Clean Water Standards, Environmental Hygiene Sanitation, and Vector Control in Prevention of Disease Transmission in Disaster in Lombok, Indonesia: A Systematic Review of Literature

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ABSTRACT

Natural disasters are events that cannot be avoided and desired by everyone. Water and hygiene are important determinants of survival at the beginning of post-disaster. An adequate amount of safe water is needed to prevent deaths from dehydration, therefore in the event of a disaster there is a need for standards to reduce the risk of water-related diseases, sanitation hygiene and vector control. This study aims to explain the concept of water standards, sanitation cleanliness and vector control as humanitarian steps in the event of a disaster. This study shows that the application of these concepts is useful for reducing disease transmission from environmental factors and disease vector exposure. The method in this study uses the epidemiological triangle model approach. Using this method, we set basic standards in humanitarian action at the disaster in Lombok to control the risk of environmental-based diseases. Details of this method are shown in the following which includes the Environment, Agent, and Host. Adjudication is mainly achieved through promoting good hygiene practices, providing safe water, reducing environmental health risks, and controlling infectious disease vectors. This condition will allow people to live healthy with dignity, comfort, and security.

Keywords: clean water standards, disasters, environmental hygiene, sanitation, vector control.
INTRODUCTION

In 2018 various disaster threats occurred in Indonesia, especially in Lombok, West Nusa Tenggara. Earthquake events in the Lombok, Sumbawa and Bali regions on July 29, 2018 with 6.4 magnitude and the epicenter centered at a depth of 24 km at a distance of 47 km northeast of Mataram were earthquakes caused by plate infiltration activities. The western segment fault is known as the Flores Rising Fault (Flores Thrust) which stretches from the east of Bali to the north of Flores. The Flores Thrust is known as a destructive earthquake generator that will continue to threaten to shake the island arc.\[3\]

![Map of the location of the East Lombok earthquake July 29 2018 at 5:47:39 WIB](image1)

From BMKG Lombok data when the earthquake occurred there were as many as 14 people died (East Lombok regency as many as 10 people and 4 North Lombok districts) and those who suffered injuries were 162 people and there were thousands of material losses in the form of damaged people's houses-broken.\[3\]

![Documentation of Material Loss at Lombok Disaster](image2)

IRJPH: https://escipub.com/international-research-journal-of-public-health/
All disaster events must cause a health crisis, especially during post-disaster, the most emergency thing besides the existence of health services is an effort to control the factors that cause infectious diseases as a result of disasters, including problems with the availability of clean water, hygiene and sanitation and vector control. Comprehensive research on the availability of clean water, environmental sanitation, hygiene and vector control among earthquake refugee populations is very difficult. The right to water and sanitation cleanliness are inseparable human rights. This right is recognized in international legal instruments and provides adequate, safe, acceptable, physically accessible water for personal and medical use and accessible sanitation facilities. Safe and adequate water are needed to prevent death and dehydration, to reduce the risk of water-related diseases and to provide consumption, cooking and personal and medical hygiene requirements.

Over the past decade, the humanitarian response community has initiated a number of inter-agency initiatives to increase accountability, quality and performance in humanitarian action. Four of the most well-known initiatives are the Active Learning Network for Accountability and Performance in Humanitarian Action (ALNAP), Humanitarian Accountability Partnership (HAP), and Projects for People Who Get Help and Sphere. Representatives from the institutions that announced this initiative began meeting regularly in 2003 to collaborate on general issues and harmonize activities where possible.

Water and sanitation are important determinants of survival in the early stages of a disaster. Disaster-affected people are generally more susceptible to illness and death, which are mostly related to insufficiency, lack of water supply and inability to maintain adequate hygiene.

**a. Environment**
1) Clean water standards
2) Environmental sanitation hygiene standard
3) Vector control standards

**b. Agent**
1) Bacteria
2) Viruses
3) Germs

**c. Host**
1) Humans
2) Other living things

Provision of clean water, promotion of hygiene, sanitation and vector control during disasters can reduce diarrheal diseases, typhoid fever, malaria, dengue hemorrhagic fever, and scurvy.

Despite efforts to maintain water and sanitation standards during a disaster are difficult due to unsupportive circumstances and situations, health workers also have to monitor sanitation and water use, population activities and focus on bridging the gap between what people know about water hygiene sanitation and their actual daily practices.

**METHOD**

In collecting data, see journal articles that discuss water standards, environmental sanitation, hygiene, and vector control. We mainly focus on articles about human actions in the event of a disaster. We cover both journal articles from Indonesia and outside Indonesia. In this case, we managed to collect 19 articles that were most closely related to our research.

To analyze the data, we use the epidemiological triangle model. Using this method, we determine basic standards in disaster events to control the risk of environmental-based diseases. The details of this method are shown in the following which includes Ice Environment, Agent, and Host.
DISCUSSION

1. Environment

a. Clean Water Standards

Every occurrence of a disaster is usually accompanied by difficulties in obtaining clean water sources, because PDAMs are damaged due to disasters, improper wells, so that in general the community uses polluted water bodies. For this reason, health workers must be responsive to the provision of clean water, which is intended to be used for bathing, drinking, washing and cooking. Water sources can be obtained from rivers, lakes, wells, deep ground water and springs. For this reason, the volume and quality of water that are required to meet standards, systems for shelter, processing, distribution and distribution is needed. In addition, officers can also provide various types of water purification drugs or water purifiers, and at the same time provide information on how to use them. [1]

1) Provision of clean water
   a) Directed to meet the minimum needs of clean water for refugees / disaster victims (drinking, cooking and personal hygiene)
   b) The main health problems are caused by poor hygiene, due to lack of clean water and consumption of contaminated water
   c) Meeting the needs of clean water

According to the Sphere Standard, the minimum water intake requirement for the survival of disaster victims is 2.5-3 / Lt / day and varies with climate and individual physiology. The total amount must also include basic clean water practices (2-6 liters per day) and basic cooking needs (3-6 liters per day) so that the total requirement is 7.5-15 liters per day. This amount is > 20 liters in accordance with UNHCR standards. (R2) Proximity and sustainability of sufficient amounts of water must be considered. When choosing groundwater sources and / or gravity-flow supplies from better springs, because they need less treatment and no pumping. [11,12,13]

2) Improved water quality
   a) Cloudy weather; use PAC
   b) Water quality; use chlorine / Aquatab.

3) Provision of clean water

Every refugee family should have water reservoirs to collect or store. [1]

b. Environmental Sanitation Hygiene Standards

Hygiene and environmental sanitation are important components of the WaSH program in disasters. Hygiene and environmental sanitation allow people to learn how to disease due to environmental hygiene and sanitation factors. [8]

At the time of the disaster, both in settlements and in refugee camps, there will be a lot of waste in the form of leaves, paper and plastic because food is ready for food. Likewise, it is also the case in defecating and waste, in general we are often late in its management, so that the residential environment or place of refuge is easily polluted, thus inviting various vocalists carrying disease. [9,16] Not a few after a few days of displacement there were frequent outbreaks of infectious diseases such as diarrhea, skin diseases, Acute Respiratory Tract Infection, and other infectious diseases. Therefore, it is necessary to immediately prepare sanitation facilities so that the refugee community can always maintain their health. The provision of bathing, washing and toilet facilities (MCK) is adjusted to the habits of refugees from the area of origin. The MCK facilities must be easy to use and can be maintained by residents. The ratio of
the number of MCKs to the number of refugees must be taken into account. Waste management is arranged by collection and disposal.\[^{[10]}\]

Facilities for disposal of feces / latrines / sanitation facilities, processing of sewage disposal is an effort to prevent diseases, especially diarrhea. Each toilet must be equipped with water supply, use of latrines (1 toilet for 20 people).\[^{[1,16]}\]

Waste must be managed properly, because it is a place for breeding flies and mice, where refugee shelters must be provided with trash cans, in the form of:

1) Wastebin (capacity 50 - 100 L) for 25-50 people / day
2) Garbage bags (1 sheet for 1 family / 3 days)

The risk of discharging wastewater against health is contamination of clean water. Waste must be disposed of in the channel to a certain place, for example by making infiltration wells with a distance of> 30 meters from the tent and the source of clean water.

As for some logistics, materials that must be fulfilled during a disaster, the following are:

1) Chlorine
2) PAC (fast water purifier)
3) Aquatab
4) Waste plastic bag
5) Insecticides
6) Fogging / Misting / Swing fog / spray can tool
7) Sanitarian kit
8) Water drill tool
9) Reservoir water
10) Extension materials (leaflets, posters, banners, etc.)
11) Water test kit

**c. Vector Control Standard**

Vector-borne diseases are a major health risk after a disaster and during a refugee crisis. Mosquitoes are responsible for the transmission of diseases, especially malaria, which are the main causes of morbidity and mortality. The mosquito is also a vector for yellow fever, dengue and hemorrhagic fever. Biting flies, bedbugs and fleas can transmit diseases such as murine typhus, scabies and outbreaks. Synanthropic flies (house flies, inflatable flies, moth flies, etc.) Acting as angels in the transmission of diarrheal diseases. Transverse lice or hemorrhagic fever, Lyme disease, babesiosis and Anaplasma; body lice send typhus and relapse fever. Mice and mice are hosts for vectors, for example, Lice, which can transmit Lassa fever, outbreaks among other infections, and they send leptospirosis, Hanta virus and salmonellosis.\[^{[15,18]}\]

Vector-borne diseases can be prevented by measures that prevent vector spread. Decisions about intervention vector control contests must be based on risk assessment. Factors such as the immune status of the affected population (e.g. Refugees, displaced people) - movements from areas that are not endemic to endemic are a common cause of the epidemic). Pathogen types, number of vectors, species and increase vector exposure (likelihood or pattern of completion, etc.) Affect risk.\[^{[15]}\]

One of the main problems in controlling vector-borne diseases are the choice of location and provision of shelter. To reduce the risk of exposure from affected populations to vectors is a major determinant in disease prevention. With regard to malaria control, for example: camps must be placed 1-2 kilometers of wind from large breeding sites, such as swamps or lakes. Of the many benefits of placing a location near a source of clean water, the decision was challenging. Other initiatives to roll out vector-borne disease, maintain clean water supplies, proper waste disposal, waste management and drainage, provision of health services (including direct mobilization and health promotion), use of chemicals for vector control, family and individual protection including the use of mosquito nets and effective food store protection. Vector control programs must aim to reduce vector population density, reduce human-vector
contact and reduce site vector breeding.\textsuperscript{[15]}

The impact of vector control programs is measured by monitoring the incidence of vectors and the number of parasites. Specific environmental engineering steps can be taken to reduce vector breeding opportunities. This includes proper disposal of human and animal waste to reduce the number of flies and rodents, drainage of stagnant water, and cleaning vegetation around open channels and ponds to control mosquitoes and fleas. If this intervention is not sufficient to reduce the proliferation of vectors of local chemical control measures or individual protective measures may be needed (e.g., spraying the affected space to reduce the number of flies). Local experts may have special knowledge about local disease patterns, breeding sites and seasonal changes in the number of vectors during a disaster on the site.\textsuperscript{[15]}

Mosquito control aims to eliminate three main mosquito nets. This species is responsible for the transmission of filariasis (Culex & Anopheles), malaria (Anopheles) and yellow fever and dengue fever (Aedes). Examples of environmental mosquito control include adequate drainage, improved ventilated toilet holes, keeping the lid on squat holes in the latrine and above the water container, and keeping the well closed and/or treating it with larvacide (for example in areas where dengue is endemic).\textsuperscript{[15]}

Some of the standards in vector control to avoid environmental-based infectious diseases during disasters are as follows: 1) Standard Vector Control 1

The purpose of protection is carried out on individuals and families consisting of:

a) All residents at risk of being infected with animal / vector-borne diseases need to understand the methods of transmission and various methods of prevention

b) A shelter that can be accessed by everyone is protected from hiding and vector development and is protected by appropriate vector control efforts

c) People must avoid the time / time when mosquitoes like to bite by using all the methods available to those who are harmless. Special attention is given to the protection of high-risk groups such as pregnant and lactating mothers, infants, newborn children, parents and sick people

d) People who use mosquito nets must do it effectively e) Control of human body lice is carried out related to the threat of rockets (flea-transmitted lice) or Relapsed fever transmitted by lice or mites.

f) Control of human body lice is done by washing and drying clothes regularly, bedding is the most effective protection for body lice

g) Food must be protected at all times from contamination through vector vectors such as flies, insects and rodents.\textsuperscript{[17]}

2) Standard Vector Control 2

The goals and safeguards carried out in this standard cover physical, chemical and environmental protection

a) Refugees are placed in locations that can minimize exposure to mosquitoes

b) Breeding sites and rest locations of vectors modified according to ability

c) Intensifying fly control in dense settlements when there is a risk of occurrence or the presence of a diarrhea outbreak

d) The density of the mosquito population is kept low to avoid the risk of infection and excessive transmission rates

e) People infected with malaria are diagnosed early and receive treatment\textsuperscript{[16]}

3) Standard Vector Control 3

Objectives and strategies for maintaining the use of chemicals include:

a) Officers are protected by adequate training, protective clothing, use of bathroom facilities, supervision and restrictions on the number of hours worked with chemicals.

b) All follow international rules and can be
accounted for at all times, including: selection, quality, transportation, storage of chemicals, equipment used for vector control and disposal of unused substances.

c) Communities are informed about the potential risks of chemicals used in vector control and about how they are used. They are protected during and after the use of poisons or pesticides, in accordance with internationally agreed procedures.\textsuperscript{[15]}

2. Agent
Agent factor is an element of living organisms or infective germs that can cause an illness. The agent factor can include: chemical factors, viruses, germs, fungi and so on.\textsuperscript{[2]}

The agent factor is the originator of infectious diseases in a place, the agent factor at the time of the disaster can be controlled if environmental factors can be maintained, such as good environmental sanitation hygiene conditions, the availability of sufficient clean water for daily activities for disaster refugees and control vectors that are routinely carried out to reduce the proliferation of vector carriers of disease in disaster relief areas.\textsuperscript{[2]}

3. Host
Host factors are humans or other living things, including birds and arthropods which are the place the natural processes of disease proliferation. The host component in this case can be distinguished in several factors, namely: age, genetics, gender, ethnicity, immunological state, behavior, lifestyle, personal hygiene, etc.\textsuperscript{[2]}

CONCLUSION
Disease control when a disaster event can basically be carried out by the principle of controlling disease trigger factors, one of the ways to control disease during a disaster is by using an epidemiological approach.

At the time of the disaster in Lombok the main factor triggering the occurrence of disease is the environment that must be controlled so that the disease-carrying agent factor cannot multiply and cause disease for disaster refugees, environmental factors in this case are: the level of clean water availability, environmental sanitation and vector control efforts in community settlements post-disaster.

By implementing clean water standards, environmental sanitation hygiene and vector control in disaster events this can be believed to minimize the occurrence of environmental-based infectious diseases.

REFERENCES

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