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Earthquake in Türkiye: Impact on Health Services and Infection Threats

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ABSTRACT

On February 6, 2023, Türkiye experienced two significant earthquakes with magnitudes 7.7 Mw and 7.6 Mw at 04:17 Türkiye Standard Time (TRT) (01:17 Coordinated Universal Time (UTC)) and 13:24 TRT (10:24 UTC), respectively, centered in Kahramanmaraş. The study aims to review the immediate aftermath of these earthquakes, their impact on health services, and the potential threats of infection due to these catastrophic events in Türkiye. Eleven provinces in the southeastern region of Türkiye, as well as areas in the northwestern region of Syria, suffered severe damage. Aftershocks continue, though with decreasing intensity. Thousands of structures, including crucial infrastructure, were destroyed. Approximately 15 million people in Türkiye and 10.87 million people in Syria were severely affected. About 200.000 people were injured, and more than 50.000 people died due to the earthquakes. Roughly 500.000 people fled from the earthquake-affected region to western cities. The rescue operations were completed within two weeks. The earthquake and its aftershocks, compounded by winter conditions, left thousands of people homeless in the region. Intensive efforts were initiated to address the health care, medicine, shelter, nutrition, sanitation, and other needs of the earthquake victims. In the upcoming days, earthquake survivors may face significant risks of infections, including airborne, food-borne, and water-borne infections, as well as nosocomial infections from resistant bacteria and parasitic infections. Identifying the risk factors that underlie the emergence and transmission of communicable diseases can enhance the development and implementation of more effective preventive measures. Currently, safety, security, mitigation, and infection control activities are essential to help restore daily life in the region.

Keywords: Türkiye, earthquake, infections, biosecurity.

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INTRODUCTION

Individuals encounter disasters in various forms: natural and man-made. These disasters can be insidious, acute, or chronic. The World Health Organization (WHO) defines a natural disaster as the "result of an ecological disruption or threat that exceeds the adjustment capacity of the affected community."[1] Natural disasters are unpredictable events that can severely impact populations, leading to loss of life, economic losses, disruption of public life, and significant damage to city infrastructure. While current technology can aid in predicting storms, hurricanes, and cyclones, a considerable number of natural disasters still strike unexpectedly.[2,3] Owing to its geographic features, Türkiye is susceptible to natural disasters, including earthquakes, floods, landslides, avalanches, wildfires, and more. In Türkiye, approximately 60 percent of disaster-related deaths are due to earthquakes. Türkiye lies within the Mediterranean-Alpine-Himalayan zone, one of the world's most seismically active areas.[4] As per the records of the Republic of Türkiye's Ministry of Interior, Disaster and Emergency Management Presidency (AFAD in its original in Turkish), 905 natural disasters were documented in Türkiye in 2020. Out of these, 321 were earthquakes with a magnitude greater than 4.0 Mw.[5] On February 6, 2023, the southeastern regions of Türkiye and Syria were hit by devastating earthquakes with magnitudes of 7.7 Mw and 7.6 Mw, respectively. The region has continued to experience aftershocks, albeit of decreasing magnitudes. Currently, by the end of August, over six months have passed since the earthquake, and intense efforts to restore normalcy in the region persist.

The aim of this study is to review the current situation, evaluate its impact on health services, discuss potential future risks to public health, and assess infection threats in the region due to the recent earthquakes in Türkiye.

For the preparation of this narrative review article, web addresses of institutions such as WHO, International Blue Crescent Relief and Development Foundation, AFAD, Kandilli Observatory and Earthquake Research Institute (KOERI), and the Turkish Ministry of Health (MoH) were searched for earthquake news, reports and other relevant publications. The PubMed and the Web of Science databases were searched using the keywords "earthquakes," "Turkey," and "Türkiye" to find reviews, case series, case reports, and news about the recent earthquakes in Türkiye. The first author (YO, an anesthesiologist) and the second author (FO, a microbiologist) of this research study were victims of the earthquakes and continue to work at the Kahramanmaraş Sütçü İmam University Hospital (KSIUH) in Kahramanmaraş. The first author (YO) was assigned to the Emergency Department of the hospital on the morning of the first earthquake. Publications related to the February 6, 2023 earthquakes were selected for this manuscript.

Kahramanmaraş Earthquakes and Their Destructive Effects

According to KOERI and AFAD, a magnitude 7.7 Mw earthquake struck at 04:17 local Türkiye Standard Time (TRT) (01:17 Coordinated Universal Time (UTC)) on February 6, 2023, with its epicenter in Pazarcık district of Kahramanmaraş province. This was followed by another earthquake with a magnitude of 7.6 Mw at 13:24 local TRT time (10:24 UTC) with its epicenter in Elbistan, 100 km away from the center of the first quake. The destructive effects were evident in 11 provinces in the southeastern region of Türkiye, including Kahramanmaraş, Adıyaman, Hatay, Kilis, Gaziantep, Adana, Osmaniye, Diyarbakır, Urfa, Malatya, and Elazığ. The most severe damage was observed in Kahramanmaraş, Adıyaman, and Hatay (Fig. 1). Two other significant earthquakes centered in Samandağı and Defne in Hatay province with magnitudes of 6.8 Mw and 5.8 Mw occurred on February 20, 2023. The water supply, infrastructure, food product distribution networks, electricity, and telephone lines in most of the affected cities were completely destroyed, particularly

Figure 1. Map of the affected region in Kahramanmaraş and Hatay during the earthquakes in Türkiye (Source: https://deprem.afad.gov.tr/assets/pdf/Arazi_Onrapor_28022023_surum1_revize.pdf).

Figure 2. View of a collapsed building in the city center of Kahramanmaraş (photo by Dr. Yavuz Orak).

Table 1. Severe earthquakes (>6.0 Mw) recorded in the last three decades in Türkiye

Year	Location (province)	Magnitude (Mw)	Deaths
1992	Erzincan	6.8	653
1995	Dinar (Afyon)	6.1	90
1998	Ceyhan (Adana)	6.2	146
1999	Gölcük (Kocaeli)	7.8	17.480
1999	Düzce	7.5	763
2002	Çay-Sultandağı (Afyon)	6.4	44
2003	Pülümür (Tunceli)	6.2	1
2003	Bingöl	6.4	176
2010	Başyurt-Karakoçan (Elazığ)	6.1	42
2011	Van	7.2	644
2020	Elazığ	6.8	41
2020	İzmir	6.6	117
06.02.2023	Kahramanmaraş		Deaths >53.000
	Pazarcık	7.7	Injured >125.000
	Elbistan	7.6	
	Hatay		
20.02.2023	Hatay		Deaths 6
	Samandağı	6.3	Injured 294
	Defne	5.8	

Data were collected from the web addresses of the Republic of Türkiye's Ministry of Interior, Disaster and Emergency Management Presidency (AFAD - www.afad.gov.tr) and Kandilli Observatory and Earthquake Research Institute (KOERI - http://www.koeri.boun.edu.tr/new/en).

in Kahramanmaraş, Adıyaman, and Hatay. These earthquakes are considered the most powerful in Türkiye since 1939. Table 1 summarizes the severe earthquakes (>6.0 Mw) that have been recorded in Türkiye over the last three decades.[6,7]

The earthquakes based in Kahramanmaraş have been termed the "*Biggest Disaster of Recent Years*." According to WHO and AFAD reports, 15 million people were affected in Türkiye and 10.87 million in Syria. Among them, the number of helpless and elderly individuals, children, and refugees is estimated at over 345.000, over 1.4 million, and 7.000, respectively. About 500.000 people fled from the earthquake-affected region to western cities in Türkiye. It was officially announced that more than 50.000 people died due to the earthquakes. The earthquake and subsequent aftershocks, coupled with winter conditions, left thousands homeless in the region.[8]

When the first earthquake struck at 4:17 a.m., people jolted awake to a terrifying situation. Thousands of buildings either collapsed or were damaged, main roads were torn apart and rendered unusable, and the infrastructure and communication systems completely collapsed (Fig. 2). Hospital buildings in the affected areas also suffered severe damage or collapse. It is estimated that over 200.000 people were trapped under the rubble, either deceased or awaiting rescue. In the affected zones, all rescue teams, medical doctors, medical staff, police, and security personnel were also victims of the earthquakes.[9,10] On February 13, 2023, the Turkish Medical Association (TMA) reported that 67 doctors perished due to the earthquakes in the affected regions.[11] The response of rescue and medical teams to the disaster zones was hampered by winter conditions and the damage inflicted on roads and nearby airports. It took a long time for the roads and airports in the region to become operational for transportation, delaying the rescue teams from neighboring provinces in reaching the disaster areas. This catastrophic situation was further exacerbated by the cold and snowy winter conditions. Earthquake victims were exposed to harsh winter elements, including cold, rain, wind, and damp shelters, until early May 2023. These conditions primarily led to hypothermia, shock, multiorgan dysfunction, and respiratory infections.

In addition to the earthquake disaster, on Wednesday, 15 March, 2023, a severe flood occurred in Adıyaman and Şanlıurfa. Reports indicate that 20 people lost their lives due to the flood. The total financial damage from the earthquake was officially assessed at 104 billion US dollars.[10]

Health Services Management in a University Hospital

In Türkiye, there are 927 secondary and tertiary care facilities and 14.301 primary health care facilities affiliated with the MoH. The total bed capacity stands at 166.949. Of these, 12.5% of secondary and tertiary healthcare facilities and 17.5% of primary healthcare facilities are located in the earthquake zone. As of December 2022, the number of hospital beds per 10.000 people is 31.3 in Türkiye and 32.3 in the provinces affected by the earthquake. Out of 118.675 specialist physicians and general practitioners working in MOH-affiliated hospitals, 19.616 in 11 provinces were affected by the earthquake. The university hospitals damaged by the earthquakes in eight provinces have a combined bed capacity of 7.806. According to the damage control data revealed during the earthquake, 42 hospital buildings were found to be heavily or moderately damaged: 27 belonging to MoH, 6 to universities, and 9 to the private sector. In total, 94 hospital kept serving with minor damage, including 75 MoH hospitals, 12 university hospitals, and seven private hospitals.[9] In Kahramanmaraş, there are 11 state hospitals, seven private hospitals, and one university hospital. Following the earthquake, two state hospitals in the districts and two private hospitals in the city center ceased operations due to extensive damage. The KSIUH was only affected with minor damage from the earthquake.

Approximately half an hour after the earthquake, patients of various age groups began arriving at the KSIUH Emergency Service in significant numbers, presenting with head trauma, body trauma, extremity trauma, chest trauma, hypothermia, or in some cases, already deceased or in critical condition. Emergency specialists managed the coordination and operations of the emergency department. Medical teams, comprising surgeons, health personnel, and other staff who could reach the hospital, worked under this coordination to the best of their abilities. After a swift triage process, patients were directed to operating rooms, intensive care units, or other services, where specialist physicians treated them. However, the hospital's information management system (HBYS) was disrupted by the earthquake, preventing patient registration until noon. The system suffered further damage from a second earthquake, measuring 7.4 Mw, at 13:24. This setback temporarily demoralized the medical team. Numerous physicians, health workers, and personnel from both the MoH and university hospitals affiliated with the Higher Education Institution (YOK) arrived at the hospital on the earthquake's first day, whether officially assigned or volunteering. Patients designated for transfer were quickly relocated to neighboring provinces less affected by the earthquake (especially Kayseri and Adana) using ambulances, ambulance helicopters, and specialized vehicles. Particularly, the infants in the neonatal intensive care unit were transferred to appropriate hospitals by ambulance.

The hospital management swiftly established a crisis management desk, and the necessary roles were delegated. The MoH appointed a manager to ensure effective collaboration between the MoH and the University Administration regarding the placement of physicians and supporting health personnel at the hospital. Most of the health services in the hospital were provided by externally assigned and volunteer health workers. Shelter for healthcare workers was provided using containers, and tents were erected in the hospital garden. From the first day, their food and beverages were supplied by both the hospital management and donations. Having established the organization on the second day after the earthquake, our hospital exerted significant effort to accurately and properly refer patients, as well as to provide diagnostic and treatment services. Patients who were not referred during the acute period were accommodated in the ground floor and first-floor corridors, which were deemed safer. Internal and surgical patients were categorized separately. Their treatments were administered after consultations with the relevant physicians, and those deemed suitable were referred.

A multidisciplinary and holistic approach to disaster management planning can result in more efficient and effective strategies. Healthcare delivery is a complex system that heavily relies on the functionality of its physical components, life-sustaining services, and supply chains, as well as a combination of management processes and highly trained personnel. Thus, the efficacy of healthcare is contingent upon the optimal performance of all these components, and any damage they incur can disrupt the service. For example, damages to road infrastructure can have debilitating effects on healthcare wait times and travel durations.[12] Disruption of network lifeline systems can result in inoperability,[13,14] necessitate hospital evacuations,[15] and even result in fatalities[16] if not addressed promptly. One significant problem we faced during the earthquake was the extensive damage to the roads. The routes to neighboring cities were blocked by rolling and falling stones from the mountains, as well as by the harsh winter conditions.

As a result, there were delays in patient transfers and in the arrival of health workers who intended to report to our hospital for their assignments. However, these challenges were swiftly addressed. The WHO suggests that hospital operations during disasters hinge on three primary elements: structural, non-structural, and functional.[17] Our hospital experienced no structural or non-structural dysfunctions. We endeavored to maintain functionality through coordinated efforts. Studies have indicated that approximately half of all injuries following an earthquake involve some type of fracture, with many necessitating surgical intervention.[18] We also witnessed a significant number of extremity traumas during the catastrophic earthquake. These patients were transferred to hospitals in neighboring cities. In the aftermath of the earthquake, healthcare institution treatment centers were inundated with a large number of patients.[19] Hence, it is essential for consultation across relevant specialties to be executed promptly and in a coordinated manner during such emergencies.

For future disaster preparedness, there needs to be enhanced coordination and communication between the Ministry of Health and the University Hospital Administration. Elevating institutional awareness about natural disasters and fostering continuous professional development are also of paramount importance.

The Perspective on Microbiology Laboratory Services

Various factors, including snowy and rainy cold weather conditions, insufficient heating, close contact with local residents who became homeless after the event, and failure to take appropriate precautions, may have increased the risk of infectious diseases following the earthquakes in Kahramanmaraş on February 6, 2023. Additionally, a lack of clean water supply and inadequate personal hygiene were potential risk factors for the development of respiratory and gastrointestinal infectious diseases in evacuation shelters and tents.[20]

Hospitals began performing laboratory test analyses two weeks after the disaster. Furthermore, microbiology laboratory services were temporarily unavailable due to damage in three state hospitals in the Dulkadiroğlu and Onikisubat districts of Kahramanmaraş province. Consequently, microbiological analysis for patients in the city was conducted at the Microbiology Laboratory of Kahramanmaraş Sütçü İmam University and at Turkish military open-field hospitals. As a backup, the mobile laboratory of the public health institution of the MoH arrived in the region to assess damage in the laboratories. Laboratory analyses continued until the local laboratories became operational again. After affixing the cabinets to the walls in the university hospital's microbiology laboratory, devices damaged by the earthquake were quickly repaired, and microbiological analyses resumed within a few days (Fig. 3). Once a constructional durability report was issued for the university hospital, most laboratory workers chose to stay in the hospital's safe areas due to damage to their homes or psychological reasons. About a month after the earthquake, syndromic Polymerase Chain Reaction (PCR) analyses for respiratory and gastrointestinal pathogens containing more than 20 agents (including viruses, bacteria, fungi, and parasites) began in the laboratory. It is also worth noting that parasitic diseases such as pediculosis and scabies were expected to become risk factors due to delays in providing mobile showers and laundry facilities in shelter camps.

Figure 3. Damage to equipments in the microbiology laboratory at the Department of Microbiology, Kahramanmaraş Sütçü İmam University Hospital following the earthquake (photo by Dr. Filiz Orak).

The etiological factors carrying epidemic risks are shaped by the geographical conditions of the region, climate variables, and endemic conditions.[21–23] Previously, it was posited that moving away from food and water supply areas and vector breeding zones during Hurricane Katrina facilitated West Nile virus transmission. Additionally, strong negative correlations were observed between conflicts and bacterial pathogens, and between vector-borne diseases and hydrological events. In contrast, positive associations were noted between geophysical events and airborne pathogens.[21] The most significant findings included the emergence of numerous bacterial or waterborne diseases due to hydrological events in South Asia, and viral diseases resulting from conflicts in Africa. As a geophysical consequence, an epidemic of pneumonia emerged in Japan due to the collapse of health services and housing after earthquakes.[21] In countries with infrastructure problems, such as sewage and sanitation, the prevalence of viral hepatitis A and E may surge after disasters like earthquakes. For example, following the 2005 earthquake in Pakistan, over 1.200 cases were reported among the displaced population in regions with limited access to safe water.[22] An atypical outbreak of coccidioidomycosis happened after the January 1994 Southern California earthquake, and it was associated with exposure to elevated airborne dust levels from landslides.[4] All these risk factors interconnect and intensify pre-existing vulnerabilities, which over time heighten the probability of post-disaster outbreaks.[21]

After the 2023 Kahramanmaraş earthquake, sporadic cases of amebiasis and gastroenteritis due to *Shigella flexneri* were reported, even though AFAD and the governorship advised earthquake victims against using tap water for drinking. A small number of seasonal pathogens, isolated from lower respiratory tract samples, such as *Streptococcus pneumoniae* and *Klebsiella pneumoniae*, as well as environmental pathogens like the *Citrobacter* species, found in water, soil, and wastewater, have been isolated from blood samples. It was determined that the prevalence of respiratory tract and gastrointestinal system pathogens did not significantly increase compared to the same months of the previous year. Additionally, there was only a 1.31% increase in rotavirus test positivity compared to the previous year. However, no cases that could be defined as an epidemic were reported.

Furthermore, regarding the potential epidemic threat, 57.947 cases of *Vibrio cholera* were reported from the northwestern cities of Syria, an area close to Kahramanmaraş. Of these cases, 23 people died, with half of the reports coming from Idlib in Syria.[24]

Beyond this, no vector-borne bacterial agents known to cause diseases such as tularemia, malaria, or leptospirosis, nor any unusual viral and protozoan agents not typically identified in the laboratory, were detected.

Those residing in camping tents or shelters were relocated to urban areas or back into their own homes once less damaged houses were repaired. They were advised to use prepackaged drinking water, supplied by volunteer patriots and AFAD officials, rather than tap water.

In the face of disaster, laboratories confront numerous challenges including developing an emergency action plan, accessing the disaster area, sourcing supplies of reagents, equipment, electricity, and materials, and addressing personnel shortages.[25] A powerful laboratory management approach and mechanism, incorporating integrated medical leadership and management, ensure a timely and appropriate response in the event of a disaster.[26]

In conjunction with the hospital's regulatory agency commission, laboratory emergency preparedness management should be able to identify the laboratory's capabilities and respond promptly within 96 hours of a disaster. Even if the laboratory's emergency response is included in the hospital's disaster plan, the laboratory itself must have its own emergency preparedness management.[27]

Appropriate measures to mitigate the effects of hazardous conditions caused by fires, severe weather, service failures, or service interruptions (such as electricity, heat, air conditioning, or water) include ensuring efficient power sources, data backups, manual recording systems, equipment suited for testing, ample storage for samples and reagents, and operational freezers. These are among the minimum requirements for restoring functionality to disaster-stricken laboratories.[28,29]

Routine laboratory services can be resumed at the field level, and slide specimens for tuberculosis sputum should be directed to the primary health care center or the nearest central laboratory.[25] For the preliminary diagnosis of infectious diseases susceptible to epidemics, such as cholera, malaria, and dengue fever, immunochromatography/lateral flow devices can be used. Microscopic techniques, such as hanging drop preparations for cholera, Gram staining for *Streptococcus pyogenes* and meningococci, and the Albert stain for diphtheria, can aid in the early identification of potential outbreaks caused by these organisms.[25,28] Accordingly, rapid diagnostic tests have been endorsed by the WHO for outbreaks of cholera, dengue, and even leptospirosis, and have proven effective in various studies.[24]

Hospitals should also have point-of-care tests (bedside testing tools) at the ready, especially when the use of a laboratory diagnostic analyzer is not feasible due to limitations in electrical supplies, human resources, or building conditions. Point-of-care testing is conducted by trained professionals outside traditional clinical laboratories or can even be self-administered by patients.[26]

Due to the abundance of irrigation channels and ponds in the earthquake region and the onset of the summer season, the risks of malaria and leishmania, which are endemic in the region, have increased. For this reason, it may be necessary to consider precautions for these risks.

As a recommendation, Disaster and Emergency Management Agencies (e.g., AFAD in Türkiye), the Ministry of Health Reference Laboratories, and university hospital laboratories should coordinate in mutual cooperation to prevent post-disaster epidemics and to aid in the early detection and surveillance of causative microorganisms.

Infection Threats

After the first earthquake, immediate rescue efforts were initiated for buildings that had collapsed or were seriously damaged. People trapped under the debris or concrete awaited rescue. The time they spent waiting for rescue was crucial. In the first days following the disaster, there were significant challenges in caring for the injured, collecting the deceased, and storing their bodies, as many health service buildings and hospitals had been damaged or collapsed. The treatment and care of the injured, as well as the shelter, safety, and security of the victims, were among the most pressing concerns in the aftermath of the earthquake.

Table 2. Risk factors for infections after earthquakes

Insufficient shelter conditions: High population density in tents, containers, and camping sites
Limited access to clean water
Poor hygiene and sanitation practices
Unsafe food supply and storage methods
Malnutrition due to inadequate food provision and lack of long-lasting food supplies
Adverse environmental conditions: lack of toilets and bathrooms, inadequate waste material collection
Extreme weather conditions: snow, cold, heat, rain, wind
Health service infrastructure: Readiness for disasters, surveillance capabilities, primary care facilities, hospital capacity, equipment availability, medication stockpiles, overall medical infrastructure
Vulnerable populations: Children, elderly, pregnant individuals, immunocompromised individuals, etc.
Low immunization rates and interruptions in vaccination schedules
Inadequate number of garbage collection sites or containers
Rodent or vector infestation and lack of vector control measures
Population displacement

After completing the rescue efforts within three weeks, removal of the demolished concrete material began without detailed analyses and separation concerning potentially hazardous materials like asbestos, heavy metals, and organic compounds. The primary temporary storage sites for the debris were also established near wetlands, farmlands, forested areas, residential areas, or temporary tent cities for the victims.[30] Therefore, the acute or long term effects of waste materials on public health and the environment should be assessed.

Earthquake victims living in urban and rural areas in southeastern Türkiye may be at risk of exposure to vector-borne and zoonotic diseases such as tularemia, malaria, leishmaniasis, sandfly fever, and West Nile virus infection. Potentially, some infections, including tuberculosis, measles, diarrheal diseases, hepatitis A, multidrug-resistant Gram negative bacterial infections, and certain vector-borne diseases might reemerge not only in the earthquake-affected region but also throughout Türkiye. The primary factors for the reemergence of infections in the affected regions appear to be related to crowded living conditions, disruption of childhood vaccination programs, residence in rural areas, and eco-biological changes due to global warming.[31–34] West Nile virus infection, which is a tropical disease, was recorded in Türkiye previously in 2009–2010.[35,36] As is well-known, hepatitis A and B, poliomyelitis, measles, tetanus, and others are vaccine-preventable diseases. During the Syrian refugee crisis in Türkiye, cases of measles, resistant tuberculous, and cutaneous leishmaniasis reemerged due to the disruption of the vaccination and control programs.[31] Irrigated agriculture is prevalent around the wetland of Amik Plain, which is situated between Hatay and Kahramanmaraş, and around Urfa, Diyarbakır, and Adıyaman. People working or living in tents or transient residential camps around these farming areas are at high risk for parasitic infections such as *Entamoeba histolytica* and free-living amoeba infections, schistosomiasis, and malaria (Table 2).

Media reports indicate that there have been incidents of scorpion and snake bites among people living in rural areas during the summer season.[37] The scorpion and snake species in this region are highly venomous. Therefore, it is of utmost importance to have snake and scorpion antivenom serum available in emergency rooms at healthcare institutions.

There is also a great risk of poliomyelitis and cholera outbreaks in the southeastern region of Türkiye, as observed in the camps in Iraq and Syria.[38] Another health concern in tent and container living is the prevalence of lice and scabies due to crowded conditions, inadequate water supply, and poor sanitation.

CONCLUSION

This earthquake has underscored the paramount importance of a disaster preparedness program that includes health care services, effective organization, and national and international communication in response to natural disasters.

At present, the most pressing needs of the earthquake victims include housing, nutrition, hygiene and sanitation, continuation of education programs, and resumption of vital programs such as childhood vaccination, health services, and regular employment. The objective is to provide permanent homes as soon as possible. However, it is estimated that permanent homes will not be available for at least three years. Population displacement and housing people in tents, container camps, or other shelters are the major risk factors for infectious outbreaks. For this reason, it is important to understand that emerging or reemerging infections can also arise after a natural disaster.

Surveillance of infections, educating victims about infection control measures, and implementing these measures in the region are essential for the prevention and control of water-borne, food-borne, air-borne, vector-borne, and zoonotic diseases. In the post-earthquake period, implementing infection control measures (such as hand hygiene, kitchen hygiene, sanitation, provision of clean water, food safety, environmental cleaning, vector control programs, etc.) within a "one health" concept can significantly increase the likelihood of success. The lessons learned from these earthquakes are invaluable, serving as guides to address challenges in future disasters.

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