic calculation of anthropological estimations on sex, age, stature and laterality, automatic calculation of the minimum number of individuals (MNI) for commingled (mixed) remains, re-association of bones or body parts while preserving the original information, and an automated matching function that proposes potential matches between missing persons and human remains according to selectable criteria designed to propose and then track hypotheses of identity [8].

Currently, the AM/PM Database is utilized by almost 70 governmental and non-governmental organizations in 14 countries across the world and four ICRC delegations. The AM/PM Database is used in contexts of armed conflicts (active and past), migration, disasters and other situations resulting in large numbers of missing persons and unidentified human remains.

4. Case study: Mexico and Central America

In Mexico and Central America, the ICRC promotes forensic best practices and provides support on forensic data management in the search and identification of persons missing in relation to two main contexts: (1) disappearances that resulted from previous armed conflicts in Guatemala; and, (2) disappearances caused by armed violence, and a steady increase in irregular migration in Central America and Mexico. The AM/PM Database was installed in multiple settings and is used by 36 governmental institutions and 16 non-governmental organizations across the region. The number of users and entered cases continues to increase, with approximately 350 individual users and 23,000 entered cases projected by the end of 2016.

4.1. Previous armed conflict

In Guatemala, most of the efforts to document and search for the estimated 42,000 wartime missing were driven by NGO's. In recent decades, various civil society organizations have collected information on missing persons, such as AM data, including data on the circumstances of disappearance. Most of these institutions collected the information independently, with little coordination amongst them. This has resulted in many different archives and registers of missing persons, collected in various formats, with different terminology, types of information and level of detail. Additionally, most of the information was collected and stored only in paper form, which represents a serious risk of data loss and may compromise data security.

The lack of a centralizing institution, such as a Commission on Missing Persons, as well as problems with communication and trust between the institutions and a lack of resources and tools, hindered the centralization of these registers into a consolidated database of missing persons. Such a database could assist in better understanding the magnitude of the problem and support the search and identification processes. In 2010, the ICRC started a project with 16 different organizations with information on missing persons in an effort to safeguard the information and work towards a consolidated database. It was decided to: (1) store the information from each institution in a common format or platform to have 16 independent but comparable sources of information; (2) compare the existing registers to identify possible duplicates; and, (3) merge the information on duplicate cases collected by two or more organizations.

The AM/PM Database provided a tool that assisted the institutions to systematize and organize their files on a common platform with standardized terminology and help further secure the information. After translating the tool into Spanish, taking into consideration the particularities of the context, it was installed for each of the 16 NGO's. The delivery of the software was

accompanied by training and support on filing, data collection, and organization so that each NGO could start entering their cases. To date, more than 18,000 cases have been entered in the 16 different installations.

Use of the AM/PM Database has already created conditions to start comparing the various databases. It is now possible to preliminarily compare cases to identify inconsistencies in the data (e.g. incomplete or missing information, different recording methods) and carry out systematic quality control and assurance measures (e.g. correction of typing errors, relocating misplaced information, clarifying factual or date inconsistencies). Furthermore, having the 16 databases on a single platform with standardized terminology has fostered communication between institutions, giving them the possibility to compare their missing persons registers to identify duplicate entries, consolidate their data and begin the process of creating a single, centralized database on missing persons. The project has also resulted in a review of existing data and efforts for its completion.

4.2. Current armed violence and migration

Migration from Central American countries to the U.S. through Mexico, including Mexican citizens, is a longstanding phenomenon in the region. The increasing number of people on the move and the risks they face during the trip due to the high levels of violence (e.g. armed gangs, drug-associated violence, death squads) increase the possibility of people dying and going unaccounted for while migrating. The fact that people disappear in a country or state (within Mexico's or the U.S.'s federal systems) different from where they originated or where their families live, presents a major obstacle in the search and identification efforts at local, national and transnational levels.

Since 2010, the ICRC is working with the Mexican and Central American authorities to institute a forensic data management system in relevant institutions, which has helped to overcome some aspects of this obstacle. However, implementation of this system is not without its challenges. Top amongst these is ensuring homogeneity amongst data collection practices and synchronizing the efforts of different institutions. This is particularly relevant in relation to coordination and communication (data exchange) mechanisms at four levels: (1) between institutions, in particular between those receiving and interviewing the families of missing persons and those performing the forensic analyses of unidentified bodies; (2) between Mexican states given that each state has an independent legal framework and institutional structure, which often limits search efforts to their own territory; (3) between the Mexican states and the federal authorities, where overlapping areas of jurisdiction sometimes results in duplicate but uncoordinated efforts; and, (4) between the various involved countries, where transnational search mechanisms are only partially established. These four levels are not independent and should complement each other. An example of a project which is aimed at the sharing of necessary information internationally is the Proyecto Frontera which is a joint project of several entities (civil society organizations, the Argentine Forensic Anthropology Team, and state authorities in Honduras and El Salvador and Mexico) where databases of information on missing migrants are compared to information on unidentified dead from some parts of Mexico and the U.S. states of Arizona and Texas. This project is an important step towards a comprehensive regional mechanism, which is slowly expanding to incorporate other areas not yet covered.

In order to facilitate efficient and effective coordination and information exchange at all four levels, it was necessary to have a base structure in which compatible data management systems could be established. Therefore, the AM/PM Database was offered as part of an integral information management and search system, through which the ICRC could also promote best practices and provide advice to overcome some of the main challenges.

The efforts towards implementing a forensic information management system in the region have so far resulted in the following positive outcomes:

- sensitization about the need to centralize, share and analyze information related to missing persons and the unidentified dead at state, national and regional levels;
- implementation of institutional changes to accommodate the AM/PM Database that have resulted in standardizing daily work routines amongst human identification units, offices interviewing and attending families, interdisciplinary analyses of high profile cases, etc. in some of the concerned institutions;
- a number of mechanisms for exchange of information on missing persons and the unidentified dead amongst various types of institutions (e.g. forensic institutes, prosecutors' offices, consulates, NGO's) are being established;
- consensus reached amongst actors on best practices and protocols for the various stages of the process (e.g. search mechanisms, recovery and analysis of remains, identification) and associated forms (particularly for AM data), which, if implemented correctly, should lead to higher quality data being collected in a more timely and organized manner [9];
- establishment of formal partnerships between different governmental institutions, NGO's and academic circles, including the development of inter-institutional agreements, which have promoted discussion on common challenges, best practices and protocols, as well as the sharing and exchange of ideas; and
- incorporation of important aspects of data management into the pending draft law on missing persons in Mexico.

All these advances are only the first steps in a long process, which will require a sustained commitment at policy, procedure and practice levels to ensure that obstacles and challenges are overcome in the search for missing persons and the identification of their remains.

4.3. Management of data on missing or deceased migrants

Data management is a particular, if not the main, challenge in the identification of missing or deceased migrants/refugees. One such example is the current situation in the Mediterranean, where thousands of people attempting to cross die on an annual basis. Here the main problems for identification are a lack of available AM data, and a lack of mechanisms to centralize information and transmit relevant data across borders. The countries of origin of those who die in an attempt to cross the Mediterranean are numerous, including the wider Middle East, Afghanistan, Pakistan, and much of north, west, and sub-Saharan Africa [10]. Most of these countries are either currently experiencing armed conflict or other forms of violence, or they suffer from limited economic development. Therefore, infrastructures and institutions in these countries of origin are often compromised, and systems to organize the professional collection of AM data from persons seeking a missing family member are lacking. For example, Ministries of Foreign Affairs and Consulates, usually tasked with the search for persons missing abroad, are based in capital cities and often are not easily accessible to families in outlying areas. Fear or mistrust towards the authorities may also discourage families from seeking official assistance, especially in countries where illegal emigration is a punishable offense. Likewise, national and international organizations may receive limited encouragement from authorities to collect such information, and families may not be aware of their options in providing information while seeking a missing relative.

On the other hand, because of the multiplicity of states and actors involved in handling the dead and in collecting or transmitting AM and PM data, the issue of access to information is particularly complicated. There is a lack of formal mechanisms between institutions in countries of origin and destination of migrants for transmitting and receiving information. In response, two international conferences on the management and identification of deceased migrants in the Mediterranean, co-organized by the ICRC [11], clearly highlighted the need for appropriate compatible data collection formats and for data exchange, be it by a centralized database/data management system or by a multilateral data exchange mechanism. Both present considerable challenges, regarding technical issues, standardization, and data quality on the one hand, and legal issues, such as data ownership, chain of custody and data protection on the other.

In addition, there have been calls for countries to establish national coordinating bodies to coordinate all national efforts in the search for missing migrants and the identification of their remains. Such mechanisms should be composed of a focal point (e.g. national commissioner) with representation/participation of concerned institutions, including forensic institutions and humanitarian agencies. Their efforts should focus on coordinating the efforts of concerned institutions, promoting the centralization of data at national level, ensuring harmonization and standardization of forms and protocols in the collection of AM and PM data and forensic procedures, promoting best practice by all concerned parties through adequate training, and the implementation of a national data management system, including a database, to be later compatible with other national and regional systems. This was also underlined in the Parliamentary Assembly of the Council of Europe (PACE) Committee on Migration, Refugees and Displaced Persons report '*The "left-to-die boat": actions and reactions*' (June 2014) [12] where it supports the recommendations of the ICRC Milan and Barcelona Conferences.

5. Challenges and lessons learned

5.1. Creating and implementing an electronic database

There are several challenges in the creation and implementation of an electronic database. First and foremost, the successful implementation of data management tools, in particular an electronic database, requires that the implementing organization or institution truly commit to the project and embed it in their institutional and every day operations. Implementation of the system must be an obligatory part of overall procedures with adequate time and resources allocated, and the added value of the system must be clearly felt by all users. Likewise, all users must understand the scope and limitations of the system well, in order to exploit its full potential. At the same time, concerned institutions must ensure that internal operational challenges are addressed (e.g. strengthening of infrastructures, ensuring competence of staff, securing adequate human and material resources) to ensure that data management tools are integrated into a well-functioning system and therefore achieve the desired objectives.

On the technical side, the electronic tool should be as comprehensive as possible to achieve all desired functions and compatible with a large variety of use scenarios and data analyses needs, yet provide the highest possible level of user friendliness. Combining both user-friendliness and complexity in one system is a considerable technical challenge. Ready-made systems, such as the ICRC AM/PM Database and INTERPOL's disaster victim identification (DVI) System International developed by Plass Data, face additional challenges; they should be based on standardized forms but configurable to meet the needs of any particular context. Also, they must be compatible with multiple platforms and provide

basic interoperability with other IT tools, as well as be kept up to date with advancing technological developments. Tailor-made national or institutional systems, such as SIRDEC in Colombia and NamUs in the U.S.A, are easier to update and expand as needs arise in a relatively homogenous setting.

Standardization of terminology is fundamental to a forensic data management system. For example, if an article of clothing is recorded under different names, it can make it extremely difficult to search for the item later (e.g. "trousers" vs "pants" vs "slacks"). Such standardization can be even more challenging when there are different teams working in the same context, for example if each has its own SOP's and/or local terminology. This can be a particular problem in the context of migration, where information from several countries and various domestic systems, languages and data collection forms need to be combined. The same challenges can be encountered in multinational DVI operations. Coordination with all concerned actors at the outset is essential in such situations.

Challenges can also be encountered with data entry, particularly if data entry staff lack knowledge of technical procedures and terminology, such as data recorded during forensic analyses. Likewise, when the forms and systems used for recording forensic data are not standardized and stem from various time periods, harmonization, especially by data entry staff inexperienced in forensics, can prove difficult. For example, during some periods in the Balkans, ICRC internal documents highlight how cases were analyzed and documented by a variety of international and local teams that used their own terminology and procedures, often working in their native languages. Collation of this varied data thus proved challenging to those later responsible for consolidating data from previous forensic operations. The lack of an established cooperation and command system can be a key factor here [13]. Overcoming these challenges requires regular supervision and technical advice from forensic and database experts.

Technical support also presents a challenge. All electronic data management systems require IT support for users, a need that increases with the complexity of the system and the number of users. Large set-ups using ready-made systems, such as the implementation of the AM/PM Database in Mexico's state and federal institutions, require in-house technical support, in addition to support provided by the developer.

Implementation of a data management system, particularly one that involves complex software, should be well planned with appropriate time and resources allocated for staff to be trained and become familiar with all of the available tools. At the onset of DVI efforts, it may seem logical to begin implementing a data management system. DVI efforts require quick response, and there are often demands for speedy answers from families and the public. However, it is not recommended to employ complex software without any prior training or use of the system. An institution that is not accustomed to working with a sophisticated electronic data management tool in its everyday work, or does not have specifically trained personnel, will not be able to successfully incorporate it into emergency response, and the tool may instead present an additional burden. Nevertheless, disasters are often the trigger for institutions to become aware of their data management needs.

Maintaining an electronic database requires sizable resources. This only increases with a growing number of users (e.g. in terms of technical support), and such matters need to be factored into initial project development. Likewise, the task of keeping an electronic database up to date is an ongoing challenge. Although the business objectives of any software application may remain the same, rapid advances in technology can quickly render software technically obsolete. At the same time, advances in technology can assist in

developing new aspects of a database that may allow for better analysis of data.

Updating of any software must address day-to-day maintenance challenges, such as bug fixes that should be provided as needed, as well as major version changes based on evolving user and business needs. Major version changes should be planned at periodic intervals and should focus on new features or other sizable changes. However, maintenance and version updates must be regarded differently as far as planning is concerned.

Electronic database updates should not be considered as merely an annual chore but rather part of a long-term strategy to provide users with a relevant and beneficial tool. New features should not be added in isolation without considering the overall objectives of the tool and should always consider maintaining software stability. Likewise, addressing user preferences is important, but all changes must be aimed at universal, rather than individual, user needs.

The ICRC is currently developing a major new version of the AM/PM Database, the first major overhaul of the system since its introduction in 2007. The current revision process has allowed the ICRC to reflect on lessons learned in relation to gaps and deficiencies, such as user friendliness, adaptation to varying investigative scenarios, auditing capacities, and interoperability with other systems.

6. Conclusions

Data management systems are becoming an indispensable part of forensic investigations, particularly in large-scale investigations. Good practices in forensic data management result in quality data, enabling the comparisons necessary for forensic identification by standardizing the data and making it accessible, at the same time safeguarding and protecting it. For the successful implementation of a data management system, it is important to take into account two main factors. First, a data management system is not limited to a specific software tool, but is a wider concept, starting from the production of data (by investigations and forensic analyses) with the necessary data quality, through to definition of workflows, data sharing and centralization and the appropriate analysis of the information. Second, a data management system can only function effectively if it is set within the necessary framework involving policies, staff, training, quality control and support. Setting up such a framework requires time and resources.

In addition to improved standardization, access and centralization and tracking of data, if set up correctly, data management systems in the wider sense can also result in improved scientific and investigative processes with implementation of international standards and best practices, improved communications amongst concerned investigating actors, and improved possibilities for feedback and communication with affected families.

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