

Dead Body Management of Epidemic Victims: A Systematic Review and Meta-Synthesis

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Abstract

Environmental health issues and epidemic pandemic aspects including infection spread during managing dead bodies revealed that infectious diseases and the associated mortality were often caused by infectious pathogens due to mismanagement of dead bodies. Dead body management is one of the main environmental health challenges during and after disasters and emergencies, especially following epidemic. This systematic review aimed to investigate the dead body management of epidemic victims. This systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. In this study, electronic databases, including Web of Science, PubMed, Scopus, Pro Quest, Google Scholar, and Cochrane Library, were searched from March 1, 1970, to September 30, 2021. A comprehensive literature search was performed using scientific databases and gray literature. A thematic synthesis approach was used to analyze the data. In total, 2764 articles were identified, 11 of which met the inclusion criteria for entering the process of final synthesis. The findings showed three main sections, including (1) dead body management in the hospital and transfer of epidemic victims, (2) mortuary, shrouding, funeral, and burial of epidemic victims, and (3) management of families and risk communication. Implementation of the standards and protocols during dead body management of epidemic victims is essential with the aim of saving the lives of service providers and participants in ceremonial washing and burial.

Keywords: Corpse, dead body, environmental health, epidemic, pandemic

INTRODUCTION

Health issues and challenges of recent epidemic and pandemic reveal that communicable diseases that are often caused by infectious pathogens have a higher potential for challenge in the health sector and should not be ignored. For example, 2009 H1N1 Pandemic, Ebola virus epidemic, severe acute respiratory syndrome outbreak, 2012 Middle East respiratory syndrome coronavirus outbreak, and COVID-19 pandemic are the latest pandemic that quickly spread and has become a global health concern, causing mortality.^[1,2] The World Health Organization (WHO) on April 4, 2022, confirmed 491 million and 6.15 million deaths globally.^[3]

Dead body management is one of the main challenges during and after disasters and emergencies. Following infectious outbreaks, risk of transmission of agents often exists concerning the fact that victims' bodies can cause diseases

among the surviving population and health workers.^[4] Epidemic and pandemic have caused a large number of deaths in a short period of time, placing overwhelming stress on individuals as well as the society and presenting health officials with an uncommon challenge of handling a large number of cadavers. Denying the right to mourn for the deceased and suppressing the means to track the body for proper grieving add to the mental health risks among the affected population survivors. Dead body management has

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important sociocultural implications.^[5] Respect and dignity for dead bodies is a value deeply ingrained in all cultures and religions. Thus, cultural and religious traditions for the dead should be respected and protected completely. Yet, rituals and practices may differ according to time, religion, or place.^[6] During outbreaks, mismanagement of dead bodies has consequences for the psychological well-being of the handlers and survivors. High-risk persons include the managers and staff of health-care facilities and mortuaries, religious and public health authorities, and families who care for suspected or confirmed infection cases.^[7] The rapid spread of disease agents and increase in deaths can generate the accumulation of victims in different care sites such as hospitals, homes, and nursing homes, among others. This creates the need to activate an interagency dead body management plan, under the coordination of the civil protection or police authorities at all territorial levels, according to the country's rules and/or exceptional measures associated with diseases. A comprehensive plan for dead body management in the context of epidemic is essential.^[8]

Some researches have been performed on the dead body management during disasters and epidemic. Finegan *et al.* developed general guidance for the management of the dead related to COVID-19.^[9] Another study entitled, Epidemics caused by dead bodies: A disaster myth that does not want to die conducted by Goyet, Claude de Ville de.^[6] Based results of prior studies, proper management of dead body during disasters is essential and should be considered.

During the pandemics and the complexities and problems caused by emergencies, paying attention to the issue of corpse management is not a priority for managers and decision makers. Due to the possible adverse consequences of corpses, proper management of the bodies remained by disasters and pandemics is necessary. Given the recent occurrence of different disasters and emergencies such as epidemic and pandemic and the unprecedented number of the corpses requiring disposal, a systematic review of the available guidance, literature, and experience is essential. The purpose of this study was a systematic review and meta-synthesis of dead body management of epidemic victims.

METHODS

Definition of concepts

This study was a systematic review and meta-synthesis of the articles and documents related to dead body management of epidemic victims. This systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines.^[10]

Data sources and searches

This systematic review was performed to review the available published articles, documents, reports, and guidelines. The key terms were identified and selected by consulting the experts, and the search strategy was developed in partnership with a research team and medical information specialists. We searched

Table 1: Databases and search strategy

Databases
Web of Science, PubMed, Cochrane Library, Scopus, Science Direct, Google Scholar, and ProQuest
FEMA, WHO, and ICRC
Keywords
("dead body" OR "corpse" OR «cadaver» OR «cadaver « OR «remains «AND ("management" OR "process" OR "methods" OR "measures" OR "plan" OR "model" OR "protocol" OR "strategy") AND ("mass fatality" OR "epidemic" OR "pandemic" OR "outbreak" OR "infectious disease" OR "biologic event" OR "disaster" OR "emergency")
FEMA: Federal Emergency Management Agency, WHO: World Health Organization, ICRC: International Committee of the Red Cross

from March 1970 to September 2021. A comprehensive literature search was performed using scientific databases and gray literature as shown in Table 1. Reference lists of the relevant articles and systematic reviews as well as the tables of contents of the key journals in this field were also searched to obtain unpublished relevant data. In order to manage the search library, screen duplicate articles, and extract irrelevant articles, we used EndNote software, version X9 (Philadelphia, United States London, United Kingdom).

Eligibility criteria

Inclusion criteria

(1) The articles or documents that addressed the dead body management of epidemic victims, (2) peer-reviewed original articles, case studies, review articles, and editorials that were available in full text, and (3) full-text articles written in English were included in the study.

Exclusion criteria

(1) The articles or documents that addressed the dead body management under normal circumstances, (2) other review study, and (3) abstracts, articles written in other languages than English, and duplicates were excluded from the study.

Study selection

After the elimination of duplicate articles by EndNote X9, two reviewers screened the titles/abstracts for eligibility independently. When the reviewers felt that the abstracts or titles were potentially useful, the full texts of the articles were retrieved and considered for eligibility by both reviewers carefully and critically. If there were discrepancies between the reviewers, the reasons were identified and a final decision was made on the basis of agreement with a third reviewer.

Data extraction

A form was used to extract the data and the following factors were included: (1) name of the first author or organization, (2) year of publication, (3) title, (4) type of document, and (5) the main findings [Table 2].

Assessment of quality and risk of bias

All identified documents were critically appraised independently by two authors for the risk of bias. STROBE tools and checklists

Table 2: Characteristics of the included studies

Author/ Organization	Years of publication	Title	Type of Document	Method	Main Concept(s)
WHO	2020	Infection prevention and control for the safe management of a dead body in the context of COVID-19	Interim guidance	Provide interim guidance	Infection prevention and control for the safe management of a dead body in the context of COVID-19 following preparing and packing the body for transfer from a patient room to an autopsy unit, mortuary, crematorium, or burial site, Funeral home/ mortuary care, autopsy, engineering and environmental controls, and environmental cleaning and control
Morgan	2006	Mass fatality management following the South Asian Tsunami Disaster: Case studies in Thailand, Indonesia, and Sri Lanka	Article	Descriptive case studies	Emergency response should not add to the distress of the affected communities by inappropriately disposing the victims. The survivors' rights to see their dead treated with dignity and respect requires practical guidelines and technical support
Conly	2005	Natural disasters, corpses and the risk of infectious diseases	Article	Short communication	These practices include the use of gloves when handling corpses, avoidance of handling of personal items with contaminated gloves or hands, and the use of personal protective equipment (gowns, masks, and eyewear) as appropriated. Splashes greatly mitigate the risk of transmission of any potential pathogen from corpses
Goyet	2004	Epidemics caused by dead bodies: A disaster myth that does not want to die	Article	Editorial	The article emphasized that survivors were a more likely source of the disease outbreak. This point is well taken and calls attention to an effective strategy of disaster response: a strategy focused on providing primary health care for the victims and their families. Active surveillance and rapid restoration of normal public health services, including the provision of safe water and food, should be the priority. The psychological health of the victims would be a casualty, along with efforts and resources that could go to more needed public health measures
PAHO	2004	Management of dead bodies in disaster situations	Manuals and guidelines	Provide manuals and guidelines	Define within the Emergency Operations Committee, the institution that will coordinate all processes related to the management of corpses Notify the family members of the death or disappearance of victims in a clear, orderly, and individualized manner. Burial of bodies in common graves or the use of mass cremation is unnecessary and a violation of the human rights of the surviving family members. Respect the cultural beliefs and religious norms of the affected populations. When the religious beliefs of the deceased are unknown, respect those of the community where the tragedy has occurred
WHO	2017	How to conduct safe and dignified burial of a patient who has died from suspected or confirmed Ebola or Marburg virus disease	Interim guidance	Provide interim guidance	The handling of human remains should be kept to a minimum. Always take into account cultural and religious concerns. Only trained personnel should handle remains during the outbreak. The burial process is very sensitive for the family and the community and can be the source of trouble or even open conflict. Before starting any procedure, the family must be

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Table 2: Contd...

Author/ Organization	Years of publication	Title	Type of Document	Method	Main Concept(s)
National Disaster Management Authority Government of India	2010	Management of the dead in the aftermath of disasters	Guideline	Provide guideline	<p>fully informed about the dignified burial process and their religious and personal rights to show respect for the deceased. Ensure that the formal agreement of the family has been given before starting the burial. No burial should begin until family agreement has been obtained</p> <p>The management of dead bodies involves a series of activities beginning with the search, in situ identification of the body, and its transfer to the facility that serves as a mortuary. It also encompasses delivery of the body to family members and assistance from the state for final disposal of the body in accordance with the wishes of the family and the religious and cultural norms of the community</p>
Department of Health Hospital Authority Food and Environmental Hygiene Department	2019	Precautions for handling and disposal of dead bodies	Guideline	Provide guideline	<p>All dead bodies are potentially infectious and “standard precautions” should be implemented for every case. Although most organisms in the dead body are unlikely to infect healthy persons, some infectious agents may be transmitted when persons are in contact with blood, body fluids, or tissues of the dead body of the person with infectious diseases. To minimize the risks of transmission of known and unsuspected infectious diseases, dead bodies should be handled in a way to reduce the workers’ exposure to blood, body fluids, and tissues</p>
International Federation of Red Cross and Red Crescent	2016	Management of dead bodies after disasters: A field manual for first responders	Manual	Provide manual	<p>Accurate, clear, timely, and updated information can reduce the stress experience of the affected communities, defuse rumors, and clarify incorrect information. The news media (television, radio, newspapers, and the Internet) are vital channels of communication with families and the public during mass disasters. Journalists, both local and international, often arrive soon after the disaster happens. Psychosocial support for families and relatives should be considered. Cultural and religious needs should be borne in mind throughout the process. The only time dead bodies pose the health risk of epidemics is when the deaths results from a highly infectious disease (e.g., Ebola, cholera, Lassa fever) or when a natural disaster occurs in an area where such a disease is endemic</p>
Fineschi	2020	Management of the corpse with suspect, probable, or confirmed COVID-19 respiratory infection – Italian interim recommendations for personnel potentially exposed to material from corpses, including body fluids, in morgue structures and during autopsy practice	Guideline	Provide guideline	<p>Considering the current spread of the disease throughout the national territory, regardless of the hospital structure where the autopsy is carried out, in all structures with a large number of positive COVID-19 inpatients, the execution of the diagnostic autopsy in any case must assume that the body is potentially infected and, consequently, all appropriate precautionary measures should be taken as indicated in the section “Hygiene precautions in the management of suspect,</p>

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Table 2: Contd...

Author/ Organization	Years of publication	Title	Type of Document	Method	Main Concept(s)
Finegan	2020	ICRC: General guidance for the management of the dead related to COVID-19	Article	Qualitative	<p>probable or confirmed case of COVID-19” so as to avoid any risk of contagion, not necessarily from SARS-CoV-2. Consequently, all procedures indicated for sanitizing the anatomical table and the sector environment must be followed after performing the autopsy</p> <p>Management of the dead in relation to the pandemic is divided into two levels:</p> <ol style="list-style-type: none"> 1. General guidance and support in the management (handling) of the dead covered by the section “The Management of the Dead Associated with COVID-19 - Technical Recommendations for Healthcare and Death Care workers” 2. General guidance and support to the authorities in their response to the increased deaths associated with the pandemic covered by the section “Protracted Response to Increased Deaths from COVID-19. A Preparatory Guideline for a Mass Fatality Response Plan”
PAHO	2020	Dead body management in the context of the novel coronavirus (COVID-19)	Interim Recommendations	Provide interim recommendations	<p>Comprehensive plan for dead body management in the context of COVID-19 is essential</p> <ol style="list-style-type: none"> 1. The plan must be an inter-agency process which includes civil authorities, civil protection, police, forensics team, funeral homes, cemeteries, the health sector, logistics and communication 2. The political authorities must create a timely decision-making framework for comprehensive management of corpses, which includes verification, collection, final disposal, and information management to the community 3. It is important to consider the need to expand the temporary storage capacity of bodies using refrigerated containers or alternate facilities with availability of refrigeration. These solutions must be analyzed on a case by-case basis
WHO	2020/ September	Infection prevention and control for the safe management of a dead body in the context of COVID-19	Interim guidance	Update of interim guidance	<p>This document updates guidance issued on 24 March with the</p> <p>Following new or modified content:</p> <ul style="list-style-type: none"> Clarification of body bag requirements Clarification of PPE requirements during autopsies; Updated ventilation requirements during autopsy Additional guidance for burial or cremation in the community

PAHO: Pan American Health Organization, ICRC: International Committee of the Red Cross, PPE: Personal protective equipment, WHO: World Health Organization

were used for standard quality assessment of the retrieved articles.^[11] Disagreements between the reviewers were resolved through consensus and discussion. Any disagreement was resolved through consultation with a third reviewer.

Data synthesis

A thematic synthesis approach was used to synthesize the original content of the studies, gather information, and identify all the themes. The initial synthesis of studies was

conducted separately for each of the included article formats. One author extracted data from the included studies into an extraction datasheet. The accuracy and completeness of the extracted data were checked by two other authors. The inductive thematic synthesis was performed by the two authors.^[12] For extraction and coding of the findings for each study, two authors independently coded the studies to capture the themes within the original studies related to dead body management. The initial set of themes was discussed and explored in terms of the frequency of endorsement, and similarities and differences, and grouped into a hierarchical structure according to their topical similarity to determine whether the findings confirm, extend, or refute each other. Then, the themes with similarities in the content and meaning were generated, reviewed, and discussed with the authors. A final level of interpretive themes was developed by further group discussions. As retaining the context of the original data is essential when extracting the true meaning from the studies,^[13] validity of the themes was ensured by re-reading the studies and drawing comparisons.

RESULTS

Totally, 2764 documents were retrieved from electronic databases and nine from other sources, and 2773 documents were found in the primary search. Four hundred and thirty-two duplicate articles were eliminated and 2341 documents were screened by reviewing their titles and abstracts and 2245 articles were removed, and in the final stage, the full texts of the 95 remaining documents were assessed and reviewed and 11 articles were found to meet the criteria for entering the process of systematic review. The identification and selection processes are shown in Figure 1 and Table 2.

Based on synthesis of data, three main themes of dead body management in hospital, transfer of epidemic victims, and dead body management in cemetery were developed. The main themes with categories and subcategories are demonstrated in Table 3.

DISCUSSION

The disease agents such as viruses, bacteria, fungi, protozoa, and helminths (worms) is transmitted among people by droplets, fomites, and close contact.^[7] Implementation of health principles during the dead body management of epidemic victims is essential with the aim of saving the lives of service providers and participants in ceremonial washing and burial.^[9] In fact, infectious agents can be transmitted from the deceased people.^[14,15] Therefore, precautions must be taken in all steps of dead body management of epidemic victims, including transport, ceremonial washing, and burial.^[7] The risk of aerosolization of any pathogenic respiratory tract organism may be reduced by masking or placing a cloth over the mouth of the corpse.^[16] Opportunities for aerosolization may also occur during exposure to epidemic victims. Therefore, the occupational risks of virus transmission to hospital staff, funeral site workers, and pathology personnel are well known. Families and other body handlers and each participant in the funeral are also at a high risk during exposure to disease agents.^[17]

Previous evidence and protocols related to dead body management developed based on all-hazards approach and focused on natural disaster such as mass casualty incident and earthquake mainly. Some paper and document developed about epidemic and pandemic diseases such as Ebola. However, after outbreak of COVID-19, some guidelines are specifically related to the diagnosis of COVID-19. In

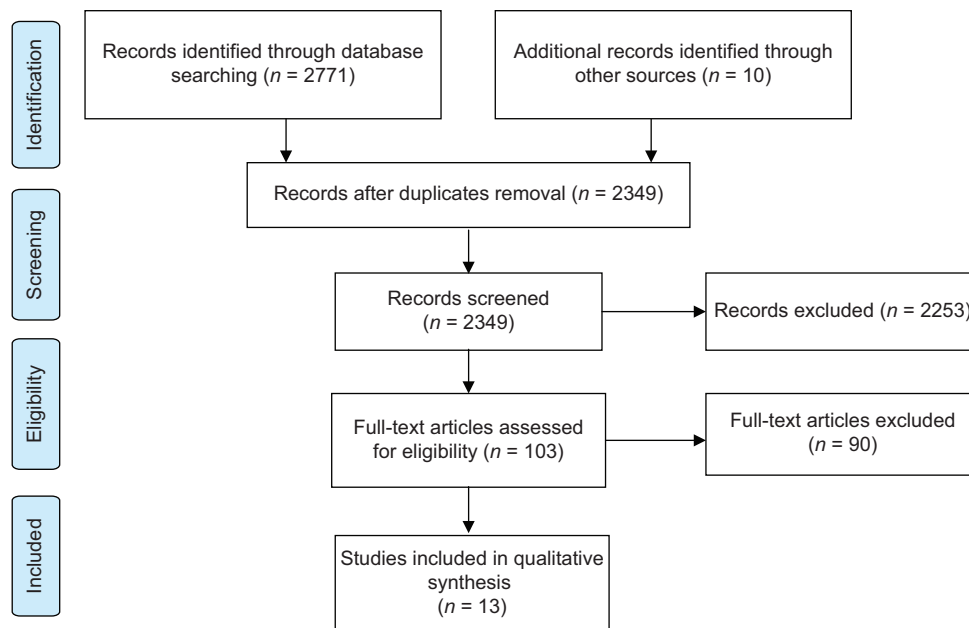


Figure 1: Flow PRISMA diagram for the study identification and selection processes. PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses

Table 3: The products of data analysis in this study

Theme	Main category	Subcategory
Dead body management in hospital	Personal safety	Personal protective equipment
		Standard precautions
		Labeled with COVID-19 tag
	Temporary storage	Refrigeration
		Use of disposable plastic bag
		Suitable ventilation
	Autopsy	Personal protective equipment
		Standard precautions
		Waste management
	Environmental health measures	Laundry management
Disinfection of surface		
Special vehicle transfer for COVID-19		
Transfer of COVID-19 victims	Vehicle transfer	Disinfection of vehicle
		Standard precautions
	Body handlers	Personal protective equipment
		Disinfection
Dead body management in cemetery management of families	Mortuary	Disinfection of the corpse
		Separation and zoning for the ceremonial washing
		Disinfection of washing supplies
		Lack of participation of vulnerable groups
		Personal protective equipment
	Shrouding	Standard precautions
		limited participation
	Funerals	Physical distancing
		Use of mask
		Religious traditions or cultural rituals
	Burial	Suitable depth of the burial
		Suitable distance from water sources
		Disinfectants after the burial
		Waste management
		Respect to families
	Management of families	Physical distancing
		Use of mask
		Psychosocial support
		Avoiding touch or kiss the body
	Risk communication	Prevent rumors
Cooperation with the media		

our study, the main measures of dead body management for epidemic were reviewed and presented. Our major focus was health action and infection control to prevent the spread of infection. In emergency conditions of outbreak of diastase, the main attention of authorities was paid to treatment of patients, and issues such as dead body management were neglected. However, due to the increasing number of deaths and health challenges of following it, management is essential.

Dead body management in hospital

Hospital workers who directly handle the corpses are mostly at risk of the transmission of pathogens during the outbreak.

Since corpses commonly leak droplets, those who handle the corpses may be exposed to the virus. This phenomenon may occur through direct contact with the bodies or indirectly through clothes and accessories. Therefore, the personnel who have contact with the body (health-care or mortuary staff or the burial team) must use the standard precautions and personal protective equipment.^[18] Precautions may reduce the risk of the transmission of the virus associated with the handling of corpses. The practice of basic hygienic measures, including hand hygiene before and after touching the body, use of standard precautions, and use of personal protective equipment will greatly mitigate the transmission risk of pathogens from the corpses.^[16] Hand hygiene needs facilities, including alcohol-based hand-rub, running water, soap, and disposable towel for hand drying (paper or tissue). When the above-mentioned facilities are not available, 0.05% chlorine solutions are recommended.^[19]

Personal protective equipment

Using personal protective equipment, such as masks (medical mask, surgical disposable-N95 masks, or similar level respirators [for aerosol-generating procedures only]), face shields, protective eye-wears (i.e., anti-fog goggles), impermeable or waterproof plastic aprons, disposable overalls, long sleeve gowns, gloves (heavy duty and mortuary types, large sizes), and rubber (washable) boots, is essential for protection of the hospital staff, mortuary refrigerators staff, and corpse washers. Disposable clothing is recommended during the outbreak of diseases.^[4,20] All workers should wear gloves when handling corpses, especially when dead bodies have discharges. Used gloves should be removed and kept in a suitable bag and disposed appropriately. Any person (e.g., family member, religious leader) preparing the deceased (e.g., washing, cleaning, or dressing the body, tidying hair, trimming nails, or shaving) should also wear gloves for any contact with the corpse.^[7,9]

Temporary storage

All corpses must be identified and correctly labeled with infectious diseases tag and personal information. Corpses should be placed in a disposable plastic bag; those with the tag should be kept in a body bag or similar storage items before storage. Before transferring the dead bodies, they should be stored in cold chambers maintained at approximately 4°C. Refrigeration between 2°C and 4°C (35.6°F and 39.2°F) is the best method for storage and preservation of dead bodies in hospitals or mortuaries. However, the capacities of various mortuaries that are available in hospitals are usually inadequate for disease outbreaks.^[4]

Autopsy

Since each and every dead body brought to autopsy is a potential source of infection, pathologists and other support staff should observe standard precautions in the performance of any autopsy.^[17] Safety measures for deceased persons infected should be consistent with those used for the autopsy of the people who have died from an acute respiratory illness.^[7,9]

The lungs and other organs of patients may still contain live agents, and additional respiratory protection is needed during aerosol-generating procedures (e.g., procedures that generate small-particle aerosols, such as the use of power saws or washing of intestines). If a body with suspected or confirmed diatheses is selected for autopsy, health-care facilities must ensure that safety measures are in place to protect those performing the autopsy.^[21] Autopsy should be performed in a suitable ventilation situation such as a ventilated room, i.e. at least natural ventilation with at least 160 L/s/patient air flow or negative pressure rooms with at least 12 air changes per hour (ACH) and controlled direction of air flow when using mechanical ventilation.^[3] Based on the latest WHO recommendation, performing autopsies in an adequately ventilated room, i.e. for natural ventilated spaces, a controlled airflow of at least 6 ACH for old buildings or 12 ACH for a new construction should be assured. Where a mechanical ventilation system is available, negative pressure should be created to control the direction of the airflow.^[22]

Lighting must be adequate as well.^[7] A particulate respirator (N-95, FFP-2, or FFP-3 masks or their equivalents) should be used in the case of aerosol-generating procedures.^[23] Finally, instruments used during the autopsy should be cleaned and disinfected immediately after the autopsy, as a part of the routine procedure.^[7,9]

Environmental health measures

Human coronaviruses can remain infectious on the surfaces for up to 9 days.^[24] Therefore, cleaning the environment and observing health measures are essential. Items classified as clinical waste must be handled and disposed of properly according to legal requirements.^[7] After use, disposable items, such as personal protective equipment, clothes, and sheets, should be disposed in a disposal bag for biohazardous waste according to legal requirements.^[20] All used linens should also be handled with standard precautions. Laundry bags should be securely tied up as well. Moreover, the staff should follow the hospital guidelines on the handling of soiled linens. Furthermore, linens, clothes, and sheets contaminated with blood or body fluids should be laundered in a washing machine with hot washing cycle (>70°C); otherwise, they should be soaked in freshly prepared “1 in 49 diluted household bleach” (mixing 1 part of 5.25% bleach with 49 parts of water) for 30 min before washing.^[7,25] Surfaces and instruments should be made of the materials that can be correctly disinfected. All surfaces that may be contaminated should be wiped with “1 in 49 diluted household bleaches” (mixing 1 part of 5.25% bleach with 49 parts of water), left for 15–30 min, and then rinsed with water. Metal surfaces could be wiped with 70% alcohol. Surfaces visibly contaminated with blood and body fluids should be wiped with “1 in 4 diluted household bleaches” (mixing 1 part of 5.25% bleach with 4 parts of water), left for 10 min, and then rinsed with water. Metal surfaces could be wiped with 70% alcohol. Used equipment should be autoclaved or decontaminated with disinfectants.^[7,25] Environmental surfaces where the bodies are prepared should

be first cleaned with soap and water or a commercially prepared detergent solution. After cleaning, a disinfectant with a minimum concentration of 0.1% (1000 ppm) sodium hypochlorite (bleach) or 70% ethanol should be placed on the surface for at least 1 min.^[24]

The personnel in charge of disinfection may not have experience in handling the dead bodies. Hence, some basic instructions about the risks and precautions should be provided. In this regard, hands should be washed after handling cadavers and before eating and other activities.^[26]

Transfer of epidemic victims

For transfer from hospital to an autopsy unit, mortuary, crematorium, or burial site, the dead body should be disinfected and packed carefully. Leaking of fluids from the body, especially the nose and mouth, must be prevented. Transfer of the corpse as soon as possible to the mortuary is of utmost importance.^[17] Morgue cadaver trolley and vehicles must be thoroughly cleaned once the transport is completed. Special vehicle transfer for the corpse should be disinfected using chlorine solution 5000 mg/L after each transfer and discharge.^[7,25] Furthermore, body handlers should follow standard precautions for blood and body fluids using personal protective equipment and washing their hands.^[5,17] Even though bodies are in well-sealed bags, it is advisable to cover the floor of the vehicle to avoid the possible contamination with liquids that might leak from the bag.^[27]

Mortuary

The mortuary and every surface that the corpse is placed on must be kept disinfected and properly ventilated at all times.^[7] For performing religious rituals for the victims of epidemic, disinfection of the corpse by sodium hypochlorite 5% prepared with cold water is recommended to prevent the transmission of disease agents before the ceremonial washing process. Since the virus can spread through the mouth and nose discharges, internal pores of the nose and throat of the corpse should be blocked by cotton impregnated with disinfectants, so that the mouth is completely closed. In addition, the mortuary should be separated and zoned for the ceremonial washing of epidemic victims.^[17] The deceased person should be shrouded by being wrapped in a plain white cotton sheet before being placed in the body bag or suitable plastic cover. The shroud should be knotted at both ends.^[19] After being used, all washing supplies for any corpse should be disinfected in 5000 mg/L chlorine solution for 5 min. They should be dried at a temperature of 65°C for 2 min or in the sun for 2 h at the end of the shiftwork. It should be noted that children, older people (>60-year-old), and people with underlying diseases, including cardiovascular and respiratory disorders, diabetes, and compromised immune systems, should not be involved in preparing the corpse for burial.^[7]

Shrouding

A plain unstitched white cotton sheet should be placed on top of the opened body bag. The deceased person should be lifted and placed on top of the shroud and the extended side edges of the shroud should be pulled over the top of the deceased person

to cover the head, body, legs, and feet. Three strips cut from the same fabric should be used to tie and close up the shroud for above the head, below the feet, and around the middle of the corpse. It should be knotted at both ends. Shrouding for female corpses is performed by female members of the burial team.^[9,19]

Funerals

Funeral in normal conditions is essential because of its public nature and it is through the public ritual that the society accepts and pays attention to the grieving process.^[27] As much as possible, the funeral should be performed with the minimum number of people. Although burials should take place in a timely manner, funeral ceremonies should be postponed, as much as possible, until the end of the epidemic. If a ceremony is held, the number of participants should be limited. In addition, participants should observe physical distancing in the funeral process, while observing respiratory protection and hand washing.^[7]

High risks exist when handling dead bodies in epidemics due to highly infectious diseases. Protective action helps protect the workers and handlers from the spread of agents by the corpse fluids. Only trained personnel should handle such bodies as epidemic victims. People with respiratory symptoms should not participate in funerals or at least wear a mask to prevent infection and further transmission of the disease.^[7]

Burial of epidemic victims

Burial is the final phase in the dead body management. The burial process is a very sensitive and important step because of cultural, ethnic, and religious considerations.^[12] Burial should be handled at all times with dignity and respect and in accordance with religious traditions or cultural rituals.^[17] Epidemic victims should be buried in individual graves with 1.5–3 m depth. Depth of the burial should be at least 0.75–3 m above the groundwater, with at least one meter covering of the soil and a 0.5-m distance between two bodies. Burial should be 1.5 m deep and at least 200 m far from drinking water sources.^[28]

All covers and wastes of the dead body management process are considered to be infectious and should be incinerated in waste incineration or autoclave and then disposed safely. Furthermore, all family members involved in the funeral process should communally wash their hands with disinfectants after the burial (using chlorine solution 0.05% or an alcohol-based hand-rub solution available for hand hygiene performance).^[4,25]

Management of families

Dead body management encompasses the process of proper handling of the corpse to reduce the physical, psychological, social, ethical, religious, and cultural issues raised by the deceased for the surviving community, especially families and relatives.^[26,29] The need for relatives to view the dead bodies of their loved ones as a part of the grieving process should be respected.^[15] They may view the dead body after it has been prepared for burial, in accordance with the customs.

However, this should be done behind the glass or from afar in order to prevent infection. They should not touch or kiss the body and should wash their hands thoroughly with soap and water after the viewing.^[7] Children, adults >60 years, and immunosuppressed persons should not be directly in contact with the body. Psychosocial support, including debriefing, should be in place for the spouse, children, and other family members. Clothing of the deceased should be washed by machine with warm water at 60°C–90°C (140°F–194°F) and laundry detergents. The clothes can also be soaked in hot water and soap in a large drum using a stick to stir, while being careful to avoid splashing.^[4] The drum should then be emptied and the linens should be soaked in 0.05% chlorine for approximately 30 min. Finally, the laundry should be rinsed with clean water and the linens should be allowed to dry fully in sunlight.^[25]

Family and friends may view the body after it has been prepared for burials, in accordance with local customs. They should not touch or kiss the body and should perform hand hygiene after the viewing.^[22]

Risk communication

In order to avoid misinformation and prevent rumors to promote the rights of the survivors to see the dead body is treated with dignity and respect, close cooperation with the media is essential.^[5,14] The media play an important role in providing public information. Managing information about the number of mortalities is of particular importance in this regard.^[27,29]

CONCLUSION

Dead body management is one of the main challenges during and in the aftermath of disasters and emergencies. Outbreak of diseases causes a large number of deaths in a short period of time, placing overwhelming stress on individuals as well as the society and presenting health officials with an uncommon challenge of handling a large number of cadavers. During epidemic, mismanagement of dead bodies has consequences for the psychological well-being of the handlers and survivors. High-risk persons include the managers and staff of health-care facilities and mortuaries, religious and public health authorities, and families who care for suspected or confirmed cases. Implementation of health principles during the dead body management of epidemic victims with the aim of saving the lives of service providers and participants in ceremonial washing, funeral, and burial is essential. In addition, respect and dignity for the dead person is a value deeply ingrained in all cultures and religions. Dead body management based on health principles and cultural and religious traditions can reduce the spread of the infection and its psychological effects.

Authors' contributions

GHGH and MD conceived of the presented idea. HS and MD developed search strategy. MD searched in database. “GHGH and M.A analyzed and interpreted data. HS and MD wrote the manuscript. H.S revised article grammatically. All authors read and approved the final manuscript.

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Conflicts of interest

There are no conflicts of interest.

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