BIOLOGICAL DISASTERS IN PRESENT PRESPECTIVES

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Biological disasters are organic origin, including pathogenic microorganism, toxins and bioactive substances. In recent years, biological disasters have become a serious problem for health, environment, and national security. These disasters are of organic origin and can include pathogenic microorganisms, toxins, and bioactive substances. Biological disasters can take the form of an epidemic or pandemic level and can be caused by diseases such as plague, cholera, H1N1 (Swine Flu), and influenza outbreaks. The Center for Disease Control (CDC) has categorized biological Disaster into four bio-safety levels (BSL 1-4) to help manage the risks associated with handling biological materials. It is essential to improve the current understanding of health hazards caused by biological disasters. Preventing and preparing for biological disasters requires assessing the risks, medical and public health consequences, medical countermeasures, and long-term strategies. Environmental monitoring can help substantially in preventing outbreaks of waterborne, airborne, vector-borne, and zoonotic diseases. Personal protective equipment like masks, gloves, protective clothing, eye shields, face shields, and shoe covers can help eliminate the source of contamination. Individuals can take steps to prevent disease by eating nutritious balanced food, maintaining up-to-date immunization status, preventing overcrowding, maintaining good ventilation, and protecting themselves from hot and cold weather. Medical treatment for biological disasters may focus on both non-Pharmaceutical and Pharmaceutical approaches. To prevent and control biological disaster, it is crucial to develop capacities, strengthen the existing legislative/regulatory framework, provide mental health support, offer rehabilitation and specialized healthcare, and establish laboratory facilities. Being vigilant and taking proactive measures can help prevent and control biological disasters.

Keywords -Biological disasters, Biological hazards, National Disaster Management Authority (NDMA), State Disaster Management Authority (SDMA), District Disaster Management Authority (DDMA), National Executive Committee (NEC), National Disaster Response Force (NDRF) and National Institute of Disaster Management (NIDM).

Introduction

Biological disasters refer to natural events that cause disability, disease, or death on a large scale among living organisms due to other living organisms and their products. These disasters can occur as epidemics or pandemics. Epidemic-level biological disasters affect a large number of individuals within a population, community, or region at the same time, while pandemic-level biological disasters spread across a large region, such as an entire continent or the world. Examples of epidemic-level biological disasters include cholera, Ebola, dengue fever, malaria, and measles, while examples of pandemic-level biological disasters include H1N1 (Swine Flu) and influenza outbreaks. Biological disasters, such as pandemics and disease outbreaks, have become a major concern in recent years due to the increased globalization, human activity &mobility of people and goods, as well as the emergence of new infectious agents. Human activity causes destruction to people and their way of life, it can be considered a severe and extreme hazard. A biological disaster occurs when harmful agents, such as bacteria or viruses, enter a vulnerable population in an environment that supports their growth and propagation. It is difficult to determine precisely when an outbreak reaches epidemic proportions and when it becomes a full-fledged disaster, as there is no clear

Source:https://freesvg.org/vector-illustration-of-internation-al-biohazard-symbol

consensus on the matter. The movement or migration of people to new locations can lead to a biological disaster. One notable historical example is the Plague or Black Death, which originated in western Asia and spread via Asian brown rats aboard a cargo ship that travelled between Italy and the eastern Black Sea during the middle Ages. Similarly, AIDS (HIV) also spread through the movement or migration of people to and from different places. Recent biological disasters include the Ebola outbreak in West Africa, which resulted in over 11,000 deaths, and the Zika virus epidemic in South America, which caused birth defects in thousands of infants. The COVID-19 pandemic, caused by the SARS-CoV-2 virus, has been the most significant biological disaster in recent times, with millions of people infected and hundreds of thousands of deaths worldwide.

Biological Safety Levels

The US Center for Disease Control (CDC) has categorized biological disaster or biological hazards into four bio-safety levels or BSL 1-4—

BSL-1: At this level, bacteria and viruses including Bacillus subtilis, canine hepatitis, Escherichia coli, varicella (chickenpox), some cell cultures, and non-infectious bacteria are present. Gloves and facial protection are important precautions to take at this level.

BSL-2: In this level, moderate-risk infectious agents or toxins cause only mild disease, such as hepatitis A, B and C, some Lyme disease, influenza A strains, salmonella, mumps, measles, scrapie, dengue fever, HIV. BSL-2 takes extreme precautions for safety purposes including the use of autoclaves for sterilizing and biological cabinets

BSL-3: In this level, biological hazards generally have known vaccines or treatments. Bacteria and viruses that can cause severe to fatal diseases in humans such as anthrax, West Nile virus, Venezuelan equine encephalitis, Severe Acute Respiratory Syndrome (SARS) virus, Middle East Respiratory Syndrome (MERS), corona virus, hantaviruses, tuberculosis, typhus, Rift Valley fever, Rocky Mountain spotted fever, yellow fever, malaria, and trypanosomiasis come under this level.

BSL-4:At this level, effective treatment or vaccines are not available for viruses that pose a potentially fatal threat to humans, such as the Marburg virus, Ebola virus, Lassa fever virus, Crimean-Congo hemorrhagic fever, and other hemorrhagic diseases. To ensure maximum safety and prevent transmission, strict protocols are necessary, which may involve the use of a positive pressure personnel suit. This suit comes with a segregated air supply and provides a barrier between the wearer and the virus. Additionally, an ultraviolet light room, multiple showers, and an autonomous detection system may be included in the protocols to further minimize the risk of infection.

Legal /Institutional and Policy Framework

Legal Framework

- The state government has the primary responsibility of tackling biological disasters according to the Indian Constitution. Health is a state subject. Several legislations control and govern the nation's health policies. Our government can enforce these legislations to contain the spread of diseases. Some of the commonly used legal instruments are discussed below;--

Legislation that supports health Action at Grass-Root Level

- The Panchayati Raj and Municipal Acts provide legislation to support health action at the grass-root level, including provision of safe drinking water, hygiene and sanitation, food safety, notification and control of diseases, and public health concerns, including containment of outbreaks.

State and District Level

The Epidemic Diseases Act (Act 111 of 1897) empowers the states to take measures for the prevention and control of dangerous epidemic diseases, thereby improving their ability to contain and prevent the spread of such diseases. This Act allows the states to designate specific officers or agencies to carry out these measures.

National level

There are several legislations that control and govern the nation's health policies. The government can enforce this legislation to contain the spread of diseases. The Water (Prevention and Control of Pollution) Act, 1974, The Air (Prevention and Control of Pollution) Act 1981, provide prevention and control of Water and Air pollution. The Environmental (Protection) Act, 1986 protect the environment and empowers the government to take all measures as it deems necessary or expedient for protecting and improving the quality of the environment and, controlling, preventing and abating environmental pollution. This Act also provides for the Biomedical Waste (Management and Handling) Rules, 1998 to control the indiscriminate disposal of a hospital/biomedical wastes

The Disaster Management Act (DM Act) provides an institutional and operational at all levels for disaster prevention, mitigation, preparedness, response, recovery and rehabilitation This includes National Disaster Management Authority (NDMA), State Disaster Management Authority (SDMA), District Disaster Management Authority (DDMA), National Executive Committee (NEC), National Disaster Response Force (NDRF) and National Institute of Disaster Management (NIDM).

International Level

International Health Regulation (IHR2005) was adopted by the World Health Assembly on 23 May' 2005 that came into force on 15 June' 2007. The purpose of this regulation is to control, prevent, and provide a public health response to the international spread of disease and to avoid unnecessary interference with international traffic and trade.

Biological and Toxin Weapons Convention (BTWC)

The Biological and Toxin Weapons Convention (BTWC) is an international treaty that was established on March 26th ,1975. Its main objective is to prohibit the development,

production, stockpiling, and use of biological and toxin weapons, and to promote their destruction. The treaty has been signed by 183 countries and is considered a crucial component of international efforts to prevent the use of biological and toxin weapons in warfare.

The BTWC is designed to prevent the use of biological and toxin weapons, which can have devastating effects on human populations and the environment. The treaty requires signatory states to destroy any existing stockpiles of these weapons and to refrain from developing or acquiring them in the future. The BTWC also includes measures to monitor compliance and ensure that countries are adhering to its provisions.

Institutional and Policy Framework

The National Disaster Management Authority (NDMA) was established under the Disaster Management Act 2005 to provide effective management of disasters. The NDMA works closely with national, state, and district-level authorities to plan, prepare, and ensure a rapid response to both natural calamities and man-made disasters/accidents. Here's how the NDMA's structure and functions have been designed to achieve this:-

National Disaster Management Authority: The NDMA is the apex body responsible for formulating policies, plans and guidelines for disaster management at the national level. It consists of a Chairperson, Vice-Chairperson, and members appointed by the central government.

National Executive Committee: The NEC is responsible for implementing the policies and plans formulated by the NDMA. It consists of the Union Home Secretary, Secretaries of various ministries, and experts in the field of disaster management.

State Disaster Management Authority: Each state has its own SDMA, responsible for implementing disaster management policies and plans at the state level. It consists of a Chairperson, Vice-Chairperson, and members appointed by the state government.

District Disaster Management Authority: Each district has its own DDMA, responsible for implementing disaster management policies and plans at the district level. It consists of a Collector or District Magistrate as Chairperson, and other members appointed by the district government.

In the context of biological disasters, the National Crisis Management (NCMC), National Disaster Response Force, Ministry of Home Affairs, and Ministry of Health and Family Welfare play a key role in controlling the spread of diseases. The Ministry of Health and Family Welfare is the nodal ministry responsible for decision-making and managing epidemics, providing advisory services, and emergency medical relief. The National Institution of Communicable Diseases (NICD) is the primary agency responsible for investigating outbreaks, while the Indian Council of Medical Research (ICMR) provides laboratory support, teaching, training, and research

The World Health Organization (WHO) The WHO is crucial in enhancing global health security by focusing on outbreak alerts and response through activities such as information collection and dissemination, verified information dissemination, technical support provision, and strengthening national surveillance programs. These activities help detect and respond to disease outbreaks,

ultimately contributing to global health security.

Prevention and Preparedness of Biological Disasters

Prevention and preparedness shall focus on the assessment of bigheads, medical and public health consequences, medical countermeasures, and long-term strategies. They are useful in reducing vulnerability and mitigating the post-disaster consequences. The important components of prevention and preparedness include:-

Pre-exposure immunization (preventive): Vaccination is an essential component of biological disaster prevention. It can prevent individuals from contracting a disease, thereby reducing the spread of infection.

Epidemiological intelligence gathering mechanism: The collection and analysis of epidemiological data can help identify potential outbreaks and assess their potential impact.

Robust surveillance: Robust surveillance system can detect early warning signs is critical for preventing and responding to biological disasters. It can help identify outbreaks before they become widespread and allow for a more effective response.

Capacity building for surveillance, laboratories, and hospital systems: Capacity building is critical for developing the infrastructure necessary to detect, investigate, and manage outbreaks. It includes training for healthcare professionals, development of laboratory capacity, and the establishment of appropriate hospital systems.

Environmental Management: Epidemics can often be caused by diseases transmitted through water, air, vectors, or zoonotic sources. Effective environmental monitoring is crucial in preventing epidemics. One approach to preventing epidemics is through integrated vector management, which involves the use of environmental engineering, chemical interventions, and biological methods to eliminate breeding places and control vectors. In the event of a biological disaster resulting in mass casualties, proper disposal procedures for dead bodies are necessary. To prevent waterborne diseases such as cholera, hepatitis, diarrhea, and dysentery, safe drinking water is essential. Promoting personal hygiene by educating the community about washing, cleaning, bathing facilities, and avoiding overcrowding in sleeping quarters can also be effective. Vector control is another important aspect of epidemic prevention, which includes environmental engineering and genetic integrated control measures, as well as evacuating breeding places through water management and regular spraying of insecticides.

Overall, the prevention of biological disasters requires a multifaceted approach that includes vaccination, epidemiological data collection and analysis, a robust surveillance system, capacity building for surveillance, laboratories, and environmental management and hospital systems.

Prevention of Post-disaster Epidemics

To prevent the outbreak of epidemics in the aftermath of disasters, it is critical to implement preventive measures such as Disease Surveillance Systems. These systems involve teams monitoring potential sources of infection, investigating the spread of epidemics, and identifying modes of transmission to quickly respond and

mitigate potential outbreaks. Ensuring the proper disposal of dead bodies is a crucial component of these measures, as it can help prevent the spread of disease and reduce the risk of post-disaster epidemics

Preventive and Control Measures of Biological Disasters

To prevent and control biological disasters, it is essential to target the source of contamination. Here are some effective measures that can be taken to prevent such disasters:-

Engineering controls are measures that are put in place to reduce exposure to hazards in the workplace by modifying the physical environment or tools. These controls are critical in preventing the spread of infections or contaminants in the workplace. The main goal of engineering controls is to address the source of the hazard, prevent it from being released into the environment, and control its transmission.

Implementing engineering controls is an important aspect of a comprehensive approach to managing the spread of infectious diseases and other hazards. While administrative controls such as policies and procedures and personal protective equipment such as masks and gloves are essential, engineering controls are also necessary to minimize the risk of exposure to hazards in the workplace.

By using engineering controls in combination with other measures, employers can help to create a safer working environment for employees and the public. This can lead to improved health outcomes, reduced absenteeism, and increased productivity.

Maintaining good personal hygiene is crucial in preventing infections, and one of the most fundamental ways to achieve this is by washing your hands with liquid soap. It is recommended that everyone should make it a habit to wash their hands before and after work or before and after wearing protective clothing to minimize the risk of transmitting germs and harmful bacteria, which can cause illnesses and diseases. By doing so, you can keep yourself and others healthy. Therefore, it's important to incorporate hand-washing with liquid soap into your daily routine.

Personal protection is important to regularly practice good personal hygiene habits such as frequent hand washing, covering one's mouth and nose when coughing or sneezing, and avoiding touching one's face. By doing so, individuals can reduce the transmission of germs and viruses, which can lead to illnesses and infections.

When choosing personal protective equipment, it is important to consider the features and level of protection offered by each item. For instance, protective clothing should be made from waterproof and impervious materials to prevent the transmission of harmful pathogens. Safety goggles and face shields can protect the eyes from splashes and airborne particles, while gloves can protect the hands from contact with contaminated surfaces. Shoe covers can also help prevent the spread of pathogens from contaminated floors and surfaces.

It is also crucial to properly sterilize and maintain personal protective equipment to ensure its effectiveness. Sterilization methods may include disinfecting surfaces with appropriate cleaning agents or using specialized sterilization equipment such as autoclaves.

In the face of a biological disaster, it is crucial to have adequate respiratory protective

equipment to safeguard oneself against the disaster. There are several types of protective equipment available, each serving a unique purpose. These include surgical masks, N95 or higher-level respirators, powered air-purifying respirators, and air-supplying respirators.

Aside from personal protective equipment, education and awareness campaigns can also play a critical role in preventing and controlling the spread of diseases. Research on infectious diseases can lead to a better understanding of their transmission and provide insight into effective prevention and control strategies. Effective surveillance systems can also help identify potential sources of contamination and enable prompt action to prevent further spread of the disease.

Ultimately, promoting good personal hygiene practices and adopting personal protective measures can help create a clean and healthy environment and reduce the spread of harmful germs and viruses..

Medical treatment is an essential part of emergency care, but it is not always the first option to consider. Instead, it is important to prioritize preventive measures that can help reduce the likelihood of needing medical treatment in the first place. Some of these measures include:

Eating nutritious and balanced food: Proper nutrition is important for overall health and can help boost the immune system, making it more resistant to disease.

Maintaining up-to-date immunization status: Vaccines are a highly effective way to prevent the spread of many communicable diseases and can help protect both individuals and communities.

Preventing overcrowding: Overcrowding in public places can increase the risk of communicable disease transmission. Limiting the number of people in a given space can help reduce this risk.

Maintaining good ventilation: Good ventilation can help reduce the concentration of airborne pathogens, reducing the risk of disease transmission.

Protecting from hot and cold weather: Extreme temperatures can increase the risk of heat or cold-related illnesses. Taking steps to protect oneself from these conditions can help prevent the need for medical treatment.

When medical treatment is necessary, both non-pharmaceutical and pharmaceutical interventions can be used. Non-pharmaceutical interventions include measures such as social distancing, isolation and quarantine, and biosafety and biosecurity. These measures can help prevent the spread of disease and protect public health. Pharmaceutical interventions include chemoprophylaxis, immunization, and other preventive measures. These interventions can help prevent disease and reduce the severity of illness in those who do become infected. It is important to use these interventions in a targeted and evidence-based manner to maximize their effectiveness.

Overall, a comprehensive approach that includes both non-pharmaceutical and pharmaceutical interventions is needed to promote public health and prevent the spread of disease. By prioritizing prevention and early intervention, we can reduce the need for medical treatment and improve overall health outcomes.

Conclusion

While biological disasters such as pathogenic toxins, microorganisms, and bioactive substances are naturally occurring, they pose a serious threat to health, environment, and national security. In recent years, the frequency and severity of these hazards have increased, leading to devastating consequences including mass mortality. To address these challenges, it is essential to enhance our current understanding of the health risks associated with biological disasters and adopt a comprehensive, proactive, and technology-driven approach to their management. This requires a focus on preparedness activities, biosafety and biosecurity measures, and vigilant prevention and control efforts through capacity development, strengthened legislative and regulatory frameworks, mental health support, rehabilitation, and specialized healthcare and laboratory facilities. By taking a holistic and coordinated approach, we can minimize the impact of biological.

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