



Large-scale forensic investigations into the missing: Challenges and considerations



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ABSTRACT

Large-scale forensic investigations may follow episodes of mass violence and disasters where hundreds or thousands of people have died or are missing. A number of unique challenges for forensic science, different from domestic investigations, arise in these contexts. The setting and situation of these investigations regularly force forensic scientists into practices not regularly encountered while working in a standard criminal justice system. These practices can entail activities not specific to a practitioner's particular field or necessarily be scientific in nature, but are still needed in order for the investigation to move forward. These activities can include (1) establishing the number of and who exactly is missing after mass violence and disaster, (2) the creation of working protocols to deal with the scale of the loss of life that often overwhelm domestic practices and institutions, (3) negotiating the form that the investigation will take with various stakeholders, (4) addressing cultural beliefs of the affected society regarding the dead and missing, and (5) working within prescribed economic, political, and time constraints, among others. Forensic scientific responses to these challenges have proven to be flexible, innovative, and continually evolving.

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1. Introduction

A burgeoning area of interest and use of forensic science has emerged in regions of the world affected by mass violence (used here to include armed conflict, interethnic violence, state sponsored disappearances, and other political violence) and disasters (both natural and man-made), which result in large-scale loss of life and disappearances of people. While the need to collect evidence and to identify human remains has always been present in such occurrences, the capacity to effectively and consistently do so has been absent until recently. Over the past thirty years, the field of forensic science has evolved from expertise dedicated to working in domestic settings in support of a criminal justice system, to a discipline capable of dealing with large-scale, complex situations in unfamiliar contexts, societies, and cultures. These situations involve negotiating relationships with institutions and stakeholders not regularly encountered in domestic settings by the forensic practitioner. While the scale of forensic investigations in relation to mass violence and disaster situations

is an obvious obstacle and has its own challenges, the context in which the investigations take place adds additional considerations that must be addressed. The aim of this article is not to test hypotheses or to provide a list of mass-casualty case studies (as such case studies are too site specific to be templated for use in other contexts), but to draw upon our combined experience to highlight broadly some of the challenges and considerations forensic practitioners may face in managing large-scale complex forensic investigations into missing persons as a result of mass violence and disasters.

The International Committee of the Red Cross (ICRC) defines a missing person as someone “whose whereabouts are unknown to his/her relatives and/or who, on the basis of reliable information, has been reported missing in accordance with the national legislation in connection with an international or non-international armed conflict, a situation of internal violence or disturbances, natural catastrophes or any other situation that may require the intervention of a competent State authority” [1,2]. In the context of this article, forensic investigations into the missing may entail the search and recovery of bodies, identification of unknown bodies, and the collection and analysis of possible criminal evidence related to cause and manner of death.

Loss of life from mass violence or disaster can overwhelm local medical-legal systems. Domestic systems are usually not equipped

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or staffed, or do not possess the expertise to handle the scale of the dead and missing associated with these situations. In some cases, the established forensic systems are themselves victims of the violence/disaster and have either ceased to exist altogether due to loss of staff, physical infrastructure, and/or governance. In other cases, the forensic institutions themselves may be part of a corrupted police/judicial system, culpable in victim deaths by turning a blind eye towards investigations or even assisting in the disappearances. In these situations, the judicial system renders itself untrustworthy in the eyes of stakeholders and incapable of carrying out unbiased investigations.

When domestic systems are overwhelmed, external forensic assistance may be offered by concerned governments, non-governmental organizations, or other humanitarian agencies/institutions. In cases where domestic institutions are culpable in the disappearances and deaths, forensic investigations may arrive after a change in government as occurred in Argentina after the human rights violations committed by military dictatorship (1970s through the mid-1980s), or come in the form of an imposed intervention on behalf of victims and their families, as the ICRC definition of a missing person suggests. Examples of such interventions include the United Nations mandated forensic investigations by the International Criminal Tribunal of the former Yugoslavia, and most recently the threat to conduct unilateral investigations into mass killings of civilians by the armed forces of the Central African Republic if its government fails to begin its own inquiries [3]. The forensic fields of archaeology, biological anthropology, pathology, and genetics have proven particularly useful in these contexts for resolving cases of missing persons and recovering evidence for criminal prosecutions, although other fields such as odontology, radiology, toxicology, and geology have made substantial contributions as well [4–7]. However, due to the circumstances and scale of death in these cases, forensic assistance regularly goes beyond simply supplementing or replacing stressed, incapable, incapacitated, or untrustworthy forensic institutions.

Mass violence and disasters affect more than individuals or a family: they can be community and society changing events [8,9]. Social and cultural mechanisms that mitigate day-to-day issues related to death, displacement, and loss of property are just as likely to be overwhelmed by the scale of loss, as a medical-legal system may be. Society itself may become incapable of coping with the situation in its regular manner because of the massive number of missing and dead, breakdown of infrastructure, and loss of cultural and social institutions that formed and maintained its processes.

For example, after the devastating 2010 earthquake in Haiti, tens of thousands of people were buried commingled in large pit and trench mass graves (as opposed to communal/multiple burial. See Ref. [10] for burial typology) because the regular social processes of managing and grieving for the dead ceased to exist [11]. Religious figures who would usually perform burial rituals, funeral homes and staff that prepared bodies and coffins, and institutions that documented deaths and burials were all themselves victims of the earthquake. Numerous news outlets reported that authorities dealing with desperate situation in Haiti felt they had no other choice but to bury the dead as quickly and efficiently as they could [11–13]. Many relief organizers incorrectly feared that dead bodies spread disease and posed a threat to survivors, despite the assurance of international experts that it was untrue [14–16]. Depositing bodies into large pits by dump trucks in the absence of funeral rituals was far from normal burial practices in Haiti, and the action inflicted additional trauma to the society: “Haiti is a nation where funeral rites are extremely sacred, but with priests gone and many people unable to identify and bury their family members, earthquake survivors worry about the spirits of

the dead” [16]. A massive forensic investigation to identify the dead was deemed too complicated under the circumstances where the immediate needs of the living were the first concern.

Dealing with the dead and missing from mass violence and disaster contexts is only a small part of the challenges faced. What is destroyed must also be rebuilt, and may mean reimagining the structure of society. After all, a society that has just torn itself apart through interethnic violence, for example, has motivation to avoid repeating the same mistakes that lead up to the conflict.

It is within these challenging situations of social breakdown and reconstruction that forensic science increasingly finds itself working in, and could invariably become an actor in the reformation process. This is not a normal position for a discipline accustomed to being a part of an existing structure of society. Forensic science, situated within a stable domestic medical-legal system, is a part of the cultural and social regulatory system, not an architect of it. That is, it is a brick within the existing structure of society, helping to support it by evaluating evidence related to crime and death in accordance to law as prescribed by social-cultural practices, not an agent of social construction. Yet, in areas ravaged by mass violence or disaster, where thousands may be missing and dead and social breakdown has occurred, the manner in which forensic science is applied and the reasons for an investigation can become an integral part of social reconstruction [7]. In addition to trying to figure out what forensic services may be needed in a given mass violence/disaster context, survivors, cultural leaders, policy makers, and other stakeholders, including forensic practitioners, often end up grappling with the question of “How can the application of forensic science best help a society reform?” This question adds dimension to the more obvious challenges of dealing with scale, time, resources, and other logistical considerations of a forensic investigation.

Rebuilding institutions is a part of normalizing society after catastrophe, but a traumatized society needs more than physical infrastructure. Reforming society may be in order, but simply recreating or supporting the past systems may likely be rejected by portions of the population as a continuation of the problems that caused the violence or disaster in the first place [17,18]. Social breakdown from violence and disaster leaves survivors without a support system to address issues such as psychological trauma, reconciliation, reparations, and memorialization of the dead and missing. The application of forensic science in the aftermath of mass violence and disaster has played a role in addressing these issues, assisting communities by providing physical evidence to support witness testimony, by helping to establish a historic narrative of past events, and by identifying the dead and missing [19,20,7].

Collection of criminal evidence and human identification are done in domestic cases as well; however, as mentioned, these processes are nested within medical-legal systems. The character of the investigations change in contexts of disaster and mass violence. For example, in Argentina after the fall of the military government responsible for forced disappearances of thousands of political activists, amnesty was granted to most perpetrators for fear of rekindling violence, while the search for the missing and their subsequent identification of recovered remains was advocated. In contrast, the International Criminal Tribunal of the Former Yugoslavia, formed out of a UN Security Council resolution during the series of wars in the Balkans, concentrated its limited resources on the prosecution of perpetrators, forgoing the identification of recovered human remains, in an attempt to reestablish social order by demonstrating the return of the rule of law. It is in these modified applications of forensic science where science itself becomes a tool of social reconstruction.

Misconceptions and myths about forensic practice can affect the course of an investigation. Some misunderstandings about

forensic science have been formed by civil society and other non-forensic stakeholders such as government officials or NGO staff, but others can originate from forensic practitioners themselves. In our experience, some of the most common misconceptions and missteps include (a) the assumption that investigation practices into mass violence are analogous to those needed to process a mass disaster or a common domestic criminal case, and that it is just a matter of applying the technical aspects of forensic investigations to the mass violence case; (b) ignoring the political, cultural, and religious contexts of the situations; (c) a lack of knowledge of local populations in terms of human variability (i.e. the use of methods derived from other contexts without proper validation with the subject population); (d) underestimating the local forensic capacity and experience, and/or overestimating their own capacity; (e) assuming that the recovery and identification of the bodies is always possible; (f) that science is infallible, or the process is not complex and should not last too long; (g) and managing expectations in an unrealistic manner.

To approach this complex topic, we will divide this article in several parts in an attempt to present a panorama on different challenges and considerations for forensic science. These are grouped in five principal subjects: (1) number of and who exactly is missing after mass violence and disaster, (2) considerations on how to deal with the scale of the loss of life, (3) negotiating the form that the investigation will take, (4) addressing cultural beliefs of the affected society regarding the dead and missing, and (5) working within prescribed political, economic, and time constraints, among others. Again, our goal is to inform the reader how large-scale investigations specific to mass violence and disasters differ from standard domestic investigations, and to provide discussion on what the practitioner should be cognizant of when working in these situations.

2. Who is missing?

Determining the identity of missing persons involves different forensic disciplines. There are multiple factors to consider in the complexity of a case, among them: number of people assumed to be missing compared to the number of people actually missing (possible discrepancies between assumed, reported and actual cases); demographic and personal characteristics of the missing people (biological profile, physical and medical data, etc.); number of victims recovered; circumstance and time when events took place; “closed” incidents compared to “open” or “mixed” incidents; condition of the remains recovered (state of preservation, degree of fragmentation and mixing); degree to which remains are disarticulated and scattered; degree to which remains are commingled; moment of intervention of forensic experts in the investigation (from the beginning, allowing for participation in planning a strategy for the collection of information as well as recovery and analysis of remains, or when the investigation has already begun, at any stage after the recovery or laboratory analysis of remains); availability and type of antemortem information and reference samples; financial resources and local forensic capacity available to implement the identification process and see it through to completion [21,22].

In the next sections, some of these points will be addressed to a certain extent.

2.1. Type of cases (context)

One of the first issues to be addressed in any forensic investigation is the context in which the facts have taken place, i.e. the *type of case* that will be approached.

Its scale (the number of missing or dead persons) and its complexity vary according to the **context** involved; hence, even if

from the scientific point of view the same techniques are applied, the context variable will condition the methodological approach as well as the likelihood of success in locating the missing and the remains of those who died.

Case types can be divided into various categories, depending on the context in which the events have occurred:

- Mass disasters.
- Domestic and international conflicts.
- Ordinary criminal cases.
- Other situations of violence (e.g. migration, femicide).

Moreover, such a context may have implicit an added complexity depending on political and social factors, that will either encourage or curtail investigation into the victims' fate. For example, the great difficulties in the clarification of the fate or whereabouts of the missing persons after armed conflicts or human rights violations, compared to a natural mass disaster has been extensively described by the ICRC. “Armed conflicts can cause mass displacements, which frequently result in many migrants, refugees or internally displaced people going missing because they are afraid of contacting their families or because they lack means of communication; victims whose bodies are abandoned, buried in haste or destroyed before identification and without any information given to their families may also be reported missing. So may people who are captured, arrested or abducted and held incommunicado or in a secret location” [23]. Specific prevention and protection measures for preventing disappearances and ascertaining the fate and whereabouts of missing persons, as well as International supervision mechanisms,¹ have been implemented due to the complexity of these situations [24].

After 34 years of experience of the Argentine Forensic Anthropology Team (EAAF) in the field of forensic investigations in different contexts around the world, specific complexities have been systematically observed in the investigation of human rights violations contexts compared to natural or man-made mass disasters. Following a mass disaster (natural or man-made), a host of support is regularly offered, to include the full and immediate action by the affected State and relevant bodies; national and international pressure exerted and resources given to recover victims' remains; widespread solidarity offered to the victims; allocation of resources to forensic investigation initiatives; implementation of mechanisms to take care of the victims and their families; recovery of corpses more likely than skeletonized remains; availability of recent antemortem data (except in cases where the whole infrastructure is destroyed and whole families are missing); and immediate and long-range action taken by the press, including support in disseminating information and calls for donations. Conversely, in contexts of political violence, in which the State is either responsible for or involved to a certain degree in the violations committed, some added difficulties have been found: investigations are not officially supported and their course is normally hindered; investigations are initiated after several years have elapsed (where the human remains are now skeletonized or in an advanced state of decomposition, and antemortem data and reference biological samples are more difficult to come by); victim's bodies are usually abandoned, buried

¹ See 1949 Geneva Conventions (GC I–IV) and their 1977 Additional Protocols (AP I and II) I; 2006 International Convention for the Protection of All Persons from Enforced Disappearance (ICPPED); 1980 Working Group on Enforced or Involuntary Disappearances, on the initiative of the United Nations Commission on Human Rights; 2003 ICRC International Conference of Governmental and Non-Governmental Experts on missing persons.

in haste, or destroyed before identification; isolation of victims from their family/community (victims, eye witnesses, and their families are frequently threatened or live with fear); limitation of resources allocated to carry out investigations; and there is a lack of information (or biased information) in the local/international press [25,26].

By way of some specific examples, differences are found in the above described aspects in the State and social response to the recovery and identification of victims from the 2004 11-M train bombing in Madrid (Spain) compared to the investigation of the more of 100,000 victims during the Spanish Civil war and dictatorship (1936–1975),² or the national and international efforts in the identification of the victims of the natural disaster in 2005 from Panabaj (Guatemala) compared to the more of 200,000 victims disappeared or killed during the internal conflict in the country in the 70s and 80s [27].³

According to the ICRC [28], “The absence of political will among those directly concerned and the lack of cooperation on the part of those who might persuade them to act often make the prevention and clarification of disappearances related to armed conflict or internal violence an arduous task. Data is withheld as a weapon against enemies or opponents. Leaders whose power is based on hate for another community obstruct any attempt to resolve the issue of missing persons, in order to maintain their control. And in many instances – in particular when disappearances result from massacres or deliberate attacks against civilians – leaders and authority figures may be unable or unwilling to provide answers, because they fear they will be held accountable.”

In the case of an armed conflict, it is important to consider whether the conflict is domestic or international, and whether the country/countries involved is/are signatory/signatories to international conventions, treaties or agreements (for example, the Geneva Conventions and their Additional Protocols, The Hague Conventions, etc.), which constitute a factor of protection for civilians and combatants against violations of international humanitarian law and international human rights law.

Furthermore, the case approach strategy and the feasibility of the investigation will largely depend on the **timing**. It is reasonable to think that the challenges faced in a large-scale investigation will be different if the case involves an ongoing conflict, a conflict that

has recently taken place, or a conflict that occurred a long time ago. The factors affected by this timing are many, and it would be too lengthy to list them all, but the following can be mentioned as examples: security (for both the victims and forensic practitioners), transportation, access to witnesses and/or victims' relatives, quality of antemortem information on the missing/dead, overburdened forensic services, and the state of such services, among others.

These investigations involve difficulties of various kinds, such as the challenges in recovering remains, their generally poor condition and preservation, and complications with accessing relevant historical information as well as the quality of this information.

Finally, we should consider whether inquiries are to be conducted within the framework of a national or international investigation, as this will add different coordination components at the governmental and non-governmental levels. This situation becomes evident in the location and identification of missing migrants, as in such cases not only is it necessary to put a national investigation system in place, but also it is imperative to develop inter-state coordination mechanisms.

2.2. Scope of victims

One of the major obstacles to initiating an investigation is to size up its **scale**, i.e. its magnitude. For this purpose, it is necessary to quantify the number of missing persons as a result of the events being investigated. *Who is missing?* This is a simple question, but difficult to answer in most investigations.

The challenge (and starting point) is to make a list of names as complete as possible, consolidated and shared with the institutions and organizations concerned with the investigation. It is common to underestimate the number of victims due to factors such as displacements, security, population dispersion, lack of coordination among the organizations involved, absence or lack of clarity in the case reporting system (reception of statements), etc. In enforced disappearance or migration contexts, fear of causing troubles to the missing usually pushes relatives not to report their absence. It also may be the case that all members of a family or community have disappeared leaving no one left to report their absence. Furthermore, it is usual for inter-institutional lists to have victims recorded twice as a result of a lack of consensus and coordination.

In order to minimize these problems, a compiled or unified list of (missing, disappeared and dead) victims should be prepared, in which a unique file number is assigned to each person for quantification and case traceability purposes. This will reduce the possibility of duplication on account of name misspellings as well as of confusion or “twice missing” due to administrative errors in the case of namesakes. Moreover, this unique file number will facilitate intra- and inter-institutional communication, as different agents concerned with the investigation will have a “common language” to refer to each case. Likewise, case recording, traceability, and information comparison will be facilitated through this unique file number. However, even though drawing up a consolidated list may seem a reasonable and apparently easy task to carry out, it is one of the main obstacles hindering investigations around the world in all the contexts above mentioned.

In large-scale forensic investigations into the missing, the range of victims is huge both at the social (different socio-economic classes) and geographical (different regions or even countries) levels. Forensic investigations should take these aspects into account in order not to restrict themselves to a certain class or victim group, leaving others aside. In this sense, a

² The Report of the Working Group on Enforced or Involuntary Disappearances (UN Human Rights Council), Mission to Spain (2014), conclude the limited scope of the Historical Memory Act, the lack of any budget for its implementation, the continued applicability of the Amnesty Act as interpreted by the courts, impunity in all the cases of enforced disappearance, the fact that there is no separate offence of enforced disappearance, the lack of any law on access to information, the difficulty in accessing the archives, and the lack of any national plan on the search for disappeared persons, inter alia. This report recommends to the Spanish State to act with due urgency and speed in the matter of enforced disappearances, as required by the Declaration and other international obligations (urgency and speed are of the essence given the advanced age of many of the family members and witnesses who were the last to see persons disappeared during the Civil War and the dictatorship alive) and to implement the recommendations made to Spain by various international human rights bodies, and notably those made by the Committee on Enforced Disappearances and the Special Rapporteur on the promotion of truth, justice, reparation and guarantees of non-recurrence [46].

³ Conclusions of the CEH report points out that *Guatemalan State tried to stigmatize and blame the victims and the country's social organizations, making them into criminals in the public eye and thus into “legitimate” targets for repression. The CEH considers that this systematic indoctrination has profoundly marked the collective consciousness of Guatemalan society (49) . . . The coexistence of victims and perpetrators in the same villages reproduces the climate of fear and silence (52) . . . The courts were incapable of investigating, trying, judging and punishing even a small number of those responsible for the most serious human rights crimes, or of providing protection for the victims (94) . . . The State of Guatemala failed to comply with the obligation to investigate and punish acts of genocide committed in its territory, thus contravening the content of Articles IV and VI of the Convention on the Prevention and Punishment of the Crime of Genocide (125).*

one-size-fits-all investigation can fail to address the concerns of outsiders.

3. Dealing with the scale in the investigation

3.1. Large-scale vs. small-scale investigations

The term **large-scale** usually refers to the **number** of victims, both missing and dead. However, other components must be considered in addition to number, as they increase the magnitude and complexity of the investigations. Among them, we can mention factors such as *displacement or dispersion of population* (specially at the international level), the *condition* in which the remains of victims are found (commingled, fragmented, or badly burnt due to several reasons, among which are both the circumstances of death and postmortem alterations), and the events that occurred afterwards that might have led to the *relocation* and commingling of human remains (secondary graves, exhumations, reburials made by villagers, etc.) Large-scale investigations could be (and often are) mixed or combined situations between the cited components.

In general, the social structure at the national level is prepared, in a greater or lesser degree, to absorb *small-scale* cases. This includes forensic systems (medical-legal system, police, etc.) as well as the institutional system of public and judicial administration. Investigations into these types of cases are usual and their quality will depend to a large extent on pre-existing capacities – staff expertise, budget, infrastructure, equipment, and intra- and inter-institutional coordination.

Yet, only few countries have the economic and structural capacity to conduct large-scale investigations. Even these countries can find themselves overwhelmed by the magnitude and complexity of a case, particularly when there is no pre-established contingency plan. Examples such as the 2004 attacks in Madrid, the Katrina hurricane in 2005 in the U.S., or the recent attacks in Paris in 2015 reveal that the correct approach to an investigation depends not only on the availability of experts or services, but also on their proper coordination through previously agreed operational plans.

The lack of national contingency plans for emergency situations as well as of knowledge of internationally standardized operating procedures and protocols is, unfortunately, very common. This lack of previous preparation restricts the capacity to respond to large-scale cases, even when they are predictable.

Large-scale investigations generally overwhelm domestic systems, due to multiple factors:

- The high number of (missing and/or dead) victims, much higher than what the system is ready to absorb.
- A shortage of experts in various fields.
- Frequent lack or deficiencies of expertise in large-scale operations.
- Limitations in facilities and equipment to process large-scale forensic investigations.
- Budget constraints to conduct a large-scale investigation.

In this regard, a strategy of approach to a large-scale investigation must pay attention to the following items:

- Operational plans (not only in emergency situations).
- Intra- and inter-institutional coordination at the governmental level and between the government and non-governmental bodies (civil society organizations, including those concerned with victims' relatives).
- Draft and implementation of standard operating procedures.
- Creation of multidisciplinary forensic teams.

- Availability of temporary morgues capable of processing a great number of corpses. Morgues should not necessarily be formal structures, but they should comply with minimum requirements for the processing of large numbers of human remains (security, protection, sufficient space, light, water, air conditioning, etc.).
- Centralization of information: centralized databases ensuring different access levels, data security and confidentiality.
- Specialized equipment and software, particularly if it is necessary to conduct genetic analyses at large scale.
- Support centers for relatives, with clearly-established mechanisms to report missing persons and to exchange information.

Many times, states show interest in improving forensic service equipment and infrastructure. However, they usually neglect other phases involved in the process of investigation and victims' identification that are particularly critical, such as the collection of information about the facts and victims and the recovery of remains in cases of death. In other words, States care about improving "postmortem analysis," leaving a large vacuum in crucial and sensitive aspects such as the collection of antemortem information and the recovery of remains. If the investigation into a case and the identification of human remains is conceived of as a **process rather than as a specific technique**, no phase should be more relevant than the others, as the lack of information or adoption of bad practices in one or more phases will lead to limitations and obstacles to complete the other ones.

It is true that the provision of well-designed facilities or sophisticated equipment at medical-legal institutes or genetics labs helps create an appealing image, but without a comprehensive approach to the entire process, interpretative (not only technical) expertise of the professionals involved, proper training for teams engaged in the recovery of remains, which is usually in the hands of police or military staff, and reliable antemortem information on the victims, the investigation will be restrained, complicated and even put at risk.

The manner in which investigations are conducted differ substantially due to the number and condition of the dead and the resources needed. Governments can feel that they do not have the capacity to deal with mass fatalities/investigations. A question arises: should we investigate? Do we have the capacity? This is a matter for thorough consideration before starting investigations of this type.

3.2. Complex cases due to the condition of human remains

As stated above, it is frequent for large-scale investigations, in addition to involving a high number of victims, to be affected by the **condition or preservation of the remains** (for example, fragmented, commingled, or severely burnt remains, etc.).

In this kind of investigation, it is necessary to address not only the process of identification of victims but also the individualization of remains, i.e. the *sorting* and reassociation of disarticulated corpses. The complexity added by the condition in which the remains are found results in the need to outline a proper strategy of approach to this kind of cases, and to meet additional requirements in terms of infrastructure, equipment, budget, and reconciliation of the data from all the stages in the process.

The collection of information in this type of investigation should include, in addition to the concept of open/closed case concerning the possible identity of missing persons (list of possible victims), a new component related to the context of commingling of the remains (secondary versus altered primary graves).

In general, the concept of open/closed context is used to refer to a case depending on the availability of further information on the victims' *identity*, i.e. on whether there is a list of presumed victims likely to be related to a case. We need to broaden this concept to

include the *context* in which the remains were *commingled*, i.e. whether the remains are commingled because of an alteration of the primary grave (where human remains are simply found intermixed, with no other pieces from other burials) or because they were found in a secondary grave, the remains being transferred from one or more primary burial sites and deposited in a secondary location. A typical example of an open context of commingled remains is the recovery and identification of the remains of the victims of the massacres that took place in former Yugoslavia, involving secondary burials as remains were moved from their original burial site to hide the corpses. An example of a closed context of commingled remains would be the alteration of a mass grave as a result of construction or of an exhumation carried out with unsuitable techniques, resulting in the commingling of the remains of the different persons buried in the mass grave.

There are many aspects to be taken into account when investigating complex cases of this nature, such as the time at which the remains were commingled (pre- or post-burial), the time at which forensic practitioners are summoned to the investigation (from the very beginning or afterwards, to act at some specific stages), the state of the remains (degree of fragmentation, commingling, preservation, condition), the number and characteristics of the victims (whether homogeneous or not in terms of biological profile and individualizing features), or the mandate or specific requests issued for the forensic experts to address (identify a victim's remains or individualize and reassociate commingled remains from various victims). In this regard, particular attention should be paid to the collection of background information about the case.

It is highly probable that large-scale genetic analysis, among other techniques, should be used either to identify or reassociate commingled remains or fragments. The World Trade Center (WTC) attack on September 11 2001 [29],⁴ the DNA-Led approach carried out by the International Commission on Missing Persons (ICMP) in human identification of victims in different contexts,⁵ or the Malaysia Airlines Flight 17 downing in July 2014,⁶ are examples of the major use of genetic analysis in the identification of the victims and the reassociation of their fragmented remains. In many cases, this will facilitate or help broaden the scope offered by other techniques, while involving a series of new considerations that need to be addressed since the start of an investigation [1,2]. It is important to note that human identification is a process requiring contributions from a number of scientific disciplines working together in a coordinated and integrated manner. The forensic identification of human remains must take a holistic approach: all information that could help identify a body or set of human remains should be considered. The greater the number of matching characteristics between the antemortem and the postmortem data, the greater the likelihood that the remains are indeed what they are believed to be [30].

In investigating these kinds of complex cases, it is important to plan, from a technical point of view, the strategy for systematically coding and analyzing commingled remains; the adjustment of protocols and procedures; the creation or improvement of

databases (including background information, postmortem/necropsy analysis, and genetic analyses), involving enhanced traceability controls; the structural organization of the facilities for the analysis of remains (morgue, anthropology and genetics labs) in terms of space; the sampling strategy for genetic testing (random or selective, one-stage or multistage); the genetic matching strategy for both identification and reassociation of commingled remains (blind tests, comparisons based on identity presumption, including autosomal DNA markers only or uniparental DNA markers as well); statistical, genetic match thresholds (LR threshold) for identification and reassociation purposes; the prior probability values; etc. [21].

Furthermore, in large-scale cases involving a high number of victims, the probability of adventitious matches is high if the cases are not approached comprehensively. Therefore, the reconciliation of DNA results with all antemortem and postmortem information related to the case (anthropology, odontology, fingerprinting, background investigation, etc.) is vital to the reliability of identification results. The identification process must be carried out as a multidisciplinary effort. It is therefore recommended that the system designed for the exchange of information among the different experts and areas be as flexible and efficient as possible. It is advisable the implementation of a mechanism for the reconciliation process of the AM-PM information in the form of multidisciplinary technical committees or identification coordinators, tasked with reviewing each case and coordinating with the different areas involved to organize the exchange of information obtained and determine the steps to be taken [31].

It will also be necessary to make decisions on limits regarding the reassociation of remains, when to notify family members and relevant authorities (with the first fragment identified, every time a new fragment is located, or once the reassociation process has been completed?), where to place unidentified and non-reassociable remains, etc. All this leads to the need to adopt a *multidisciplinary and integrated approach* to the processing and systematization of a huge amount of information. The risk does not only lie in *misidentifying* a body, but also in restoring mixed remains from various victims to a victim's family.

A challenging issue to resolve is how to conduct an investigation of this magnitude when it is impossible to afford large-scale genetic analysis, a reality for many countries trying to undertake the recovery and identification of victims of both mass disasters and violence. It would be unrealistic to pretend in this article to offer alternatives to such a complex aspect, since they will depend on multiple factors that include, among others, the specific characteristics of the case, its magnitude and the local capacity to address them. Forensic practitioners who are involved in the planning of investigations must emphasize what is possible in a given circumstance, be cognizant of the form the investigation is scheduled to take, and understand the factors that can shape the investigation. Aspects of these factors will be discussed in the next sections.

4. Negotiating the form that the investigation will take

Roughly stated, we can establish two major kinds of frameworks to conduct an investigation:

- **Humanitarian:** designed only to locate and identify victims.
- **Criminal prosecution:** determining criminal responsibilities (accountability).

There is a third category, *adjustment of historical records*, which is usually restricted to the administrative sphere and covers the so-called reconstruction or recovery of the historical memory.

⁴ The Office of Chief Medical Examiner (OCME) reports in 2015 the identification of 14,254 remains (out of the 21,906 remains recovered), using mainly genetic techniques. The 89% of 1003 victims were identified using genetics as a single modality.

⁵ ICMP maintains a database of close to 100,000 family reference DNA profiles, and over 50,000 profiles from degraded human remains. See <https://www.icmp.int/news/dna-led-human-identification/>.

⁶ The Netherlands Forensic Institute (NFI) reports the examination of about 3500 samples using DNA testing in the identification process of 296 victims, being the biggest research conducted by them. See <http://nos.nl/artikel/2013068-nieuwe-identificatie-slachtoffer-mh17.html>.

This type of framework allows for mixed investigations in which it is possible to examine any aspect related to victims' identification, causes and circumstances of disappearance/death, and persons responsible for the deaths, but without criminal prosecution purposes.

An example of an investigation aimed at readdressing the historical record is the recovery of remains of the missing and dead during the Spanish Civil War and Franco's dictatorship. Large-scale investigations of this kind are not limited to the identification of victims for humanitarian purposes, but are intended to reconstruct as much as possible the circumstances of the victims' deaths and the identity of the people responsible for such crimes, even if there is no chance of bringing a criminal prosecution against them.

Regardless of the legal framework of the investigation procedure, it is essential that some fundamental formal requirements be met for its results to have legal relevance. In other words, even when the findings cannot be used in criminal proceedings, the investigation procedure should still comply with basic formalities [32].

Let us take, for example, the case of an identification made within a humanitarian framework. If such identification is not properly documented following the formalities required (e.g. issuing a death certificate), it would be legally null and void. Thus, for instance, the relatives of the victim identified would not be given any document accounting for the findings resulting from the truth determination process. This would prevent the victim's relatives from legally burying the remains or instituting any succession or filiation proceedings. Also, they would be forever denied the possibility of a future criminal prosecution and, consequently, of access to justice.

Therefore, prior to any investigation, it is necessary to clearly establish the legal framework within which such investigation will be carried out and the specific mandate issued for the forensic experts to address, in addition to assessing the consequences that an incorrect procedure might have in terms of access to justice for victims and relatives.

A fundamental principle is yet to be stated: investigation quality and due process guarantees should be kept invariably the same in any legal framework.

5. Cultural beliefs regarding the dead and missing

A major challenge to mass violence/disasters forensic responses is the fact that responders may be outsiders to the cultures they seek to assist. In addition, the response team itself may be made up of forensic practitioners from many different parts of the world. Practitioners may find that the standard forensic operating procedures they are familiar with do not articulate well with the cultural beliefs involving the dead and missing among the society they now find themselves in. These differences may even extend between colleagues. In such cases, a cultural relativistic view must be taken when preparing large-scale investigations. Failing to take into account cultural needs and requirements can have dire consequences on the investigations if not properly considered. For example, the Defense POW/MIA Accounting Agency (DPAA), the United States government's organization that is tasked with the search, recovery, and identification of American personnel lost during past wars, coordinates with the governments of southeast Asia several times a year to recover American dead from the Vietnam war. American investigation and excavation teams work in Vietnam, Laos, Cambodia, and Thailand throughout the year. Part of the negotiation with these governments entail inquiring whether or not the local populations where forensic investigations are to take place have any cultural requirements. A number of

populations in Southeast Asia have a strong belief in spirits, and some villages near where it is believed a missing American may be fear that the ghost of the dead may be disturbed by any investigation or excavation. Ethnographic research in several different societies, to include Southeast Asia, illustrates how the dead are socially, spiritually, politically, and legally present among the living [33–37]. The believed agency of the dead can negatively affect an investigation if not navigated properly.

One of the authors (HT), who currently works for the DPAA, has personally participated in several cleansing ceremonies on Vietnam era aircraft crash sites aimed at appeasing the spirits of the dead crew members before any work could be conducted on site. Disturbed spirits are thought to be harmful to the communities in the immediate area, having the ability to cause nightmares, illness, and crop failures [36]. In the minds of the villagers, failing to conduct these ceremonies would expose their villages to the ill effects of angry spirits, and those that disturbed the spirits would be accountable. If the DPAA teams did not support these cleansing ceremonies, which can involve the purchase of animal sacrifices, they would not receive any support from the local villages, local land owners could object to investigations, and it is likely that the host government would halt DPAA operations within their country until the cultural needs of their people are met.

When responding to a crisis in another country, it is important for the forensic practitioner to understand the customs and traditions involving treatment of the dead. Standard forensic practices may need to be modified to fit better with the local culture. In turn, cultural treatment of the dead that conflicts with forensic investigations to the point that the science becomes compromised must itself be adjusted if possible through respectful negotiation.

Multiple questions need to be addressed when conducting work in different countries/cultures. Although not an exhaustive list, this provides an idea of the type of cultural practices that should be considered prior to starting an investigation:

- What cultural conditions exist in dealing with the dead?
- Are bodies buried or cremated?
- Will these conditions affect the forensic investigation?
- Are there ceremonies that need to be conducted before, during, or after examination?
- What are the requirements of such ceremonies?
- Who needs to be present as required by cultural/religious practices?
- Is there a time limit on how long a body may be examined before being buried or cremated?

In Muslim and Jewish traditions, the body is buried as soon as possible from the time of death, and autopsies are discouraged in most cases as it is viewed as a desecration of the body. In some cultural traditions, a member of the family or community is required to watch over a body until burial. Can cultural traditions work with forensic scientific protocols, or must something give, and if yes, what?

As the outsider, it is the forensic team's responsibility to negotiate how differences will articulate. Family members, cultural and community leaders, and government officials will be familiar with how their society deals with the dead and missing, and will have certain expectations that this will continue. It is, after all, their country and cultural norms. The forensic team needs to be aware of these expectations and be prepared to negotiate them if conflict with scientific practices is foreseen. If local practitioners are part of the investigation, they can take the lead on such negotiations and will have a better sense as to what is possible and how to proceed. Culture and its traditions are not monolithic. It is flexible and open

to change when the need arises [38]. Within a culture, there will be a number of interpretations as to what tradition requires, and it is in this space that forensic investigations can engage.

A question that one of the authors (HT) has been exploring among the Acholi in northern Uganda is whether or not it is necessary to identify a body as part of a forensic investigation. Since independence, Uganda has suffered from more than thirty years of war in which tens of thousands of people have died and gone missing. Hundreds of mass graves and surface scatters of remains are present throughout the landscape [39]. The Acholi believe that without proper burial the dead become restless and angry, and can cause harm to family members and villages, much like those in Southeast Asia. So, in order to conduct investigations into past atrocities, examined bodies must be properly buried. What constitutes a “proper burial” for the Acholi? Traditionally, a known individual is buried within their family compound. Certain ceremonies are conducted and the body is processed in a particular manner during the burial ceremony. However, in the post-conflict context of the Acholi, where the regular social systems of identifying remains and conducting proper burials has broken down due to the effects of 30 years of war and the sheer number of dead, identification and proper burial has not taken place. A forensic investigation must seek a way to provide their services to the population while working with the Acholi concepts of proper burials and spirits.

A forensic investigation will fail the Acholi if it only focuses on the collection of evidence for the prosecution of perpetrators without attempting to identify the remains of the dead. While a measure of justice may be served to offenders, the forensic investigations would not necessarily alleviate the anxiety among the survivors regarding the unidentified dead, and could actually exacerbate these feelings through the additional disturbance of the dead that the investigation will cause. If the purpose of a forensic investigation includes helping an affected population recover from war or disaster, then their cultural needs must be taken into account. Proper planning and communication with government officials, cultural leaders, and family groups is necessary to find a middle ground solution to this conflict.

The context of the forensic investigation may be the impetus for a shift in both forensic and cultural practices. The scale of the violence/disaster overrides the ability of the usual social-cultural mechanisms to deal with the dead in the usual manner, and the need for a forensic investigation to collect evidence and/or identify the dead may outweigh the need for strict traditional treatment of the dead. Working with cultural and political leaders, as well as families of the dead/missing is key to finding common ground between science and cultural traditions. Transparency and clear explanations into the necessary scientific procedures, as well as an honest explanation of the time-frame large-scale investigations require, will go a long way in the negotiating what all sides need.

A final consideration that forensic responders should be aware of, especially in disaster contexts with the sudden loss of hundreds or thousands of people, is the misunderstanding of bodies and disease. As previously mentioned, many people think that decomposing bodies will spread disease, and may overreact when faced with large numbers of dead. While decomposition will spread fluids, the idea that these fluids are poisons is false [14,15]. People caught in disasters are generally healthy and not diseased: they died from trauma, not infections. When responding to disasters, forensic practitioners are often asked about the quickest way to dispose of bodies out of fear of disease, rather than about storage and identification capabilities. While recovering and moving the dead is a priority, the forensic team should be prepared to discuss the concept of disease spread and alternative approaches to creating ad hoc mass graves.

6. Working within prescribed economic, political, and time constraints

A final challenge that forensic practitioners must contend with when working in large-scale investigations is how the constraints on resources, time, and politics can affect the nature of the work. While these constraints are present in all forensic work, their nature differs considerably in mass violence and disaster situations to that of domestic contexts. In domestic cases, the forensic practitioner works within the criminal justice system seeking to provide evidence and identify the dead. In many societies, there is no statutory time limit in cases of murder. Cold cases will continue to be investigated for decades looking for new leads and revisiting old ones hoping to solve it. Likewise, where forensic science is unable to identify a body, the case remains open in hope that new evidence or technology can assist in providing an identification. This, however, is not the situation with most cases of mass violence and disaster. Time, resources, and political will are usually finite resources that must be used judiciously.

As stated above, States affected by war and disaster may not have the resources to conduct forensic investigation on the scale that they are experiencing. Even wealthy states like the U.S. and China have accepted outside expert assistance and donations in dealing with disasters. For most states, their medical-legal infrastructure, if still intact, may not be sufficient to handle large-scale investigations, nor do they have the resources to fund such an endeavor. In addition, large-scale violence and/or disasters are situated outside the normal domestic context. Authorities must seek ways outside the capacity of the regular medical-legal system to cope with the massive loss of life, and this often demands setting up short-termed, focused investigations with specific goals, and may also mean asking for outside help.

Those offering and organizing assistance have their own motivations, be it humanitarian or otherwise, and will come with their own ideas of what should and can be done given the specific context. These stakeholders can be other States, non-governmental organizations, or civil society groups, all with various levels of resources and political capital. As mentioned previously, in a context of mass violence, it may be decided that the best course of action is to bolster the state's infrastructure by re-establishing the rule of law through the creation of criminal tribunals focused on prosecuting perpetrators (examples include ICTY, ICTR, and ICC investigations). In other contexts, the action may be to instead identify the dead in hopes of providing a measure of closure to families and reconciliation between former warring parties (examples include the Committee on Missing Persons in Cyprus, the International Commission on Missing Persons, and the initial investigation in Argentina after the fall of the military government). Ultimately, these decisions are affected by the available resources and political goals. When taking part in investigations, forensic practitioners must be cognizant of the goals and limitations of the investigation and motivations of the organizations that create them, or risk being a pawn to them.

The East Timor Commission for Reception, Truth and Reconciliation (CAVR – acronym in Portuguese) provides an example of how politics can subvert investigations in armed conflict contexts. The CAVR was established between 2001 and 2005 to investigate the causes of the violence in East Timor after it declared independence from Indonesia in late 1975, prompting an Indonesian military occupation of the territory and repression of certain elements of society. Like most transitional justice process, the CAVR was ostensibly designed to seek the truth of past violence, deter future abuses, hold perpetrators accountable, and aid reconciliation, among other things. Participants of this commission were the UN, Indonesia, and East Timor; however, the structure of the CAVR only covered crimes that occurred between 1974 and 1999, which

prevented investigations into violence that lead up to the invasion and after 1999. CAVR narratives of what happened in East Timor could only be derived from evidence allowed by the court authorities to be investigated. Excluding evidence outside the stipulated timeframe prevented more insightful and truthful alternative narratives from being formed [40]. The narratives were further manipulated by the fact that each participant was allowed to conduct their own separate investigation with limited cooperation between them. In short, control over what can be investigated and who can investigate is control over the narrative process.

The CAVR trial conducted in Indonesia ultimately portrayed the violence as a civil war within East Timor, and ignored the Indonesian government's role in militarizing the society and promoting inter-Timorese fighting. While it acknowledged that certain actors and groups had been targeted by the Indonesian military, these killings were justified as being bad elements eliminated by an Indonesian military presence attempting to restore order. In contrast, the East Timor CAVR investigation could not include any background information related to tensions with mainland Indonesia or the subsequent military invasion because of the 1974 time-frame limitation. Furthermore, Indonesia refused to extradite any accused leadership to East Timor, so the courts could put *only* those that were in East Timor on trial, supporting the idea that the conflict was an internal one rather than a foreign occupation [40].

The CAVR was not a truth revealing process, but a commission that allowed politics to frame an international investigation in such a way as to undermine the historic narrative, absolving guilty parties, and demonizing victims. This is not a unique case. The grandfather of war crimes/crimes against humanity investigations, the Nuremberg trials of WWII, also limited the time frame of investigations to exclude mass killings perpetrated by the Soviet Union and other atrocities committed by all allied powers within their colonies or against their own minority populations [41: 16–19, 42: 45–46].

Political motivation, especially in contexts of mass violence, regularly seeks to promote a specific narrative. Forensic practitioners and groups thinking of lending their expertise to such commissions and institutions are encouraged to take the time to understand the aims of the investigations and make informed decisions if they should participate. Congram and Sterenberg [43] speculated that European forensic practitioners may have avoided participation in the U.S. sponsored investigations of mass graves in Iraq out of opposition to the invasion and distrust of the motivations for the investigations. The findings of those initial investigations ultimately assisted in the conviction and execution of Saddam Hussein and several of members of his command, a sentence that is unacceptable to most Western states.

Differences will be found between domestic initiated extrajudicial investigations and international ones sponsored by outside entities. Several states have conducted what are considered productive truth commissions and trials after violence, such as the South African post-apartheid Truth and Reconciliation Commission and ongoing trials in Argentina associated with the political disappearances of thousands of people. Still others, have been whitewashes, targeting opposition groups, justifying political repression, and creating alternative historic narratives, such as the past transitional justice processes in Morocco and Rwanda [44,45]. Again, many states do not have the capability to field forensic practitioners experienced in large-scale investigations, and may seek to hire some as consultants or experts. It behoves the forensic practitioner to know who their employer is and what their goals are.

Touching back upon the concept of economic constraints, the size and scope of mass violence and disaster investigations are

often regulated by the economic resources available. Fielding a full forensic team to help recover and identify hundreds of victims and, let alone thousands, is logistically and economically challenging even when there is an abundance of political will. Criminal investigations, and scientific processes of identification take time and money to support. In many cases, laboratories must be created just to begin the process. When the number of the dead reach into the tens of thousands, the length of time to conduct forensic work may take decades.

Economic support is often tied to specific time frames. Thus, the length of a forensic investigation may be dictated by how much resources cost and the ability to generate more money to fund it. Without deep pockets or the ability to constantly generate more funds from donors, an investigation can only go so far. If thousands of people are missing, the chances of recovering and identifying them or investigating how they were all killed, is not likely to happen.

Instead, a sampling strategy may be created where a portion of the investigation will be conducted. While sampling strategies can provide a general overview of what took place in the past and is helpful for acquiring data for criminal prosecutions, it fails when it comes to the identification process. Hundreds or thousands of dead and missing will not be found and identified. Furthermore, sampling may target a specific event or group of victims, which means other events and groups are ignored. Forensic practitioners who are in planning investigations where sampling is to be used need to be versed in what is possible given the resources afforded to them and be prepared to justify how those resources are used.

7. Conclusions

Due to the context of the events, mass violence and disaster driven forensic investigations are set apart from normal domestic criminal justice based investigations. Practitioners must be more keenly aware of the circumstances prompting the investigations, the aims of the investigations, and goals of the stakeholders driving them. Size, scale, complexity, and timeframes of investigations will impact the techniques and methods utilized. Furthermore, one must approach such investigations with an eye towards cultural understanding and the overarching politics that surround these events. War and disasters can affect whole societies. Responses to these events, especially ones that seek to redress their causes, are therefore potentially societal altering. Forensic investigations and those who participate in them may consequently become an author of change in these contexts. We need to consider not only the technical challenges that face us in such circumstances, but our responsibility to the victims and the society in which we work, and to act accordingly.

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