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Prevention of Infectious Diseases after an Earthquake

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ABSTRACT

The earthquake in Kahramanmaraş, Turkey, on February 6, 2023, was recorded as one of the most severe earthquakes recently. Because of the magnitude of the intensity of the earthquake and its coverage of many provinces, it had devastating effects. In addition to the impact of the disaster after the quake, the emergence and spread of infectious diseases were facilitated by insufficient safe water, housing problems, inadequate nutrition, inadequate hygiene conditions, and many individuals living in public areas. In this context, respiratory tract infections, gastrointestinal infections, skin infections, and vector-borne infections are more common after disasters. Necessary measures should be taken to establish an effective surveillance system for preventing and protecting infectious diseases after the earthquake, plan new settlements, continue immunization services, access safe water, and provide adequate and balanced nutrition, sanitation, vector control, and health education.

Keywords: Earthquakes, communicable diseases, infections, disaster

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Introduction

Globally, between 2000 and 2019, 7348 major disaster events caused serious economic losses, affecting 4.2 billion people in total, of which 1.23 million people lost their lives, an increase of approximately twenty times compared to 1980-1999 (1). In this context, the major earthquakes in eastern Turkey are examined. The Erzincan earthquake, with a magnitude of 7.9 on December 27, 1939, caused 32.962 deaths (2). The Van earthquake, which was 7.1 in eastern Turkey on October 23, 2011, caused 604 deaths, 4152 injuries, and 32,938 people to be affected (3). Finally, on February 6, 2023, two earthquakes with a magnitude of 7.7 in the center of Pazarcık in Kahramanmaraş and 7.6 in the center of Elbistan occurred (4). The last two earthquakes in Kahramanmaraş were recorded as the most severe earthquakes since 1939 (5). After the Kahramanmaraş-centered earthquakes, approximately 26 million individuals (5 million in the vulnerable group) were affected (6). Approximately 50 thousand deaths occurred in Turkey, and 107 thousand people were injured (7). After the earthquake, 298 thousand buildings were destroyed, and 3 million people settled in other provinces temporarily or permanently (7).

In addition to the physical and psychological effects that occur depending on the magnitude of the disaster experienced after the earthquake, the restriction of access to safe drinking and utility water, deterioration of sanitation and hygiene conditions, infrastructure damage, and traumatic injuries lead to the emergence and spread of

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infectious diseases in the society (8). Effectively responding to the needs of disaster-affected populations requires an accurate communicable disease risk assessment. The effective use of humanitarian aid depends on implementing priority interventions based on this risk assessment (9). In public health emergencies such as earthquakes, several factors can influence the emergence and spread of infectious diseases. These include the following: prevalence of endemic and epidemic diseases in the affected area; living conditions of the affected population, including the number, size, location, and density of the affected settlements; availability of safe water and adequate sanitation facilities; nutritional and immunization status of individuals; level of access to health services; existence of an effective surveillance system; and effective management of emerging infections (Table 1) (10). According to a systematic review and meta-analysis of the incidence of post-earthquake infectious diseases, gastrointestinal and hepatic infections were most common after the earthquake, with 163.4 cases per 100,000 people. The second highest rate is skin infections, with 84.5 cases per 100,000 people, followed by respiratory tract infections, with 9.9 cases per 100.000 people. Central nervous system infections are seen least frequently, with 0.5 points per 100.000 people (11).

During the acute period after a natural disaster, non-specific infections (such as tetanus, gas gangrene, and wound infections) and respiratory system infections (such as influenza, measles, rubella, and diphtheria) occur due to trauma. In the sub-acute period, after individuals are evacuated to public living areas and live in crowded environments, insufficient ventilation and unhealthy conditions, skin infections (such as scabies, and anthrax), viral infections (such Japanese encephalitis) because of close contact between people, vector-borne infections (rickettsia, malaria, typhus) and gastrointestinal infections (norovirus, cholera, typhoid, food poisoning) occur. In the later period after the disaster, tuberculosis, other viral infections (Hepatitis A, E, polio), and various animal-borne infections (such as rabies leptospirosis) were observed (13,14).

Infectious diseases in survivors after the earthquake are caused by disruption or complete cessation of infection control activities. The increase in transmission increases the risk of post-disaster infection because of infection control and routine surveillance studies, changes in the sensitivity of society, and new factors that have emerged. Registration and notification are essential for effective infectious disease management. All employees working in the region should be informed about how and where to make these statements. The information obtained should be evaluated in a short time. Considering the endemic diseases and immunization rates in the disaster region, diseases that may cause epidemics should be determined, and precautions should be taken to control these diseases. Standard case definitions should be made and explained employees regarding possible cases. The quantities and needs of materials such as vaccines, drugs, and oral rehydration fluid to be used in an emergency should be determined, and where they can be obtained if necessar. It should be ensured that the cold chain is not disrupted (15).

In the days following the earthquake, patients and their possible contacts should be monitored, and infection control measures should be taken. Especially for diseases transmitted by contaminated water and food. Therefore, adequate hygiene conditions should be provided for water and food, clean water supply and storage, proper removal of feces and wastes, and washing hands with soap and water (16).

It has been stated that 15 hospitals were partially or completely damaged in the acute period after the Kahramanmaraş earthquakes (6). After an earthquake, structural damage in health facilities causes delays in managing and treating infectious disease cases when the emergency response and subsequent processes are not repaired and

Table 1. Groups of communicable diseases preventable according to post-earthquake precautions (12)

Precaution taken	Disease group
Settlement planning	Diarrheal diseases and respiratory tract infections
Safe water	Diarrheal diseases and typhoid fever
Sanitation	Diarrheal diseases, vector-borne diseases, and scabies
Malnutrition	Tuberculosis, measles, and respiratory tract infections
Vaccination	Measles, meningitis, yellow fever, Japanese encephalitis, diphtheria, tetanus
Vector control	Malaria, leishmaniasis, dengue, and Japanese encephalitis
Personal hygiene	Typhus, relapsing fever
Personal protection	Malaria, leishmaniasis
Health education	Sexually transmitted infections and respiratory tract infections

service delivery is not continued. For this reason, it should be ensured that health institutions continue to provide evaluations as soon as possible after the earthquake (17). In this context, the infectious diseases frequently encountered after the earthquake and the methods of protection will be examined.

Skin Infections and Prevention

Risks arising from living together in collective living areas and camps: inadequate ventilation and inappropriate hygienic conditions due to close contact between people. Because of these conditions, scabies from skin infections can occur. Other family members and close contacts should be treated when scabies occurs, and various medical treatments should be used. In addition, the sheets, pillows, and clothes used by the person should be washed and dried at high temperatures. If these items cannot be washed, they should be used after being stored in a closed plastic bag for a week. Treating scabies as soon as possible and isolating contacts is the best way to prevent outbreaks (18).

Gastrointestinal Infections and Prevention

Gastrointestinal infections are the most common infectious diseases after earthquakes and have a high mortality rate in risky groups (11,19). Gastrointestinal infections have been reported after many earthquakes in Turkey and around the world from the past to the present (20,21,22,23,24,25,26,27). Many pathogens, including *Shigella* spp., *Salmonella* spp., *Escherichia coli, Campylobacter* spp., *Vibrio cholarea, Yersinia enterocolytica,* and viral infection agents (hepatitis A, E, rotavirus, norovirus, and adenovirus) are causative agents in these infections (28,29). The most important factors in water-borne infections and epidemics caused by infections after earthquakes are the mixing of pollutants and infectious agents into the water supply and network due to fractures in the ground floor during earthquakes (29). In this respect, various recommendations are offered for the supply of safe water to the community in the acute period after the earthquake. These recommendations include the following:

1. Provide packaged water, if possible, to the community during the acute period,

2. If the acute situation gets better, use the mains water with permanent solutions as soon as possible, first by chlorination; if this cannot be achieved, boil it, on the condition that it is constantly monitored.

3. If the network system cannot be used, chlorination or filtration techniques should be provided to appropriate families by providing necessary training after safe and individual storage, provided that local conditions are considered (29).

Immunization against hepatitis A, which is a gastrointestinal infection factor, is carried out regularly in Turkey by adding it to the childhood vaccination calendar as of 2012 (30). In this context, inadequate access to safe water and hygiene conditions, especially in regions with low vaccination rates, should be considered and caution should be exercised.

Respiratory Tract Infections and Prevention

Respiratory tract infection is another infection that is frequently encountered in the short term after an earthquake. Adverse weather in temporary settlements where the crowding factor is effective, where most people affected by the earthquake live, inadequate ventilation and heating, close contact, inadequate nutrition, and inadequate personal hygiene are among the risk factors for respiratory infectious diseases (17,31,32,33,34,35). Mortality may increase due to pneumonia, especially in risk groups such as children, the elderly, and individuals with chronic diseases. Therefore, providing temporary shelter and housing assistance quickly after the earthquake, making primary health care services functional, and ensuring effective surveillance of emerging infectious diseases are vital for the livelihoods of the displaced population (36). In addition, considering that coronavirus disease-2019 (COVID-19) is still widespread and the season is suitable for the spread of influenza, immunization studies should be conducted in risk groups. To protect against these infections, wearing a surgical mask, washing hands frequently, and, if possible and if the conditions are suitable, vaccination of unvaccinated individuals (for diphtheria, whooping cough, measles, COVID-19, and influenza) or chemoprophylaxis (for meningococcal meningitis, diphtheria, and whooping cough) may be recommended.

Other Infections and Prevention

Tetanus and wound infections occur with traumas after earthquakes. After the Indonesian earthquake in 2004-2006, many tetanus cases were observed, especially in regions with lower vaccination rates (37). Case fatality rates in these cases ranged from 18.9% to 36.6%, and trauma was found to be the main factor in the occurrence of these cases. Poor access to health services due to limited transportation or inadequate hospital facilities, low vaccination coverage, and low awareness of tetanus risk, as the main causes of case fatality rates and case occurrence, contributed to the delay for treating patients and the progression of cases (37,38). Tetanus is prevented to a great extent by effective vaccination. Because of impaired skin integrity because of trauma, the wound site should be properly cleaned, and vaccination and, if necessary, antibiotic therapy should be initiated to prevent

secondary infections (39). Therefore, post-earthquake tetanus cases can be prevented by increasing vaccination coverage, improving wound care treatment, and establishing a regular surveillance system, in addition to good disaster management practices and supportive care in line with national guidelines. In addition, public health education should be provided to increase awareness about reducing the risk of tetanus (12).

Vector-borne diseases may become more common in the post-earthquake period because of the changing contact patterns between individuals, pathogens, and vectors. Individuals can become infected by direct contact with rodents, pets, livestock, and infected animal shelters or by exposure to water, food, or soil contaminated with various body fluids, such as the urine of infected animals. The increased frequency of contact of these vectors with earthquake victims or various aid and rescue teams in the earthquake zone leads to diseases. The vector types commonly seen in these regions should first be determined to protect against these infections, and precautions should be taken accordingly (40). The local distribution of such creatures should be examined, regional breeding areas and environmental variables should be determined, and vectors should be dealt with accordingly. In this struggle, eliminating poor hygiene conditions, cleaning stagnant water bodies, providing sufficient potable water, and disposing of garbage and waste are important (41). In addition, importance should be given to the surveillance system against vector-borne diseases in these regions. Health personnel working in these regions should be informed about the symptoms of the diseases, methods of transmission, management of such cases, and what needs to be done to control and prevent these diseases (42).

In natural disasters, sexually transmitted infections caused by viruses such as HIV, *N. gonorrhea, T. pallidum, Chlamydia* spp., and Herpes simplex type 2 may occur (43). In this regard, the community should be informed about protection measures against sexually transmitted infections in the earthquake region, and protective measures should be taken.

Conclusion

Epidemiologically, the connection and interaction between the three elements play a role in the emergence of infectious diseases. These include a pathogenic agent, a susceptible host, and a suitable environment in which the pathogen and host encounter each other (44). Considering the post-earthquake period, the risk increases with the emergence of facilitating factors. To protect against these risks, precautions should be taken by targeting three elements. In this respect, the following recommendations should be considered.

An effective surveillance system for the prevention and protection of infectious diseases expected to emerge after the earthquake, accurate planning of settlements, continuation of immunization without interruption, provision of safe drinking and potable water, sanitation, vector control, and health education should be provided.

• New settlements should be planned with high population density and not be crowded, away from areas at risk of infectious diseases, and chosen in an area with easy access to clean water.

• The problem of safe drinking and potable water due to damage and contamination of water supply systems and resources must be resolved.

• Due to the lack of personal hygiene materials, individuals should be provided with adequate personal hygiene products.

• Adequate nutrition of individuals should be ensured by supplying the required food products.

• Heating and ventilation systems should be installed in shelter areas, which are basic needs.

• In order not to disrupt the provision of health services, health units should be established in accommodation areas as soon as possible.

• To prevent the spread and emergence of rodent/vector infestation and infectious diseases, waste must be appropriately disposed of, and vector control must be ensured.

• Individuals exposed to disasters should be informed about the methods of infection and control measures.

• A data collection system appropriate to the conditions in the disaster area should be established, and the data should be analyzed regularly.

Ethics

Peer-review: Externally peer-reviewed.

Authorship Contributions

Concept: A.B., A.Ö., Design: A.B., A.Ö., Data Collection or Processing: A.B., A.Ö., Analysis or Interpretation: A.B., A.Ö., Literature Search: A.B., A.Ö., Writing: A.B., A.Ö.

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