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## Health Impacts and Post-Flood Handling in Ijen District, Bondowoso Regency

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Meri Dwi Apriliyanti<sup>1(CA)</sup>, Hadi Prayitno<sup>2</sup>, Isa Ma'rufi<sup>3</sup>

<sup>1(CA)</sup>Post Graduate Program of Public Health, Universitas Jember, Indonesia; meriajha12345@gmail.com  
(Corresponding Author)

<sup>2</sup>Post Graduate Program of Public Health, Universitas Jember, Indonesia; hprayitno29@yahoo.co.id

<sup>3</sup>Post Graduate Program of Public Health, Universitas Jember, Indonesia; isa.marufi@gmail.com

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### ABSTRACT

Bondowoso Regency is ranked 19 out of 29 regencies in East Java based on the mapping of disaster-prone areas. Rampant land clearing in Ijen District has resulted in flooding. The results of the preliminary study affected by the flood reached 503 people. The five most non-traumatic health problems are myalgia, hypertension, shortness of breath, gastritis and conjunctivitis. This study used a quantitative approach, the type of analytical research with a cross-sectional research design. The research was conducted in Sempol Village and Kalisat Village, carried out in August 2021. The population of this study was 101 respondents. The research sample was 81 respondents in 4 hamlets located in Ijen District and five respondents from the health task force, surveillance officers, BPBD officers, Sempol and Kalisat village nurses. The sampling technique used was proportional sampling. The variables studied included flood disasters, flood disaster management, health impacts including myalgic, hypertension, shortness of breath, gastritis, conjunctivitis. Collecting data using questionnaires and interviews. Data analysis with logistic regression test and partial least square. The results showed that there was no effect of flooding on the incidence of myalgic, hypertension, shortness of breath, gastritis and conjunctivitis caused by other factors such as psychological stress, excessive activity, and personal hygiene. Post-disaster management strategies were classified as good, policies related to mitigation were available and appropriate, community response and community cohesiveness in disaster management were classified as good.

**Keywords:** flood disaster; management; health impacts

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### INTRODUCTION

#### Background

Indonesia, which is one of the countries in the ASEAN region, has a very large forest wealth, so that the productivity of the timber industry in Indonesia is increasing every year. Various types of wood are easy to grow in Indonesia's forests very well, so that the quality has been recognized by the world community <sup>(1)</sup>. Based on a review by the FAO Deputy Representative for Programs in Indonesia, he explained that from 2010 to 2015, Indonesia was in the second-highest position in losing its forest area, which reached 684,000 hectares per year. Massive loss of forest function has an impact on the absence of optimal water absorption, so that when there is heavy rain there will be overflow of water and floods will occur <sup>(2)</sup>. In addition to having an impact on material losses, flooding also has a significant impact on health aspects <sup>(3)</sup>.

Indonesia itself as a country with a tropical climate as of May 18, 2020, 1,296 disasters have been recorded, which are dominated by natural disasters such as floods, cyclones, and landslides. Flood events in Indonesia during the period January 1, 2020, to May 18, 2020, were recorded as 495 incidents spread throughout Indonesia. East Java Province is one of the regions that has a mountainous demographic with sufficient rainfall and the potential for flooding in the rainy season <sup>(4)</sup>. Based on the East Java BPBD report, it is known that from 2,384 disaster events in Indonesia in 2016, 386 disaster events occurred in East Java with 98% (379 incidents) dominated by Hydrometeorological Disasters such as landslides, floods and tornadoes. Based on the mapping of areas prone to natural disasters, Bondowoso Regency is ranked 19 out of 29 regencies or cities in East Java. Bondowoso

Regency with a mountainous geography tends to be at risk of experiencing floods and landslides due to high rainfall <sup>(5)</sup>.

Ijen District is one of the sub-districts in Bondowoso Regency with mountainous geographical conditions. Rampant land clearing results in the loss of forest function as a water absorption area when it rains. This is proven on January 31, 2020, there was a flood in Ijen District, precisely in Sempol Village and Kalisat Village. The second flood occurred on March 14, 2020 in the two villages. Based on the analysis of the Bondowoso Regency BPBD, the flood incident in Ijen District was allegedly triggered by heavy rains on Mount Suket and deforestation due to conversion and forest fires that occurred some time ago in Jampit Village <sup>(6)</sup>.

Based on data from the Bondowoso District Health Office obtained during a preliminary study, it is known that from January to March 2020, the total number of client visits affected by flooding in Ijen District, Bondowoso Regency reached 503 people. The five non-traumatic health problems most commonly encountered due to flooding in Ijen District, Bondowoso Regency are myalgic, hypertension, asthma, gastritis and conjunctivitis. Based on the results of the data recap of patient visits due to flooding in Ijen District for the last 3 months, it is known that the number of visits with patients diagnosed with myalgic is 81 visits, hypertension is 77 visits, asthma is 12 visits, gastritis is 10 visits, and conjunctivitis is 6 visits <sup>(7)</sup>.

Regional disaster management agency in Bondowoso Regency has carried out disaster mitigation in the form of socialization and training related to disasters, this mitigation effort is to reduce the impact of disasters that can occur. . Mitigation in Ijen District already exists, such as the formation of a disaster-resilient village (DESTANA) and disaster response students (SISTANA). Mitigation efforts in the health area are a step for the first handling of health problems that occur due to disasters that can occur in the Ijen District, Bondowoso Regency. Handling natural disasters such as floods must be done optimally. Flood disasters that have both social and health impacts must receive immediate treatment to suppress the increasingly widespread impact. Post-disaster health management is closely related to the ability to analyze disasters in the health sector <sup>(8)</sup>.

Mapping the risk of health problems that can occur after a disaster will minimize the occurrence of complications, and can even eliminate a risk from becoming an actual <sup>(9)</sup>. Disaster management strategies do not only focus on post-disaster activities, but must be synchronous and sustainable starting from pre-disaster as a form of strengthening disaster response communities. Increasing public understanding in flood prevention must continue to be intensified as a flood prevention strategy <sup>(10)</sup>. The flood management strategy above can be considered in Ijen District, Bondowoso Regency. The increase in the emergence of health issues after the flood in Ijen District must be considered properly. There needs to be a mapping of post-flood health issues in the form of optimal post-disaster handling patterns. Of course, the mapping of health issues is carried out not only on biological issues, but also on psychological problems and their relation to the incidence of flood events. According to scientific studies and the above phenomena related to disaster mitigation, especially in the health sector, researchers wish to conduct research that focuses on analyzing health impacts and handling post-flood disasters in Ijen District, Bondowoso Regency.

## Purpose

The purpose of this study was to identify health impacts and develop post-flood management strategies in Ijen District, Bondowoso Regency.

## METHODS

The researcher used a quantitative approach, the type of analytic research with a cross-sectional research design. The research was conducted in Sempol Village and Kalisat Village, Ijen District, Bondowoso Regency, Indonesia, carried out in August 2021. The population of this study was 101 respondents based on inclusion criteria. The research sample was 81 respondents spread over 2 villages consisting of 4 hamlets located in Ijen District and five respondents consisting of the health task force, surveillance officers, BPBD officers, Sempol village nurses and Kalisat. The sampling technique used was proportional sampling.

The variables studied include flood disasters, flood disaster management, health impacts which include five diseases, namely myalgic, hypertension, shortness of breath, gastritis, conjunctivitis. Collecting data using questionnaires and interview methods. Data wer analyzed using logistic regression test and partial least square (PLS).

## RESULTS

### Respondents Characteristics

The research was carried out in Ijen District, Bondowoso Regency, which is spread out in Kampung Baru Village, Pesanggrahan Village, Sempol Village, and Kalisat Village. The number of respondents in this study

were 81 respondents spread over several villages based on proportional sampling. The following is a description of the characteristics of the respondents in this study.

Table 1. Distribution of flood disaster respondents in Ijen District

Region (village)	Frequency	Percentage
Kalisat Baru	63	77.8
Sempol Pesanggarahan	13	16
Sempol	3	3.7
Kalisat	2	2.5

Based on table 1, it was known that most of the respondents came from Kampung Baru Village (77.8%).

### Severity of Flood Disasters

The severity of a flood disaster was measured by several indicators, including physical, economic, social, and flood heights. The results of the study indicate the severity of the flood as follows.

Table 2. Severity levels of flood disasters in Ijen District in 2021

Indicator	Category	Frequency	Percentage
Physique	Severe	40	49.4
	Moderate	30	37
	Mild	11	13.6
Economics	Severe	40	49.4
	Moderate	30	37
	Mild	11	13.6
Social	Severe	40	49.4
	Moderate	30	37
	Mild	11	13.6

Based on table 2, it is known that all indicators on the severity of flooding in Ijen District show a severe impact (49.4%). The average water level when the flood hit Ijen District was 165.43 cm.

### Impact of the Flood on Myalgic

The description of the incidence of myalgic after the flood disaster includes the incidence of disease occurrence and duration of disease occurrence. The following are the results of the analysis of myalgic events after the flood disaster in Ijen District.

Table 3. The impact of the flood on myalgic in Ijen District in 2021

Indicator	Category	Frequency	Percentage
Incident	Never	32	39.5
	Occur	49	60.5
Time of occurrence	<24 hours	19	38.8
	1-3 days	30	61.2
	>3 days	0	0

Note: p-value (physical) = 0.475; p-value (flood high) = 0.159

Based on table 3, it is known that most of the residents of Ijen District who were affected by the flood experienced myalgic (60.5%) with the duration of illness mostly between 1-3 days (61.2%). All p-value results were >0.05, so there was no effect of the impact of the flood on the incidence of myalgic.

### The Impact of Flood Disasters on Hypertension

The description of the incidence of post-flood hypertension included the incidence of disease occurrence and duration of disease occurrence. The following are the results of the analysis of the incidence of hypertension after the flood disaster in Ijen District.



Table 4. The impact of flood disasters on hypertension incidence in Ijen District

Indicator	Category	Frequency	Percentage
Incident	Never	57	70.4
	Occur	24	29.6
Time of occurrence	<24 hours	7	29.2
	1-3 days	17	70.8
	>3 days	0	0

Note: p-value (physical) = 0.947, p-value (flood high) = 0.518

Based on table 4, it is known that the incidence of hypertension in Ijen District residents affected by the flood disaster was the second-highest incidence of disease after myalgic (29.6%) with the duration of illness mostly between 1-3 days (70.8%). All p-value results were >0.05, so there was no effect of the impact of the flood on the incidence of hypertension.

### The Impact of Flood Disasters on Shortness of Breath

The description of the incidence of shortness of breath after the flood disaster included the incidence of disease and the duration of the disease. The following are the results of the analysis of the incidence of shortness of breath after the flood disaster in Ijen District.

Table 5. The Impact of the flood on shortness of breath in Ijen District

Indicator	Category	Frequency	Percentage
Incident	Never	76	93.8
	Occur	5	6.2
Time of occurrence	<24 hours	2	40
	1-3 days	3	60
	>3 days	0	0

Note: p-value (physical) = 0.947, p-value (flood high) = 0.440

Based on table 5, it is known that the incidence of shortness of breath in Ijen District residents who were affected by the flood disaster was in third place (6.2%) with a length of illness between 1-3 days (60%). The results of the p-value were >0.05, so there was no effect of the impact of the flood on the incidence of shortness of breath.

### The Impact of Flood Disasters on Gastritis

The description of the incidence of gastritis after the flood disaster includes the incidence of disease occurrence and duration of disease occurrence. The following are the results of the analysis of the incidence of gastritis after the flood disaster in Ijen District.

Table 6. The impact of flood disasters on gastritis in Ijen District

Indicator	Category	Frequency	Percentage
Incident	Never	80	98.8
	Occur	1	1.2
Time of occurrence	<24 hours	0	0
	1-3 days	1	100
	>3 days	0	0

Note: p-value (physical) = 0.947, p-value (flood high) = 0.998

Based on table 6, it is known that the incidence of gastritis in Ijen District residents who were affected by the flood disaster was in fifth place (1.2%) with a length of illness between 1-3 days. All p-value results were >0.05, so there was no effect of the impact of the flood on the incidence of gastritis.

### The Impact of Flood Disasters on Conjunctivitis

The description of the incidence of post-flood conjunctivitis includes the incidence of disease and the duration of disease occurrence. The following are the results of the analysis of the incidence of conjunctivitis after the flood disaster in Ijen District.

Table 7. The impact of the flood on conjunctivitis incidence in Ijen District

Indicator	Category	Frequency	Percentage
Incident	Never	79	97.5
	Occur	2	2.5
Time of occurent	<24 hours	2	100
	1-3 days	0	0
	>3 days	0	0

Note: p-value (physical) = 0.947, p-value (flood high) = 0.620

Based on table 7, it is known that the incidence of conjunctivitis in Ijen District residents who were affected by the flood disaster was in fourth place (2.5%) with a duration of illness between <24 hours. All p-value results were >0.05, so there was no effect of the impact of the flood on the incidence of conjunctivitis.

### Development of Post-Flood Disaster Management Strategies for Myalgic, Hypertension, Shortness of Breath, Gastritis and Conjunctivitis

The description of the development of post-flood handling strategies includes physical rehabilitation, rehabilitation of facilities, social rehabilitation, health rehabilitation, and the responsibility of health workers. The following is a description of the post-flood management strategy in Ijen District.

Table 8. Results of Post-Flood Disaster Management Strategy in Ijen District in 2021

Indicator	Category	Frequency	Percentage
Physical rehabilitation	Good	81	100
	Moderate	0	0
	Bad	0	0
Facility rehabilitation	Good	81	100
	Moderate	0	0
	Bad	0	0
Social rehabilitation	Good	81	100
	Moderate	0	0
	Bad	0	0
Health rehabilitation	Good	81	100
	Moderate	0	0
	Bad	0	0
Responsibilities of health workers	Good	81	100
	Moderate	0	0
	Bad	0	0

Based on table 8, it is known that all indicators in the post-flood management strategy in Ijen District were in the good category (100%).

Interviews were also conducted to explore the pattern of post-flood handling in Ijen District. The results of the interview are as follows.

Table 8. The results of interview

No.	Position	Interview result
1	Bondowoso Regency BPBD Planning Section	1. Regulatory Aspect a. There are policies that regulate management or management patterns in the post-disaster phas b. There are obstacles during the implementation of post-flood handling policies, including: 1) There are damaged buildings that are under the authority of the central government 2) The realization of the identification results is still adjusting to the availability of the budget

No.	Position	Interview result
		<ul style="list-style-type: none"> <li>2. Aspects of Preparedness                             <ul style="list-style-type: none"> <li>a. Team readiness is good in handling post-floods</li> <li>b. The form of team preparedness is as follows:                                     <ul style="list-style-type: none"> <li>1) The BPBD team immediately went to the location to identify victims and losses as well as post-disaster needs and report them to the regent</li> <li>2) Coordinate assistance from the community</li> </ul> </li> </ul> </li> <li>3. Mitigation Aspect                             <ul style="list-style-type: none"> <li>a. The mitigation provided is in the form of providing information to the public about the climate and potential flood areas that may occur</li> <li>b. The obstacles faced during mitigation are long distances and low public awareness</li> <li>c. The forms of mitigation are:                                     <ul style="list-style-type: none"> <li>1) Reforestation</li> <li>2) Providing information</li> <li>3) Repair of drains</li> </ul> </li> <li>d. The result of mitigation is that people's knowledge increases</li> </ul> </li> <li>4. Aspects of Emergency Response                             <ul style="list-style-type: none"> <li>a. Emergency response procedures by the team in the event of a flood disaster include:                                     <ul style="list-style-type: none"> <li>1) Information via pusdalops</li> <li>2) Conduct site evaluation and rescue</li> <li>3) Coordination with local government</li> </ul> </li> <li>b. The obstacles faced are long distances and the absence of technical/technical implementers</li> </ul> </li> <li>5. Aspects of Recovery and Rehabilitation                             <ul style="list-style-type: none"> <li>a. Efforts are being made in the form of repairing facilities such as installing gabions, dredging drains and cleaning drain</li> <li>b. The obstacles faced are the existence of affected buildings which are the authority of the central government and the availability of inadequate funds</li> <li>c. The support system during rehabilitation is a high level of mutual cooperation from the community</li> <li>d. The end result of rehabilitation is quite good</li> </ul> </li> </ul>
2	Surveillance Officer	<ul style="list-style-type: none"> <li>1. Regulatory aspect                             <ul style="list-style-type: none"> <li>a. There is a health center policy related to post-disaster management or management in the form of forming a quick response team that is scheduled every day</li> <li>b. Implementation of post-flood handling in accordance with existing policies</li> <li>c. There are no obstacles in implementing the policy</li> </ul> </li> <li>2. Aspects of preparedness                             <ul style="list-style-type: none"> <li>a. The team is very ready when doing post-flood handling</li> <li>b. The form of preparedness is in the form of dispatching a rapid reaction team directly when a disaster occurs to the location to build a health post, prepare medicine, prepare medical equipment and oxygen.</li> </ul> </li> <li>3. Mitigation aspects                             <ul style="list-style-type: none"> <li>a. The mitigation carried out is in the form of searching for residents who need health services</li> <li>b. The obstacles faced are the number of broken bridges, a lot of mud and heavy equipment</li> <li>c. The form of mitigation is in the form of mapping the hardest areas</li> <li>d. The result of mitigation is that residents who have lost their homes are temporarily evacuated to the homes of their relatives or neighbors</li> </ul> </li> <li>4. Aspects of emergency response                             <ul style="list-style-type: none"> <li>a. The emergency response procedure is that the rapid reaction team is always ready to step in at any time when a disaster occurs</li> <li>b. No problem</li> </ul> </li> <li>5. Aspects of Recovery and Rehabilitation                             <ul style="list-style-type: none"> <li>a. Efforts are made in the form of monitoring around the houses of residents who need health checks</li> <li>b. No problem</li> <li>c. The existing support system is the nature of mutual cooperation from the community</li> <li>d. The final results of post-flood rehabilitation are quite good</li> </ul> </li> </ul>

No.	Position	Interview result
3	Village nurses and health task force	<ol style="list-style-type: none"> <li>1. Regulatory aspect                             <ol style="list-style-type: none"> <li>a. Availability of policies in the form of a quick reaction team</li> <li>b. There is a match between the handling and the existing policy</li> <li>c. No problem</li> </ol> </li> <li>2. Aspects of preparedness                             <ol style="list-style-type: none"> <li>a. The team is very ready</li> <li>b. The form of preparedness is that the rapid reaction team immediately goes to the field when a disaster occurs</li> </ol> </li> <li>3. Mitigation Aspects                             <ol style="list-style-type: none"> <li>a. The mitigation carried out is in the form of sending a quick reaction team to the location to look for residents who need health services</li> <li>b. The obstacles faced are the number of broken bridges, a lot of mud and heavy equipment</li> <li>c. The form of mitigation is in the form of mapping the most affected areas</li> <li>d. The result of mitigation is temporary evacuation of residents who have lost their homes</li> </ol> </li> <li>4. Aspects of Emergency Response                             <ol style="list-style-type: none"> <li>a. The existing emergency response procedure is the availability of a rapid reaction team that is ready to act</li> <li>b. No problem</li> </ol> </li> <li>5. Aspects of Recovery and Rehabilitation                             <ol style="list-style-type: none"> <li>a. Efforts made by going around the homes of residents who need health services</li> <li>b. No problem</li> <li>c. The existing support system is in the form of good community cooperation</li> <li>d. The end result of the rehabilitation has been very good</li> </ol> </li> </ol>

Hypothesis testing is the final step in PLS analysis as a proof step of the hypothesis. This study is declared valid if the p-value 0.05 (value = 5%). The results of the PLS analysis of this study obtained a p-value of 0.510 (p-value >  $\alpha$ ). The conclusion is that there is no effect of the impact of the flood on the incidence of myalgic, hypertension, shortness of breath, gastritis, and conjunctivitis through post-disaster management efforts.

### DISCUSSION

Based on the results of the PLS test, it is known that there is no effect of the flood disaster on the incidence of myalgic, hypertension, shortness of breath, gastritis, and conjunctivitis. On closer inspection, it is known that flood events do not directly affect the five diseases above because these diseases are classified as non-waterborne diseases. The emergence of the five diseases above as an indirect impact that is more related to the psychological effects and excessive physical activity as victims of the flood disaster.

These two factors are very strong in influencing the incidence of myalgic, hypertension, shortness of breath, gastritis, and conjunctivitis. Myalgic is a condition of discomfort felt by individuals in part or all of the body, triggered by injury or tension of muscle tissue. Based on clinical conditions, myalgic conditions can occur due to infection, excessive activity, nutritional deficiency, and the presence of metabolic disorders such as myopathy. Judging from the epidemiological conditions of myalgic during the flood disaster, there is no direct relationship between flood events and myalgic, because myalgic is not a category of waterborne disease, but the high incidence of myalgic can be an indirect effect due to excessive community activities after the flood disaster in evacuating, improving infrastructure, and increasing access to health services <sup>(11)</sup>.

Myalgic events after the flood disaster are not direct, but as an indirect effect <sup>(12)</sup>. Based on theoretical studies, it is explained that one of the triggers for hypertension is psychological stress and excessive physical activity. The two triggering factors have the same effect on the peripheral nervous system, especially on the sympathetic system. Psychological stress and excessive physical activity will trigger the activation of the sympathetic neurotransmitter, namely adrenaline. Adrenaline secretion will cause a standby effect through the action of 1 system and 1 system agonists, causing vasoconstriction of blood vessels and increasing myocardial contractility.

Increased blood pressure which is a reflection of increased hydrostatic pressure in the vasculature occurs due to the effects of sympathetic activation <sup>(13)</sup>. Most of the flood victims experience post-traumatic stress disorder (PTSD) and prolonged conditions trigger hypertension <sup>(14)</sup>. The results of previous studies explain that severe psychological stress after a disaster triggers the occurrence of post-traumatic stress disorder which indirectly triggers an increase in blood pressure <sup>(15)</sup>. Based on the results of previous studies, it was explained that the flood disaster caused bad things for environmental sanitation. A dirty, dusty environment, dirty well water and damaged



houses are triggers for the development of pathogenic microbes. The level of respiratory allergies increases and triggers bronchial vasoconstriction, resulting in shortness of breath <sup>(16)</sup>.

Psychological pressure due to the flood disaster also triggers the occurrence of shortness of breath. Alertness due to stress triggers a psychological disorder known as PTSD. The bronchi become vasoconstriction and oxygen circulation is obstructed. The work of the respiratory muscles increases to increase the supply of oxygen, so that the rhythm of the breathing pattern becomes faster or slower to adjust to the needs of the body. Disaster victims who experience psychological shocks certainly have a risk of shortness of breath compared to others. PTSD that triggers shortness of breath after the flood disaster becomes a secondary or indirect impact, so that the pattern of distribution of the disease depends on the pattern of emotional coping <sup>(17)</sup>.

Just like myalgic, hypertension and shortness of breath above, gastritis occurs after a flood due to the effects of psychological stress. PTSD that occurs due to floods can increase the secretion of HCl in gastric parietal cells, so that the pH of the stomach becomes more acidic. Irregular eating patterns due to increased orientation in the recovery situation will aggravate the condition of the gastrointestinal tract. As a result, lesions occur on the surface of the stomach, which in turn causes a sensation of discomfort and nausea in a person. Psychological stability that is not achieved will further exacerbate nausea and can trigger vomiting. This condition causes gastritis, so that gastritis in flood victims is not a direct impact but the effect of psychological stress <sup>(18)</sup>.

There is no effect of the flood disaster on the incidence of conjunctivitis because there are many other factors that can affect it, for example due to abrasions from physical trauma. Increased physical activity after the flood disaster as a form of infrastructure recovery resulted in individuals working hard. Conjunctivitis is an inflammation of the conjunctiva, with symptoms that appear are red eyes and an itching sensation in the conjunctival area. Conjunctivitis can occur due to invasive viruses, bacteria and allergies. Most conjunctivitis occurs due to allergies, especially in areas with poor sanitation. The environment after the flood disaster will certainly be very dirty and dusty. Allergens and microbial growth media are very conducive to conjunctivitis.

The high activity for the recovery and repair of the flood victims' infrastructure makes their bodies sweat and dirty. The behavior of rubbing the eyes without realizing it also occurs with dirty hands, so that microlesions on the conjunctiva occur and the transmission of pathogenic microbes takes place. This is what makes flood victims experience conjunctivitis in the category of infection or allergy <sup>(19)</sup>. High temperature and humidity also support the proliferation of microbes, so that conjunctivitis conditions are getting worse <sup>(20)</sup>.

Based on the information from cross-sectoral interviews, it is also known that the existing pattern of disaster management is good and in accordance with the direction of national policy in terms of national disaster management. The community's response in supporting post-disaster mitigation and recovery is also quite good with the characteristics of the community who work together to facilitate faster access to recovery. Good cooperation is needed for all elements of society in realizing disaster management, both from policymakers to all levels of society. Good knowledge about disaster mitigation both from policymakers, mitigation implementers and the local community will facilitate post-disaster management. Nurses as part of the flood disaster mitigation team, must have good knowledge about flood disasters. This is to facilitate the implementation of mitigation when a flood disaster occurs. It is evident that nurses who have good knowledge of flood disasters are easier to manage after a flood disaster than nurses who have less knowledge. This knowledge can be obtained from training or exposure to disaster information that is obtained continuously <sup>(21)</sup>.

Based on the results of the interview, it is known that policies related to disaster mitigation are available, and their implementation is appropriate. Departement of Management disaster in Bondowoso and the Health Service has prepared itself in managing disasters in Ijen District through the formation of a special task force team to carry out disaster mitigation. This preparedness can be seen from the team's quick response during the flood disaster in Ijen District. The rapid reaction team immediately moved to the location to carry out evacuations and health services, but the mitigation policies carried out were still based on direct mitigation in the event of a disaster.

There is a need for a complex mitigation study in Ijen District to see in real terms the disaster-prone map and prevention patterns. In line with the results of previous studies, it is explained that development is needed in preparing disaster mitigation strategies. Assessment of risks in flood-prone areas must be carried out carefully. The disaster mitigation carried out consists of 2 types, namely structural mitigation in the form of constructing flood control buildings in high risk areas, and non-structural mitigation in the form of evaluating policies or regulations on spatial planning, land use and zoning in flood-prone areas <sup>(22)</sup>. This is in line with the results of previous studies stating that the flood disaster management strategy is influenced by the community's own perception of the flood disaster. Public perception is the initial provision of public awareness of their vulnerability to being exposed to flood disasters, thus indirectly shaping the character of disaster-aware communities. Mitigation management for people who are aware of disasters will be easier than people who are not aware, because a good understanding of flood disaster mitigation has been formed <sup>(23)</sup>.

The complexity of disaster management strategies can be seen from the mapping of disaster management which includes pre-disaster, during disaster, and post-disaster. The results of the study show a good picture of post-disaster disaster management including physical, facilities, social, and health rehabilitation with good team responsibility as well. The cohesiveness between the community and the rapid response team in disaster



management has been well established, but this was not apparent in the pre-disaster phase. The behavior of cutting trees indiscriminately by the community as an effort to clear new plantation land still occurs illegally.

Deforestation is what then triggers the occurrence of flooding in Ijen District which is a picture of poor pre-disaster mitigation. The poor disaster mitigation in the pre-disaster phase above is very relevant to the results of previous research that disaster management must be complex and not focus on the post-disaster phase only. The disaster management development strategy must cover the pre-disaster, during-disaster, and post-disaster phases. Good management patterns in the three phases will form a strong disaster management system and of course be able to minimize losses that occur due to disasters. Analysis at each phase must be carried out to see a picture of strengths or weaknesses, thus facilitating the determination of disaster management development strategies <sup>(24)</sup>.

## CONCLUSION

Referring to the results and discussion related to health impacts and post-flood handling in Ijen District, Bondowoso Regency, it can be concluded as follows: These are non-waterborne diseases and each disease has other factors causing physical activity, psychological stress, environmental sanitation and personal hygiene behavior. The post-disaster management strategy in Ijen District, Bondowoso Regency includes good categories which include physical rehabilitation, facilities, social, and health as well as the responsibility of health workers, existing disaster management patterns are good and in accordance with national policy directions, policies related to mitigation are available and implementation has been completed. Appropriate, the community's response in supporting post-disaster mitigation and recovery as well as community cohesiveness in disaster management has been well-formed.

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