

CHAPTER 3: HEALTH CONSIDERATIONS IN CASES OF MASS FATALITIES

Karl Western*

The facts indicate that there has not been any epidemic generated from large numbers of dead bodies. In the event that mass fatalities from epidemics occur, the dead body poses a limited risk only for certain pathogens. That minimal risk is determined by very specific circumstances or situations. This chapter focuses on the real risks that the bodies of the dead in disaster situations have for public health, contrary to certain deep-rooted myths.

INTRODUCTION

The assumed infectious risk that a dead body poses has been discredited by science through numerous observations and by epidemiological and scientific evidence, which while scarce, is documented. This is an initial attempt at developing a chapter to relate the epidemiology of human health with exposure to decomposing bodies.

This poses an enormous challenge. In spite of the importance of the subject and of attempts made to demystify the infectious risk of dead bodies, a definitive analytical protocol still has not been developed that makes it possible to objectively quantify whether the presence of dead bodies increases health risks for the living.

This document should serve as a starting point for stimulating interest among the experts in the design of such a tool, or, at least, to provide a critical assessment of the scientific evidence presented that can lead to the measurement of risk. All the conclusions and assertions made here are based on observation and descriptive epidemiology.

The commonly held belief that human and animal corpses pose a public health threat has resulted in confusion among authorities and the general public. This confusion has frequently led to incorrect prioritization and use of scarce resources in crisis situations, and these errors often have caused more deaths and illnesses than caused by the disaster itself. For example, after the scourge of Hurricane Mitch, the limited fuel available was used for massive cremations of dead bodies.

One of the principal obstacles that authorities and health professionals face when managing a large number of dead bodies is the presence of myths about the bodies. These myths have become so deeply ingrained in the human psyche that they are almost instinctual. Myths, however, are simply that. As scientists it is our job to convince a very skeptical public that dead bodies do not pose a danger. The most effective way to eliminate these myths is to compile what is actually known about whether

* National Institute of Allergies and Infectious Diseases, National Institutes of Health, United States of America.

the presence of a large number of dead bodies poses risks for causing illness or epidemics.

In order to discredit all of the myths surrounding dead bodies, we will thoroughly review the available scientific evidence that challenges the supposed epidemiological risk presented by corpses. It is necessary to precisely define the risk/exposure topic, so we will analyze different scenarios in which this relation could arise:

- ◆ Corpses that might or might not transmit the germs that caused the death of that person or animal;
- ◆ Corpses that might or might not transmit the germs even though the cause of death was infectious; and
- ◆ Corpses that might have indirect responsibility for an increase in the disease index, either by effects on the environment (cremation or burial), effects on the mental health of the survivors or rescue personnel, or excessive outlays of human, financial, and material resources for managing dead bodies to the detriment of services for the living.

Finally, we will examine the relationship that exists between the environment and human and animal bodies; the possibility that a large number of dead bodies will affect the environment; the steps that should be followed to prevent deterioration of the natural environment of the affected area; and necessary precautions for correct disposal of animal corpses, regardless of their size or number.

MYTHS

The myths surrounding corpses are completely unfounded and border on the ridiculous. These beliefs have developed and become ingrained in the psyches of populations with the passage of time. They normally are caused by distortions of religious norms, by superstition, or by simple observation of a presumed reality. We distinguish between religion and superstition because the first generally refers to a set of formally established doctrines. Superstition, on the other hand, arises from a poor understanding of religious beliefs, a mixture of socio-cultural factors, scientific facts, and, even, science-fiction (see Chapter 4).

Anthropologists and other scientists recognize that religious customs, superstitions, and myths have a historical root or are based on empirical observations of actual events. For example, disposal of the dead was a matter of major concern during the infamous “black plague” that ravaged Europe; the plague was a major event and gave rise to the appearance of many of the myths concerning corpses.

The following section examines the realities behind the myths about the danger of corpses causing epidemics.

EPIDEMIOLOGICAL RISK OF DEAD BODIES IN AREAS WITH ENDEMIC DISEASES

We should be very conscientious by emphasizing that a dead body is the result of an epidemic and not the cause of the epidemic.

When a natural disaster happens, deaths occur mainly from trauma as a direct result of the type of disaster. In the management of dead bodies, care should be taken with certain endemic diseases (for example, *Vibrio cholerae* and *Mycobacterium tuberculosis*, among others), depending on the type of etiology, when priorities for corpse disposal are considered. Care should also be taken because certain vectors (flies, fleas, rodents, or others) can transmit microorganisms harbored in the corpse (host), such as typhus or plague. At any rate, it is important to note that even in these cases, the presence of dead bodies cannot be considered a significant public health threat. The reason dead bodies pose such a limited health threat is that as the corpse desiccates, the body temperature drops quickly. Even the most resistant bacteria and viruses die quickly in an animal that has died recently. This makes it extremely difficult for microorganisms to transfer from dead bodies to vectors, and from vectors to human populations.

The only thing we can definitively say about dead bodies in disease endemic areas is that they can be carriers of the etiologic agent, without their being the cause of epidemics. Scientific research has not been able to link the presence of dead bodies as the cause of an epidemic in any of the recent disasters or in situations with a great number of fatalities.

Cholera is a concern in endemic areas since *V. cholerae* can have a devastating effect. The concurrence of the cholera season in endemic regions and a disaster with mass fatalities has been a scenario that has caused major concern for more than one public health officer. Overcrowding, poor sanitation measures, and degraded drinking water systems can exacerbate the spread of the disease almost exponentially.

In such cases, corpses might play an important role in the increased rate of infection, especially if there are decaying bodies in contact with water sources.

In Zaire, approximately 12,000 Rwandan refugees died in July 1994 due to an epidemic cholera outbreak. It was later determined that the area where the refugees were located was endemic for this disease.¹ Popular belief attributed the worsening of the outbreak to the presence of corpses, but it could be demonstrated that other factors, such as overcrowding, poor sanitation measures, and the lack of drinking water, were the primary causes.

The presence of dead bodies in this refugee camp proved to be only a cofactor when the tragedy was examined, owing mainly to the fact that those handling the bodies did not observe necessary standards of hygiene, which means they became transmitters of the disease. In a few other cases it was due to the fact that dead bodies contaminated drinking water sources.

1 Armstrong D, Cohen J (eds). "Geographic and Travel Medicine: Cholera." *Infectious Diseases*, Vol. 2; Mosby: London, 1999.

It is impossible to determine to what extent the dead bodies were responsible in the appearance of the Zaire outbreak, but it is very clear that the cholera epidemic might have declined dramatically if the authorities and emergency personnel had prioritized sanitation measures, housing, and the issues of water and waste management in the refugee camp. In conclusion, it cannot be said that the Zaire incident could have resulted in fewer deaths if body disposal had been a priority.

There are several recommendations for proper management of dead bodies in situations such as that described in Zaire:

- ◆ Strengthen personal hygiene measures both of relief and humanitarian workers and of the community in general;
- ◆ Disinfect bodies with a chlorine-based solution;
- ◆ Monitor transport vehicles;
- ◆ Prevent direct contact between the corpse and family members. Bodies can be delivered to the family members in airtight boxes so that they can be buried rapidly in accordance with the customs of the community;
- ◆ In this and many other situations, avoid exposure of the dead bodies to animals. The best way to avoid this is to bury the body.

Public beliefs have also associated salmonellosis with the presence of dead bodies. *Salmonella*, like *V. cholerae*, is a very resistant bacterium.

Chile has experienced serious problems with salmonellosis, and it is regarded as an endemic area. The country had a salmonellosis epidemic between 1977 and 1986 at a time when statistics showed improvement in systems for drinking water and waste disposal due to better sanitation procedures.²

In general, we can say that conditions of overcrowding and poor sanitation measures are directly related with cholera and salmonellosis. There are no conclusive data to quantify the exact effect that dead bodies might have on the spread of salmonellosis, but it is possible that such a connection does exist. Although some authors have linked the spread of salmonellosis to the presence of dead bodies, the connection is as tenuous as the relationship between illness, corpses, and cholera.

Popular belief maintains that dead bodies played an active role in some of the salmonellosis epidemics that affected Chile. At any rate, as with cholera, the bodies are only regarded as a cofactor. When situations in Chile and similar cases are carefully examined, it can be concluded that good sanitation infrastructure does not necessarily indicate good health practices in the general population. This important lesson has been difficult to learn in many communities and has proven to be an important cofactor when the relationship between corpses, sanitation measures, and epidemics is examined.

2 Fica AE, Prat-Miranda S, Fernandez-Ricci A, D'Ottone K, Cabello FC. "Epidemic typhoid in Chile: analysis by molecular and conventional methods of *Salmonella typhi* strain diversity in epidemic (1977-1986) and nonepidemic (1990) years". *J Clin Microbiol* 1996; 34(7):1701-7.

Both *Salmonella* and *V. cholerae* are extremely resistant and tenacious organisms. Cholera and salmonellosis outbreaks are serious events, especially in low-income communities. However, the role that high numbers of dead bodies play when they exist in areas with endemic diseases requires a very critical assessment of whether the following can be verified:

- ◆ The area is endemic for the disease in question. Certain baseline data are needed to judge the level of disease in a given area;
- ◆ The disease can survive in a dead body for a considerable period of time;
- ◆ The confluence of the factors previously referenced, together with the local environment and a third potential event (for example, a disaster), make the presence of dead bodies a greater hazard than in “normal” conditions.

No single factor can increase the risk due to the presence of corpses. Furthermore, we know that while bacteria such as *Salmonella* or *V. cholerae* are resistant, the majority of these microorganisms do not survive for long after the death of the host.

Other diseases should be taken into account: for example, it has been verified that the human immunodeficiency virus (HIV) can survive for 16 days in a corpse, and at temperatures as low as 2°C.³

Tuberculosis should be mentioned because it is highly contagious. It can pose a hazard especially during autopsy or handling of the body when air is exhaled from the respiratory tract.⁴ Several simple techniques dramatically reduce the risk of contagion from this disease. These include placing a cloth over the mouth of the body when it is being handled to prevent the escape of air,⁵ and ensuring adequate ventilation in the area chosen as a temporary morgue, especially when there are large numbers of corpses.⁶

In Table 3.1 we list the principal diseases that should be avoided by those responsible for managing corpses in order to avoid possible contagion.⁷

Table 3.1. INFECTIOUS RISK OF HUMAN CORPSES

Bacterial infections	Viral infections
Tuberculosis	Gastrointestinal infections
Streptococcal infections	Creutzfeldt-Jakob disease (“mad cow” disease)
Gastrointestinal infections	Hepatitis B
Meningitis and septicemia produced by meningococcus	Hepatitis C
	HIV infection
	Hemorrhagic fever

3 Demiryurek D, Bayramoglu A, Ustacelebi S. “Infective agents in fixed human cadavers: a brief review and suggested guidelines.” *Anat Rec* 2002;196.

4 Gershon RR, Vlahov D, Escamilla JA, Badawi M, McDiarmid M, Karkashian C, et al. “Tuberculosis risk in funeral home employees.” *J Occup Environ Med* 1998;40:497-503.

5 Healing TD, Hoffman PN, Young SE. “The infectious hazards of human cadavers”. *Commun Dis Rep CDR Rev* 1995;5:61-68.

6 Centers for Disease Control and Prevention (CDC). “Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health care facilities.” *MMWR* 1994;43.

7 Taken from Healing TD, Hoffman P, Young SEJ. *Guide to infection control in the hospital*. Second edition. International Society for Infectious Diseases; 2000. Ch. 42.

SCIENTIFIC BASIS OF THE ABSENCE OF EPIDEMIOLOGICAL RISK IN NON-ENDEMIC AREAS

There exists little evidence suggesting that dead bodies constitute a risk in areas that are not endemic for certain diseases.⁸ When a disaster strikes a community, authorities prioritize their actions to address the most pressing public concerns, that is, attending to the injured, the displaced, and the dead. Little time has been devoted to documenting the fact that dead bodies do not constitute a significant risk of infection during a disaster. At any rate, the evidence obtained from emergency operations and subsequent reconstruction projects would indicate that in the majority of the cases the dead bodies do not pose an appreciable risk for public health in areas where there are no endemic diseases. For a more thorough examination of this subject, we should review the scenarios before and after the occurrence of a disaster.

On 17 August 1999, one of the deadliest earthquakes in Turkey's history struck, resulting in approximately 16,000 deaths and more than 44,000 injured. The emergency teams that converged on the site dealt with Phase 1 of the emergency and Phase 2 of treatment. The teams worked for two-week periods to treat injuries, illnesses, and traumas that resulted from the incident. They dealt almost exclusively with surgery, births, trauma cases, and neonatal and post neonatal care. Infectious diseases played a very small or no role in the activities of the medical teams.⁹ The teams prioritized the search for buried survivors, treatment of the injured, and management and organization of the refugees and injured. Disposal of the dead was of secondary concern during this period.

To be objective about this example, we should emphasize that this case should be viewed with caution since the absence of epidemics can be explained in large measure by the good condition of Turkey's health system, particularly in the western part of the country.

The year 1998 was marked by one of the most devastating and deadly hurricanes in history. Hurricane Mitch devastated Central America. Flooding and landslides resulted in an estimated 10,000 deaths between 26 October and 2 November 1998. The flooding of roads and destruction of health centers hindered emergency relief efforts.

The immediate causes of morbidity and mortality were the landslides and floods. The emergency teams treated a great number of the injured immedi-

8 The absence of scientific evidence can be attributed to the following factors:

- Difficulty of carrying out investigations in crisis situations;
- Owing to the observations made during disaster situations, it is possible to conclude that there is no solid evidence linking dead bodies to the spread of the disease. Scientific evidence would have a relative impact in this regard;
- Finally, there is little interest on the part of scientists to corroborate a fact that has always been observed.

9 Halpern P, Rosen B, Carasso S, Sorkine P, Wolf Y, Benedek P, Martinovich G. "Intensive care in a field hospital in an urban disaster area: lessons from the 1999 earthquake in Turkey". *Crit Care Med* 2003;31:1589-90.

ately after the storm. A study of infectious diseases before and after Hurricane Mitch in the Nicaraguan community of Villanueva showed that the incidence of acute diarrheal illness and acute respiratory infection increased significantly.¹⁰ This study found that the incidence of acute diarrheal disease rose from 2,849 to 6,798 per 100,000 ($p < 0.01$) after the hurricane. Specifically, they found that the incidence of acute respiratory infection increased from 295 to 1,205 per 100,000 ($p < 0.01$). The evidence suggested that the increased incidence of these illnesses was attributable to flooding, poor sanitation measures, overcrowding, and damage to the basic infrastructure.

It should be noted that this study was unique in that it was carried out at the same time as relief operations. In fact, the study was used to assist the relief teams in prioritizing their activities. Thanks to the investigations, emergency personnel were able to prepare for an increase in patients with acute respiratory and diarrheal illnesses. Evidence was never presented to link the presence of dead bodies to these increased rates of infection. On the contrary, the lack of drinking water, poor hygiene, and overcrowding were indicated as the causal factors in the increase in these illnesses.

Many scientists consider poor policies, misconceptions, and myths to be partly responsible for the disaster caused by Hurricane Mitch. Many of the deaths, much of the property damage, and the chaos that surrounded the event could have been ameliorated, to some extent, if the authorities had had accurate information about disaster management, or if they had prioritized the relief activities in a more logical way. According to a study published after the hurricane, “The devastation in Central America following the 1998 hurricane (Hurricane Mitch) resulted more from economic and political policies than from ‘natural’ disaster.”¹¹ The authors conclude that the forced migration over the years of poorer populations from stable agricultural areas onto degraded hillsides and into floodplains made these people particularly vulnerable to the effects of the hurricane. Furthermore, the authors note that inappropriate emergency planning greatly exacerbated the death toll from Hurricane Mitch. The authors go so far as to say that the population settlements in degraded areas coupled with the failure to anticipate the disaster through massive evacuations or to respond effectively to the damages caused the loss of thousands of lives. Regarding this last point, it should be emphasized that attending to the care of survivors is clearly of higher priority than attending to the disposal of dead bodies in an emergency.

In addition to the evidence presented in the previous examples, many health institutions have disputed the assumption that dead bodies present a public health hazard. The World Health Organization (WHO) has repeatedly pointed out that there is a minimal risk for infection from dead bodies. In a document published in 2002, WHO established that: “Dead or decayed human bodies do not generally create a serious health hazard, unless they are polluting sources of drinking-water with faecal matter, or are infected with plague or typhus, in which case they may be infested with the fleas or lice that spread these diseases.”¹²

10 Campanella N. “Infectious diseases and natural disasters: the effects of hurricane Mitch over Villanueva municipal area, Nicaragua.” *Public Health Rev* 1999;27:311-9.

11 Cockburn A, St.Clair J, Silverstein K. “The politics of natural disaster: who made hurricane Mitch so bad?” *Int J Health Serv* 1999;29:459-62.

12 Wisner B, Adams J, editors. *Environmental health in emergencies and disasters: a practical guide*. Geneva: World Health Organization; 2002; p. 198.

According to scientists from the Water, Engineering and Development Centre (WEDC) of the United Kingdom, the relationship between corpses and epidemics has never been scientifically demonstrated or reported.¹³ The authors indicate that, contrary to popular belief, corpses rarely contaminate water sources and are not associated with the transmission of malaria or dengue; they also state that many of the hurried disposal methods constitute more of a hazard for public health than the corpses themselves. For example, mass cremations produce high quantities of smoke with airborne dioxin, resulting in significant respiratory problems.

The experience of WHO and the WEDC in managing incidents with large numbers of dead bodies and subsequent health related problems, supports the assertion that the presence of corpses plays a negligible role in the spread of infectious diseases.

The large quantity of evidence presented makes it possible to recommend to authorities to redefine priorities regarding disposal of the dead. Hasty disposal of dead bodies is unnecessary, particularly when this implies a failure to respect family members and their desire for a worthy burial in accordance with their beliefs and customs.

ANIMAL CORPSES

Many of the issues about human corpses directly correspond to those relating to animal corpses. Myths have been developed about animal corpses as well, mainly from events out of the past without any apparent scientific basis. The black plague, which left an indelible mark on the human conscience, was spread by animals, and their corpses were regarded as just as deadly as the live animals. We should consider, also, that animal vectors do spread a number of diseases among humans; the majority of the population believes that these vectors are dangerous whether alive or dead.

In most cases, the bodies of dead animals pose as little risk to humans as human bodies. That is, animal corpses constitute a public health hazard only in specific conditions.

An animal that has lived through its life cycle or has died from injuries does not represent any health hazard for humans. Massive animal deaths in cases of natural disasters are not a health hazard for humans, either. However, it is necessary to emphasize that animals that die from exposure to a disaster or as a consequence of injuries, and that have had a specific communicable disease, may pose a risk to the population.

Zoonoses are becoming an increasing threat to human populations. However, most zoonotic infections do not survive in the dead body of an animal. Like diseases that survive in the corpses of humans, zoonotic diseases from animal corpses must occur in an endemic area for that disease if they are to present any risk. If the area is not endemic for the disease, the probability of corpse-to-human transmission is very low.

There exist two specific situations in which the animal bodies can be a risk for humans: the presence of specific infectious agents and the contamination of water by

¹³ Harvey P, Baghri S, Reed B. *Emergency sanitation: assessment and programme design*. Water, Engineering and Development Centre, Loughborough University; 2002.

feces and discharge from lesions. The microorganisms of greatest concern are *Cryptosporidia*, *Campylobacter*, and *Listeria*, but only when the bodies are in the water. These microorganisms do not survive for long if the animal is on dry land.

Although animal corpses pose a minimal health risk, the proper disposal of animal remains is important after the initial response to the disaster. The procedures recommended for animal corpse disposal are fairly standard, but we will analyze protocols for two types of situations. The first was developed in order to handle the animal remains after Hurricane Floyd, and the second was designed at the University of Virginia in order to be used in a variety of natural disasters.

In the United States, the Department of Health and Human Services for North Carolina (DHHSNC) issued a set of guidelines for the disposal of animal remains as a consequence of Hurricane Floyd.¹⁴ They recommended that corpses be moved with either a shovel or gloves in order to avoid the potential transmission of infectious diseases. Pets and wild animals were to be buried in holes at least 3 feet deep. In some cases the DHHSNC designated specific dumpsters for depositing corpses. Livestock animals were to be disposed of by incineration. The DHHSNC emphasized that due to the low risk of transmission of infectious diseases from animal corpses, personnel should prioritize care of the living above the disposal of animal corpses.

The Office of Health and Environmental Safety of the University of Virginia (OEHS) developed protocols for the disposal of animals deliberately infected for research purposes and animal corpses resulting from natural death or disasters.¹⁵ For our purposes we will examine the protocols for animals that have died naturally or from injuries. The OEHS recommends disposal of animal bodies in duly sealed, thick plastic bags; subsequently these should be taken to the area designated for final disposal, which might include incineration. Ashes are buried or deposited in a secured landfill.

It is important to note that standard methods of animal disposal vary from country to country, always taking into account the infrastructure and available manpower as determining factors. In general, it is difficult to bury or cremate large animal corpses (entire bodies) due to the great investment of resources. Initially they are sprayed with oil and then covered with soil to protect them from predators until they can be destroyed or buried. The same approach is used when parts of animals or large numbers of smaller animals are found. Another recommendation is to use quicklime, thus delaying the onset of putrefaction and diminishing the numbers of bacteria that might pose a risk for zoonoses.

Other practical advice for the final disposal of animal corpses is offered by Eduardo Fuhrer Jiménez¹⁶ and presented below:

“Certain experiences have shown us that before covering a corpse with dirt, it is helpful to place of layer of blackberry branches or some other thorny

14 Bruton HD. “State health official recommendations for disposal of dead animals in Floyd’s aftermath.” North Carolina Department of Health and Human Services, 7/29/03. The document can be viewed at the NCDHHS web site: www.dhhs.state.nc.us/pressrel/9-22-99a.htm.

15 Office of Environmental Health and Safety, “Waste management decision tree,” 7/29/03. This protocol can be viewed at: www.keats.admin.Virginia.edu/tree/home.html.

16 Eduardo Fuhrer Jiménez, veterinarian with the Servicio Agrícola y Ganadero del Ministerio de Agricultura de Chile (Agriculture and Livestock Service of the Ministry of Agriculture of Chile), personal communication.

plant over the corpse followed by the soil. In this way, dogs, foxes, or other canines that dig to find the corpse are hurt by the thorns, and discouraged from digging.

“When there are corpses of herbivores that have a large amount of grass in their stomachs (they have four stomachs), putrefaction will set in, and gases will swell the body causing the level of the soil covering the animal to rise. It is advisable to break the stomach with a blow to allow the gas to escape.

“Another aspect has to do with incineration of dead bodies. Although on some occasions it is advisable to burn them, when there are a large number of bodies, especially large animals (herbivores), there are negative results. The bodies have been sprayed with oil, and there is an impressive flame that lasts only a couple of minutes. The hair burns and the bodies remain intact. Another negative result is that if someone wants to bury the remains later, it is more difficult to move them without a backhoe, since they easily fall apart.”

Final disposal requires burying the dead animals in pits that are 3 feet deep, and covering them with soil in a site where there is no possibility of contaminating surface or ground water. This should be sufficient in most situations, but should be reviewed in the case of flooding when it is more appropriate to bag the corpses until they can be cremated or buried.

Dr. Eduardo Fuhrer also reported on the management of dead animal bodies after the foot-and-mouth disease outbreak in Chile in 1984:

“In 1984, an outbreak of foot-and-mouth disease occurred and 8,000 animals had to be sacrificed. It occurred in the middle of autumn and in the high mountain range; the snows start in May in that area. In many places there were no roads on which to move the equipment needed to make graves. There remained a series of herds of animals that had not been buried in approximately seven sections, with an average of some 200 cattle (the majority over 250 kg), and 300 sheep and goats (weighing about 30 kg) in each section.

“The site was fenced and people could not access the area, but there were cases of dogs and foxes eating the remains. During the months of May, June, and July the remains stayed under the snow. In August, when the snow melted, the action of the sun and water caused decomposition of the corpses. By the end of October, people were hired to dig pits with shovels using proper standards for hygiene and personal protection. The remains were dragged to the burial area using horses. Negative aspects of this process were the presence of foul odors and the fact that bodies were easily dismembered when dragged by the horses.”

As can be observed by this account, no health problems arose at any time during the process. Since the virus causing foot-and-mouth does not continue to multiply, but remains in the bone marrow, the only problem presented was that of decomposition.

As a final analysis, we can state that the dead bodies of animals represent little or no threat for public health. A series of coexisting factors must be present for the animal bodies to constitute a risk for humans. First, the animal should be infected with a disease that can be transmitted to humans. Second, the germ should be able to survive the death of the host. Third, the environment should facilitate the spread of the infectious agent (for example, contaminated water). Any interruption in this chain of events results in there being a minimal public health hazard. Moreover, the presence of corpses of animals alone cannot be associated with the spread of infectious diseases. The preponderance of evidence demands that the final disposal of dead animals be deferred in favor of attending to the living.

CONCLUSIONS

The available evidence indicates that the presence of human and animal corpses represents little to no public health hazard.

The scientific evidence derived from the examination of diseases that may pose a public health threat in the presence of dead bodies suggests that a very specific set of criteria must be met. These include: that the bodies are hosts of a disease present in endemic areas; that the microorganisms can live on in the corpse or in the environment after the death of the host; and that the necessary environmental conditions exist (for example, degraded infrastructure for waste disposal, overcrowding, etc.).

The presence of dead bodies that result from a disaster, without the presence of another risk factor, is not the cause for the spread of infectious diseases. The criteria outlined above must be concurrent for the body to become a hazard for public health. The removal of any one of them results in a significant reduction of those risks.

The same postulate regarding the public health threat posed by human corpses applies to animal corpses. Furthermore, the same set of criteria for disease transmission by animal corpses corresponds to the criteria that apply to human corpses. Animal corpses pose very limited public health risk to humans, except under very specific conditions.

The authorities and public health professionals face the difficult task of trying to persuade a skeptical population of the limited threat posed by human and animal bodies. At any rate, based on scientific observation, the authorities should understand their critical role in ameliorating the effects of a disaster.

The limited role that human and animal corpses play in the spread of diseases requires authorities to change their prioritization strategies, and better educate the public about the risks posed by dead bodies. Policy, in the absence of mitigating factors mentioned above, must prioritize attending to the survivors above disposal of the dead, taking into account the key issue of the correct use of resources.

Our relationship to the environment is an important aspect of the fear that exists in the general population, and even among many authorities, concerning the probable negative effects that human and animal corpses have on nature. In this regard, it is necessary to insist that there is no risk that dead bodies resulting from natural dis-

aster will spread infectious disease. It should be pointed out that corpses found in bodies of water could contaminate it with fecal matter or with diseases that are endemic in that area.

Disposal of animal bodies involves special processes in accordance with their number and size. Generally disposal of large animals (cattle or horses) is difficult. A temporary, initial measure is to spray them with oil and cover them with dirt until the necessary conditions for final burial exist. Moreover, it is important not to neglect the surviving animals, which should be brought together, cared for, and monitored in order to prevent any outbreak of disease. Since vectors can transmit endemic diseases, necessary steps to control and eradicate them should be taken.

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