

Guidelines for the effective conduct of mass burials following mass disasters: post-Asian Tsunami disaster experience in retrospect

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Abstract The frequency of mass disasters is increasing, demanding actions that deal with these promptly and effectively to secure human interests. An undeniable and inevitable reality of any mass disaster is the massive number of fatalities, which will give rise to a further chain of events ranging from the recovery of the deceased, to their transport, storage, identification and, finally, disposal. Past experience has shown that traditional human disposal methods should be redesigned according to the requisites of mass fatality scenarios, and it has been proven that a proper mass burial is by far the most appropriate and standard method for disposal of the dead due to mass disasters as it takes all its practical issues into consideration. A mass burial can be defined as burying more than one deceased of a single or related incident in a single grave or multiple graves simultaneously or separately within a restricted time period in a single or multiple burial sites located within an identified geographical area. In the present context, it is an utmost necessity that we develop uniform detailed guidelines for the proper conduct of mass burials that provide the deceased with all due respect to

human dignity, as this will enable these guidelines to be incorporated into future national mass disaster management schemes as an integral component.

Keywords Documentation · Forensic pathology · Guidelines · Mass burials · Mass disaster · Mass fatalities

Introduction

Burial is one of the oldest methods for disposal of deceased known to mankind. It is well documented in all ancient civilisations, major religious texts and in many chronicles. The biblical Christian faith and Egyptian history would have been much different today if the practice of burial had not existed. The good Earth is holding, in its various strata, single and mass burials of various generations who died of multiple causes over innumerable time periods. The Black Death that devastated Europe in the medieval period resulted in numerous mass burials across the countries affected. Human burials have philosophical, anthropological, psychological, pathological and many other perspectives, even in modern society of the technological age. However, at the present time, the phrase ‘mass burial’ is used synonymously with the terminology of ‘mass graves’, thereby evoking emotional, unbearable and passionate feeling among the public as it is mostly heard in the context of war crimes, genocide and ethnic conflicts. Although all mass graves are obviously mass burials, the fact remains that they offer a valuable mode for the disposal of dead bodies when natural hazards or disasters strike.

It is essential to paraphrase the terms mass graves, mass burials and disaster at the outset as they are all commonly used in descriptions related to management of the dead. There is no universally accepted definition of a mass grave

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just as there is no agreement on the minimum number of individuals that comprise a mass grave [1]. As revealed by Haglund and Sorg [2], Mant suggested that this definition refers to two or more bodies, UN special Rapporteur interprets it as including three or more victims and Skinner previously [3] considered it to mean at least half a dozen individuals. More recently Vanezis and Black [4] have attempted to define mass graves in its widest possible context. According to these authors, the term ‘mass graves’ refers not only to the occupation of a single grave cut by the remains of more than one deceased, but also to a plurality of grave cuts, each containing one or more deceased persons, located within a restricted geographic area and originating from the same or related criminal incidents [4]. Thus, *a mass burial may be defined as the burial of more than one deceased of a single or related incident in a single grave or multiple graves simultaneously or separately within a restricted time period in a single or in multiple burial sites located within an identified geographical area.*

The term ‘disaster’ is more difficult to define as it encompasses a broader range of scenarios in its textual applications. It is not feasible to formulate a universally acceptable definition of disaster that will satisfy all practitioners, but common and agreed-upon definitions must be formulated in the various fields and areas concerned with disasters [5]. According to definition of the United Nations International Strategy for Disaster Reduction [6], a disaster is a serious disruption of the functioning of a community or a society causing widespread human, material, economic and/or environmental losses which exceed the ability of the affected community or society to cope using its own resources. The Royal College of Pathologists, United Kingdom [7] defines a major disaster from the pathologist’s point of view as an episode in which the number of fatalities is in excess of that which cannot be dealt with using the normal mortuary facilities. The National Association of Medical Examiners, USA [8] defines a disaster as any situation in which there are more human bodies to be recovered and examined than can be handled by the usual local resources.

It is also important to differentiate the application of the terms ‘disaster’ and ‘hazard’ in a disaster context. Earthquakes, storms and torrential rains are natural phenomena we refer to as ‘hazards’ and are not considered to be disasters in themselves. For example, an earthquake that occurs on a desert island does not trigger a disaster because there is no existing population or property affected. In addition to being a hazard, some degree of ‘vulnerability’ to the natural phenomenon must be present for an event to constitute a natural disaster. ‘Vulnerability’ is defined as a condition resulting from physical, social, economic and environmental factors or processes that increases the susceptibility of a community to the impact of a hazard.

Sri Lanka experienced a major geographic hazard, which amounted to the biggest disaster in its recorded history, costing over 35,000 lives, when the Tsunami struck its shores on 26 December 2004 [9]. The management of the post-Tsunami conditions demanded the prompt address of two issues: the rescue and rehabilitation of the survivors and the identification and proper disposal of the deceased. Although Sri Lanka did remarkably well in its management of the injured and in preventing disease outbreaks in temporary settlements and camps, its actions were exceptionally deficient in terms of management of the deceased. The unexpectedly high numbers of deceased resulting from a mass disaster always lead to the critical question of disposal of the dead. Although the ideal approach to disposal can be varied—according to the situation—the methods adopted by most of the affected countries during the post-Tsunami period for disposal of their dead were mass burials and mass cremations.

The statistics on post-Tsunami mass burials in Sri Lanka are simply devastating. The criteria for selecting mass burial sites were not uniform throughout the affected areas. Some mass burial sites were located adjacent to community habitats. The depths of these burial sites also varied, and in cases of exhumations it was revealed that some of the burials were less than a metre below the surface. The boundaries of many of the burial sites were indistinct when inspected by a team of forensic experts 6 months after the disaster. The main problems confronting the Sri Lanka authorities were the need to utilise the services of untrained personnel and the adoption of unsupervised procedures to dispose of the dead. The deceased were not tagged with permanent identification codes prior to disposal. Most burial sites were utilised for reburials, and some burials were performed during the evening or in the night, thereby preventing any possibility of proper documentation and leaving thousands of mourning survivors in misery forever. These actions not only go against the cultural and religious practices of a civilised people, but they also have social, psychological, emotional, economic, and legal repercussions with respect to the legacy of the deceased that exacerbate the damage caused by the disaster. Any form of mass burial will always have a negative psychosocial impact at the individual and community level and, consequently, it is essential to formulate proper application guidelines for mass burials by international experts as an integral component for the management of mass disasters.

In our experience, mass burial is a potentially safe and appropriate method for the disposal of large number of deceased in a developing country if proper guidelines are followed, even though it was not recommended initially by international experts as the ideal standards. The Pan American Health Organisation [10] originally held this view and stated that victims of a natural disaster should

never be buried in common graves. The World Health Organisation (WHO) technical note on the disposal of dead bodies [11] also reiterated the same opinion by stating that burials in common graves and mass cremations are rarely warranted and should be avoided. The post-Tsunami experience has changed the situation, and a basic framework for the conduct of mass burials is now being formulated [12]. The INTERPOL DVI version 2002 [13], which is the popular format used for documentation in victim identification procedures, has no reference to the disposal of dead.

The aim of this report to attempt to characterise the concept of ‘mass burial’ as a specific and essential entity, especially within the framework of natural disaster management, by reformatting all of the essential components of a standard mass burial. In the present context, mass burials have an additional advantage as they can also be used as a method of safe temporary storage in less-resourced countries when the authorities are not in a position to accommodate refrigerated containers or temporary morgues within a short time frame – for example, in the acute phase of the post-disaster period. Under present-day conditions, if mass burials were to be performed effectively to dispose of the deceased of natural disasters, three major components of the concept of mass burials need to be analysed in depth:

- geography of the mass burial site(s);
- contents of the mass grave(s);
- conduct of the mass burial proper.

Our recommendations for the credible and accountable conduct of mass burials during a post-disaster period based on the above components are discussed in the following sections below.

Ten rules for the effective conduct of mass burials in mass disasters

1. Potential mass burial sites should be pre-selected and mapped in all regions of a particular country as a part of the national disaster mitigation procedures.

A single mass burial site may contain more than one mass grave. Careful thought must be given to the location of any burial site prior to selection. A mass burial site is best located in identified burial areas or in cemeteries already in use; they should not be selected from highly inaccessible, mountainous, potentially water-logged, remote regions or within close proximity to highly populated areas. Soil conditions, the highest water table level, available space and access route to the site must be considered in the pre-selection process.

If the mass burial site is in a newly located area, it should be acceptable to communities in close proximity to it. The site should be close enough for the affected community to visit. This is very important when the deceased comprise various nationalities, as was the case in the 2004 Asian Tsunami. It is also essential to consider the impact of the burial site on the human habitat. Burial sites should be at least 100 m away from the nearest community dwelling and, ideally, the distance would even greater – up to 500 m, as recommended by the WHO Technical Note [11] – although this prerequisite may be logistically restrictive for less-resourced countries. The WHO estimates that an area of at least 1500 m² per 10,000 population is required with regard to a burial space [11]. According to a more recent recommendation [12], mass burials should be at least 200 m away from water sources, such as streams, lakes, springs, waterfalls, beaches and the shoreline, although the WHO recommends a 50-m distance only [11].

2. All mass burials should be conducted with the perception of possible future exhumation.

The logistics of possible future exhumation should be considered during the pre-selection process of all mass burial sites and should be given high priority in the case of temporary burials. The total burial space available, number of corpses to be buried and the maximum free space left for movement are the important factors to be considered (Fig. 1).

3. The mass burial site should be accessible from all directions.

The bereaved should have space to access the burial site at later times, and accessibility is essential for the logistics of future exhumations. Each dead body should be directly



Fig. 1 Temporary burial of dead bodies in parallel trench graves: Thailand post-Tsunami disaster period, December 2004. Adapted from Morgan et al. [12]

accessible at the very least from one direction. Once the deceased are placed in a mass grave, the distance between the peripheries of the bodies and the grave boundaries should be at least 0.3 m.

4. The boundaries of a mass burial site should be clearly identified and documented and should be marked by a permanent structure after completion of the burial.

The burial site should be clearly marked and surrounded by a buffer zone that is at least 10 m wide to allow planting of deep-rooted vegetation and to separate the site from inhabited areas [12]. This requirement should be taken into account during the pre-selection stage of burial sites.

5. The extent of the mass grave should be determined according to the prevailing circumstances.

Whenever possible, complete or incomplete human remains should be buried in clearly marked, individual graves, although multiple trench communal graves may be unavoidable in mass disasters. Prevailing religious practices may indicate a preference for the orientation of the bodies. The preferred medico-legal position is to orientate the head towards the interior/middle of the grave to ensure maximum safety to the cranial region. The authors suggest that any type of permanent grave should have a minimum depth of 1.8 m unless specific reasons determine otherwise. This may be reduced to a minimum depth of 1 m in the case of temporary burials. According to the WHO recommendations, burial depth should be at least 1.5 m above the groundwater table, with at least a 1-m covering of soil [11].

The recommended distance between bodies is 0.4 m [12]. If bodies are placed in several rows in a single grave, the minimum distance between the two rows should be 0.6 m. In standard practice, any single grave should have a maximum of two opposing rows of bodies. A mass grave containing more than two rows of bodies leads to difficulties during the closure of the grave and in exhumation procedures. The minimum basal distances required to be followed in preparation of a standard mass grave are given in Illustrations 1 and 2. Such an approach obviously requires prior information on the number of bodies that need to be buried in a given burial ground. Once this information is obtained, the experts in the response team (see below) should decide how many mass graves they can have depending on the area of the burial ground.

If the mass burial ground is located in a public cemetery that is already in use, it is appropriate to have the mass grave(s) located in a corner of the cemetery – if possible, with a separate access route. If the number of dead is very high, as in the Asian Tsunami disaster, it is essential to select new burial grounds. The preparation of mass burial grounds should not be carried out in haste, and the response team should be given adequate time to prepare the graves.

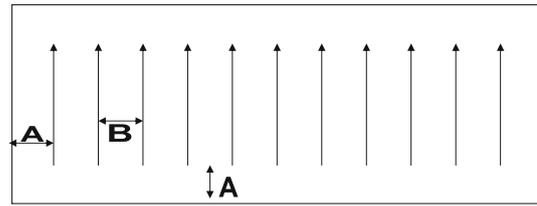


Illustration 1 Schematic cross section of a mass grave with a single row of dead bodies: basal distances; Note: *arrowheads* signify the position of the head

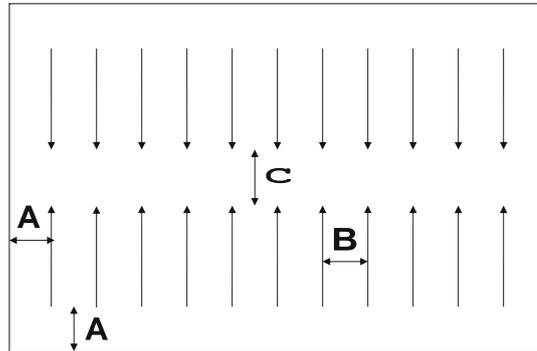


Illustration 2 Schematic cross section of a mass grave with two rows of dead bodies: basal Distances; Note: *arrowheads* signify the position of the head $A = 0.3$ m, $B = 0.4$ m, $C = 0.6$ m

Mapping of the selected burial ground according to the above guidelines should be the first step in preparing standard mass grave(s). Any such grave site should not be overloaded with dead bodies due to casual reasons that can create enormous difficulties in the retrieval of remains if the need for a subsequent exhumation arises. The administrators and non-experts who may interfere with the burial process should be reminded that every single individual buried is of equal importance.

6. Mass burials should be carried out only during the daytime and under appropriate weather conditions.

Mass burials should not be attempted during the evening or at night as it will not provide the best ground conditions either for burial or for documentation. All grades of personnel involved in the formal mass burial process should be clearly documented for future reference, and the whole procedure should be recorded using available resources, ideally with photographs and video recording. If possible, inclement and rainy weather conditions should be avoided during a mass burial.

7. All dead bodies or remains should be tagged by a specific identification reference code.

All dead bodies, irrespective of their integrity and individual identification, should be tagged with predetermined indelible reference codes. In a standard exercise,

these codes may be clearly marked at ground level and mapped for future reference. As a general rule, positively identified bodies should not be buried together with unidentified bodies.

8. The dead bodies or remains should always be completely covered.

Human remains should not be in direct contact with the soil and should be completely covered and sealed by non-degradable material such as polythene. The most suitable method is burial in individual coffins in a single row. The WHO recommends that if coffins are not available, the corpses should be wrapped in plastic sheeting to keep the remains separate from the soil [11]. No personal belongings of the deceased should be buried with them (Fig. 2).

9. No overlaying of dead bodies is permitted.



Fig. 2 Unorthodox post-Tsunami mass burials in India: partially covered deceased

Bodies should always be buried in a single layer and at the same level, and the depth should be clearly documented before the closure of the grave. The overlaying of dead is a disrespectful approach to burial, and it complicates the possibilities of future exhumation; however, these principles were not followed in many post-Tsunami mass burials (Figs. 3, 4). There is no accepted maximum number of bodies that can be buried in a single mass grave as it is dependant on multiple factors. If the numbers of dead are very large the best option is to have many mass graves in a single or multiple burial sites. The minimum distance between two mass graves at the same site should be 50 m.

10. No reburial should be attempted in an existing mass grave.

Reburial in an existing mass grave may result in tampering/damaging the existing boundaries of the primary burial site, injuries to the already buried bodies and commingling of bodies. It will severely disrupt any means of future exhumation and worsen the possibilities of identification. The shifting or relocation of already buried bodies should also be discouraged unless for authorised medico-legal investigations.

Conduct of mass burials – preparation, deposition and closure of mass graves

A mass burial procedure should be planned meticulously to prevent flaws as its steps are non-reversible although the



Fig. 3 Overlaying of dead in India: improper post-Tsunami burial



Fig. 4 Single-row mass burial of post-Tsunami dead wrapped in polythene: standard burial procedure in Thailand

prevailing circumstances may not be fully favourable. The following best practices are recommended to obtain optimum results in mass burials.

1. Preparation, burial and closure of mass graves should always be conducted by pre-selected Mass Fatality Management Operational Response Teams (MFMORT) comprising death investigators/coroners, police officers, local administrators, public health personnel, forensic pathologists, mortuary technicians, funeral directors and counsellors. Such teams should be pre-established for various regions of a country as a part of the national disaster management plan. There should be an integrated plan that encourages close liaison with religious leaders and other humanitarian assistance teams and which allows for the mobilisation of volunteers if and when required.
2. Mass burial is a stepwise, multidisciplinary, prolonged and painstaking procedure and, consequently, appropriate circumstances should be established to perform it satisfactorily. There should be restricted access to the general public. It is essential to maintain adequate space for mass burial activities. Additional measures should be taken if it is to be conducted under poor weather (rainy/windy) or soil (water logged) conditions.
3. The health and safety of the mass burial team members should be given priority, and if heavy machinery is used, their locations should be predetermined. Members should be given access to pre- and post-burial counselling if required.

4. Mass burial team members should be fully clothed with disposable aprons, masks, gloves and boots and should never be in direct contact with human remains without appropriate protection. This has been emphasised by the Centers for Disease Control and Prevention (CDC) interim health recommendations for workers who handle human remains [14].
5. Frequent communication among mass burial team members is essential as they may be operating from several positions, both on the ground and in the grave. Therefore, modes for uninterrupted communication should be established prior to conducting a mass burial.
6. While heavy machinery, such as backhoe machines, may be used to dig mass graves for burials during the initial stages, manual instruments like mamoties and shovels should be used for the finer movements of landscaping at the latter stages of the mass grave preparation (Fig. 5).
7. Heavy machinery should never be used to move or dump bodies into a mass grave. Such casual procedures are liable to cause post-mortem injuries, especially if dead bodies are not placed in a coffin. Burial should be carried out by the team-appointed members and should be performed by manual handling of the remains. No members of the



Fig. 5 Improper and undignified use of heavy machinery to move dead bodies following the 2004 Tsunami disaster

attending public should be called to assist in the burial process.

8. Closure of the mass grave should be done in a stepwise manner without causing unnecessary distress to the bereaved families as well as post-mortem injuries to the bodies, which may be deeply located. Massive influx of soil into a grave within a few minutes from several meters above the bodies is not a pleasant sight and can be traumatic if the bodies are not enclosed in coffins and the soil composition is hard and stony.
9. Mass graves should not contain anything other than dead bodies. It is not a dumping site for used plastic containers, garments and disposable material used by the burial team members, furniture, household items or any nonhuman debris (Fig. 6).
10. The Boundaries of a mass grave should be clearly established as soon as the grave is closed and should be supplemented by subsequent permanent construction. If there are multiple graves in single or multiple burial sites in the same area the best practice is to complete burial in one grave before commencing the next, unless there are adequate numbers of teams and equipment available to carry out mass burial procedures simultaneously.

Cremation

There are no health advantages to adopting cremation over burial, but some communities may prefer it for religious or cultural reasons. It is essential that we discourage the cremation of deceased at all costs during the immediate post-disaster period, considering the immense possibility of erroneous or non-identification of the deceased. However,



Fig. 6 Improper unsupervised Tsunami mass burial in Sri Lanka: burying non-human material together with dead bodies

the cremation of deceased was witnessed in many of the countries affected by the 2004 Tsunami, mainly in India and Thailand during the acute phase of the post-Tsunami disaster management (Figs. 7 and 8). During the first 2 days after the Tsunami had struck, the hurried disposal of corpses by cremation or mass burials was carried out at some locations in the regions of Phuket and Khao Lak under the surveillance of local authorities, resulting in bodies being either wrongly identified or not identified at all [15]. These events were indirectly influenced by the most common disaster myth that corpses represent an imminent risk of epidemics and hence must be disposed of immediately.

Burial is the method of choice in disposing of the deceased in natural hazard/disaster scenarios as it preserves evidence for future forensic investigation, if the need arises. Mass disaster investigations seldom achieve a 100% identification rate, with the consequence that at least some of the deceased may be examined at a later stage. The mass cremation of the deceased will destroy all remaining



Fig. 7 Cremation of Tsunami deceased: India



Fig. 8 Cremation of Tsunami deceased: Thailand

evidence for future positive identification, especially if the deceased are unidentified. In addition, it further creates logistic issues of obtaining fuel (a single cremation requires approximately 300 kg wood according to WHO [11]), smoke pollution, disposal of the residues of incomplete combustion and social issues pertaining to the dignity of the deceased.

Most mass disasters inevitably result in mass casualties and invariably in many deceased. Therefore, it is of great necessity to carry out periodic reviews of the disposal arrangements of deceased as an integral part of a disaster mitigation process at both the national and the local community level. In medical epidemics, where possible, handling of the dead should be performed by specialised medical staff. This is more relevant in the present context in view of the recent announcement by the United Kingdom of its plans to consider mass burials as the preferred mode of disposal of human remains resulting from a potential avian flu epidemic.

The management of deceased and the disposal of the dead in particular has become a significant component of modern mass disaster scenarios and cannot, therefore, be overlooked in any national or regional disaster management plan, although it has not been addressed adequately nor have its broad-based issues been explored in less-resourced countries. Therefore, it is more than timely that we develop sensible, detailed and integrated plans for the management of the dead in mass disasters that can be flexibly implemented in any region.

Educational message

1. Mass fatalities resulting from a major disaster represent an unavoidable challenge to any disaster management system during the immediate post-disaster period.
2. Disposal of fatalities is an issue that should be dealt with as an integral component of the national disaster management plan of a country.
3. Single burial in individual coffins is the gold standard of disposing of mass fatalities; however, mass burial is the best possible and practical mode available for disposal of mass fatalities in the current context.
4. Mass burial is a methodical, multistage, multidisciplinary procedure which should be performed cautiously by skilled and pre-trained personnel.

5. Mass fatalities should never be cremated unless they are specifically identified and documented accordingly.

References

1. Skinner M, Alempijevic D, Djuric-Srejec M. Guidelines for international forensic bio-archaeology monitors of mass grave exhumations. *Forensic Sci Int* 2003;134:81–92.
2. Haglund WD, Sorg MH. *Advances in forensic taphonomy: method, theory, archaeological perspectives*. Boca Raton, Fla.: CRC Press; 2002. p. 244.
3. Skinner M. Planning the archaeological recovery of evidence from recent mass graves. *Forensic Sci Int* 1987;34:267–87.
4. Vanezis P, Black S. The forensic investigation of mass graves and war crimes. In: Payne-James J, Busuttill A, Smock W, editors. *Forensic medicine-clinical and pathological aspects*. London: Greenwich Medical Media; 2003. p. 69.
5. Al-Madhari AF, Keller AZ. Review of disaster definitions. *Pre-hospital Disaster Med* 1997;12:17–20.
6. United Nations International Strategy for Disaster Reduction. 2004 (accessed online March 2007), available from: <http://www.unisdr.org/eng/library/lib-terminology-eng%20home.htm>
7. Busuttill A, et al. Deaths in major disasters – the pathologist's role. United Kingdom: Royal College of Pathologists. 2000 (accessed online 22 April 2006), available from: <http://www.rcpath.org/resources/pdf/majordisasters.pdf>
8. National Association of Medical Examiners, Mass Fatality Plan. 2005 [accessed online 22 March 2007], available from: http://thename.org/index.php?option=com_docman&task=doc_download&gid=62&Itemid=26&mode=view
9. UN Office of the Special Envoy for Tsunami Recovery (accessed online 22 March 2007), available from: <http://www.tsunamispecialenvoy.org/country/srilanka.asp>
10. Pan American Health Association, Management of Dead Bodies in Disaster Situations. 2004 (accessed online 22 March 2007), available from: <http://www.paho.org/English/DD/PED/DeadBodiesBook.pdf>
11. WHO/SEARO Technical Notes for Emergencies. Technical Note No. 8 Disposal of dead bodies in emergency conditions. 2005 (accessed online 22 March 2007), available from: http://www.who.int/water_sanitation_health/hygiene/emergencies/deadbodies.pdf
12. Morgan O, Meltzer M, Muir D, Hogan H, Seng C, Hill J, et al. Management of dead bodies after disasters: a field manual for first responders. 2006 (accessed online 22 March 2007), available from: <http://www.icrc.org/Web/eng/siteeng0.nsf/iwpList378/CB3C1B94D2C9DF4BC125714C002A35F5>
13. INTERPOL Disaster Victim Identification Version. 2002 (accessed online 22 March 2007), available from <http://www.interpol.int/Public/DisasterVictim/Forms/DVIRreportEng.pdf>
14. CDC Interim Health Recommendations for workers who handle human remains. 2005 (accessed online 22 March 2007), available from: <http://www.bt.cdc.gov/disasters/tsunamis/pdf/handlerremains.pdf>
15. Tsokos M, Lessig R, Grundmann C, Benthous S, Peschel O. Experiences in tsunami victim identification. *Int J Legal Med* 2006;120:185–7.