



## Preparedness and Mitigation of Flash Floods in Urban Area

Hidayah Abdullah<sup>1</sup>, Maizatul Raihanah Mokhtarul Kudus<sup>1</sup>, Mohd Khairul Asraf Mustapha<sup>1</sup>, Muhammad Rafhan Johary<sup>1</sup>, Nur Anis Syamine Muhammad Shukri<sup>1</sup>, Nur Najihah Mohamad Zulkifeli<sup>1</sup>, Faridah Othman<sup>2</sup>, Noor Mazhuari Zakaria<sup>3</sup>, Noor Haziqah Kamaludin<sup>1</sup> & Farah Ayuni Shafie<sup>1,4\*</sup>

<sup>1</sup>Centre for Environmental Health and Safety Studies, Faculty of Health Sciences, Universiti Teknologi MARA, Kampus Puncak Alam, Selangor, Malaysia

<sup>2</sup>Department of Civil Engineering, Faculty of Engineering, University of Malaya, Jalan Universiti, 50603 Kuala Lumpur, Malaysia

<sup>3</sup>ALPS Inspirations Consultant, Kuala Lumpur

<sup>4</sup>Malaysian Association of Environmental Health

\*Corresponding author: [farahayuni@uitm.edu.my](mailto:farahayuni@uitm.edu.my)

### Abstract

Flash flood incidents have recently increased, especially in the heart of Malaysia, Kuala Lumpur and its nearby areas. This Focus Group Discussion (FGD) was conducted to identify the reasons and causes behind these incidents. The main objective of this article is to gain a comprehensive understanding of Climate Change and Adaptation Strategies for Human Health by refining the assessment of its health impacts. Additionally, it aims to raise awareness and enhance the understanding of flash floods, as well as assess the level of preparedness of citizens in dealing with such events. The FGD took place at the Teesside Room, Fakulti Sains Kesihatan 6 (FSK 6), UiTM Puncak Alam. Three panellists were invited to participate, namely Prof. Ir. Dr. Faridah Othman from Universiti Malaya (UM), Encik Noor Mazhuari Zakaria representing ALPS Inspirations Consultant and General Takaful Insurance, and Encik Mohd Khairul Asraf bin Mustapha representing the Inspectorate & Enforcement Unit, District Health Office of Tanah Merah. Their opinions were recorded and are presented in this manuscript.

**Keywords:** urbanization, emergency preparedness, health, safety

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### 1. Introduction

According to Bari et al. (2021), flash floods in Malaysia are the most catastrophic event. Examples of excessive water flow include rainstorms, delayed run-off, and burst dams. Flash floods occur within minutes or hours following severe rain and are particularly dangerous due to their combination of a flood's normal destructive potential, unpredictability, and a short duration. They can cause dry creeks and river banks to fill with water and overflow during a flash flood before people

have time to react. The US Department of Commerce (2014) notes that flash floods can be caused by more than just heavy rain, as dam failures, likewise, can also result in walls of water rushing downstream without warning. Various factors contribute to the vulnerability of certain locations vulnerable to flash flooding. Buildings, motorways, and vast parking lots, for instance, can make metropolitan environments unsafe because they restrict the amount of soil available to absorb heavy rains, making metropolitan environments unsafe during such events (Bari et al.,

2021). Flash floods are typically triggered by a sudden rise in water level, high wind speeds, and the presence of debris in rapidly developed areas (Buslima et al., 2018). Climate change, due to its effect of warmer air holding more water, climate change has the potential to generate more intense rainstorm events. However, flash flood occurrences vary greatly from location to location based on the local microclimatic variations, which are challenging to forecast accurately (Bari et al., 2021).

As mentioned in a report by Mahidin (2022), the flood that affected Malaysia in late 2021 and early 2022 had significant impacts on various sectors, including living areas, automobiles, commercial locations, the manufacturing and agricultural industries, as well as public assets and infrastructure. The total loss resulting from the flooding amounted to RM6.1 billion, equivalent to 0.40 percent of the nominal Gross Domestic Product. Losses from dwellings totaled RM1.6 billion, losses from commercial properties reached RM0.5 billion, losses from cars amounted to RM1.0 billion, losses from agriculture were RM90.6 million, losses from manufacturing totaled RM0.9 billion, and losses from public assets and infrastructure amounted to RM2.0 billion.

When flooding occurs in flood-prone areas, Malaysia has effective measures in place to provide information and assistance before, during, and after a disaster. However, due to the changing climate with new patterns, Malaysia needs to enhance its pre-disaster delivery system to mitigate future adverse effects and minimize flood damage. It is also crucial to raise public awareness in order to improve flood preparedness (Harith et al., 2016; Busmah et al., 2021). The objective of this article is to gain a comprehensive understanding of Climate Change and Adaptation Strategies for Human Health by refining the assessment of the health impacts. Additionally, it aims to improve awareness and understanding of flash floods and enhance the level of preparedness among citizens for such events.

### 3. Preparedness Pertaining to Flash Flood Events

Disaster preparedness is an initiative aimed at increasing readiness and knowledge among the various stakeholders about the risks, relevant agencies, preventive measures, and other disaster-related information (Harith et al., 2016; Zakaria et al., 2022). One mitigation measure for flash floods is the implementation of smart tunnels, which are designed not only for drainage but also for water storage during flood events. To illustrate this concept, consider a bottle with a capacity of 300ml. If we pour 500ml of water into it, the excess water will cause flooding. This analogy emphasizes the need for adequate storage capacity. The government has implemented various storage solutions, such as water retention areas in housing and playgrounds. When water levels exceed their capacity, the water will flow towards these retention areas. From there, it will gradually drain into the drainage system, preventing excessive pressure and water overflow. Different types of retention systems, including surface retention and underground retention, are utilized. In the Klang Valley, three major rivers—Sungai Klang, Sungai Langat, and Sungai Selangor—are present. However, the smart tunnel specifically covers the Sungai Klang area, starting from Kampung Berembang to Klang Gate.

The Ministry of Health (MOH) is one of the agencies involved in disaster preparedness, particularly in terms of medical and public health aspects. In 2015, the Ministry of Health published the Flood Action Plan to address floods and related emergencies. This plan aims to coordinate all efforts of the Ministry of Health in preparing for and providing public health assistance during such incidents. Asraf, a representative from the Ministry of Health, mentioned during the FGD that he has been working at the Health District Office for over ten years and has been directly involved in flood preparedness and mitigation programs. Additionally, compliance with Directive No. 20 from the National Security Council

ensures readiness through the formation of committee members at three levels: headquarters, state, and district. This action plan guides the Ministry of Health's preparedness in three phases: before, during, and after the disaster.

#### 3.1. Preparedness Before Disaster

(a) Ensure adequate space and equipment for the Flood Operations Room preparation. This includes setting up a designated area with sufficient space to accommodate the necessary equipment, such as computers, communication devices, and monitoring systems.

(b) Conduct site visits and assessments of locations intended for the settlement of flood victims. This involves evaluating the suitability of the sites in terms of accessibility, infrastructure, sanitation facilities, and capacity to accommodate and provide essential services for displaced individuals.

(c) Conduct studies and preparations in high-risk areas based on past experiences and historical data. Take preventive measures to minimize the occurrence of disease contagious diseases. This may include implementing vaccination campaigns targeting specific groups in certain circumstances only.

(d) Develop a schedule of duties for the relevant health personnel involved in flood preparedness. Clearly define their roles and responsibilities, outlining the activities they are expected to perform during flood situations.

(e) Ensure that all hospitals, health offices, health clinics, and rural clinics are always prepared in terms of logistical needs for health services. This includes maintaining an adequate supply of human resources, medical equipment, and specialized emergency equipment to address the potential influx of patients during flood emergencies.

(f) Provide feedback to the Ministry of Health (MOH) Headquarters and the State and Central Operations Room regarding the preparedness status and any specific needs, if applicable. This information may include the names and contact details of the chief officers on duty, address, operating room locations, telephone numbers, fax numbers, and email addresses for effective communication and coordination.

#### 3.2. Preparedness During Disaster

a) Communicate with and receive instructions from the Disaster Operations Command at the state and regional levels.

b) Establish an effective, complete, and operational Operations Room within the specified timeframe.

c) Ensure that all steps and preparations at each stage are ready and ongoing, as necessary.

d) Conduct a daily Rapid Health Risk Assessment (RHA) daily to track the progression of floods in different areas and relay the information to the Flood Operations Room (Health) at the state and national levels.

e) Monitor the temporary settlement situation of flood victims based on the Temporary Placement guidelines.

f) Monitor the incidence of infectious diseases, particularly waterborne and foodborne diseases, as well as other related illnesses (epidemiological monitoring).

### 3.3 Preparedness After Disaster

a) Assess the impact or effects of floods on the settlements or villages of flood victims, following the format provided.

b) Receive reports and monitor the situation in flood-affected areas regarding the increased incidence of infectious diseases, particularly waterborne and foodborne diseases like cholera, typhoid, food poisoning, diarrhea, and dysentery.

c) Implement measures to prevent infectious diseases, including the provision of safe drinking water, sanitary toilets, hygienic food preparation practices, health advice, and other relevant measures.

d) Prepare a comprehensive final report on the flood situation, covering the public health actions taken, weaknesses which have been identified, and recommendations for action made for the future actions.

However, Asraf emphasized the importance of readiness at the individual and family levels, stressing the need for awareness regarding flood expectations and necessary preparations. An all-hazards preparedness handbook, based on the Centers for Disease Control and Prevention, is available for individuals and families to utilize (Harith et al., 2016).

### 4. Food Safety Issues during Flash Flood Events

Food safety is a crucial element during disaster events. An article authored by Mikulsen and Diduck (2016) proposes a comprehensive, integrated model for food safety that combines the cycle of disaster management with the governance framework for food safety. The model aims to unify various factors involved in food safety and food catastrophe decision-making, while also allowing for communication and public engagement initiatives that encompass a wider range of concerns and activities compared to standalone models. The integrated model's main objective is to reimagine decision-making processes by emphasizing the importance of dialogical risk communication and deliberate public participation in all aspects of health and catastrophe governance.

Water and foodborne diseases often occur during and after floods. These diseases, such as typhoid fever, cholera, hepatitis A, dysentery, and food poisoning, are frequently diagnosed in flood victims. Common symptoms include diarrhea, vomiting, fever, abdominal pain, and headache. Infections are typically caused by consuming contaminated water or food. These diseases are highly contagious and pose significant risks. Monitoring and control of disease incidence are carried out by government-appointed medical and health officers, as well as environmental health officers appointed by the government.

Asraf explained that at the district level, the Ministry of Health (MOH) receives a list of caterers responsible for preparing food and water for flood victims at temporary placement centers. Prior to any flood event (in the case of seasonal flooding or adverse weather signals from the Malaysian Meteorological Department), inspections are conducted as part of their preparation. Additionally, all food handlers involved in food preparation are advised to have valid anti-Typhoid injections and food handler training certificates. These measures aim to ensure compliance, promote good behaviour, and establish proper practices among food handlers to prevent food and waterborne diseases.

During the flood event, the team from the Health District Office team visits the temporary placement centres daily. The purpose is to ensure that the food that the victim received is well and in good condition. If necessary, health education on food safety is repeatedly provided to the victims, particularly children under twelve, emphasizing the use of clean and safe water and the importance of consuming their food within four hours from receiving it to prevent spoilage.

### 5. Relationship between Climate Change and Flash Floods

The hydrological cycle is expected to intensify with global warming, leading to an increased risk of flooding and more intense extreme precipitation events. The changes observed often differ from the expected increase in the water-holding capacity of the atmosphere under warmer conditions, particularly when water availability is limited (Tabari, 2020).

According to the Focus Group Discussion conducted, Prof. Ir. Dr. Faridah mentioned that the Climate Change index is measured based on Greenhouse Gas (GHG) emissions. Human activities such as combustion, open burning, and fertilizer usage contribute to human activities. The increase in GHG concentrations leads to a rise in temperature. Previous research indicates that human activities are the main driver of the increase in GHG concentration. The primary effects of Climate Change include droughts and increased precipitation, particularly heavy rainfalls. Climate Change leads to an increase in atmospheric moisture, resulting in more intense rainfall within shorter periods. Floods are often associated with Climate Change due to the high intensity of rainfall. Insufficient drainage capacity and inadequate maintenance of the drainage systems are major factors contributing to flash floods. Sedimentation from construction activities and the accumulation of rubbish block the drains, impeding the smooth flow of water from flowing smoothly.

### 6. Insurance for Natural Disasters

Firstly, it is important to note that "natural disaster insurance" is not a specific type of insurance policy that can be purchased by people. However, homeowners insurance typically provides coverage for various perils, including wind and rainstorms, accumulation of snow, and fire. Homeowners' insurance can also be extended to provide protection against more extreme natural disasters such as tornadoes, wildfires, volcanic eruptions, falling meteorites, and blizzards.

Additionally, car insurance coverage also can be expanded to include protection against floods. While this additional coverage may come at a higher cost, it is worth considering, particularly if the community area is prone to flooding.

### 7. Conclusion

Lately, there has been a rise in the frequency of flash floods, impacting a significant number of people both physically and mentally. Flash floods can result in substantial losses to the economy, resources, individuals, and properties. Climate change is among the various factors contributing to flash floods. Implementing measures like Smart Tunnels can help mitigate the impact of flash floods in urban areas, although they can be costly to implement. It is crucial for the government to increase awareness among the public so that people can be more vigilant and prepared before, during, and after such disasters. Individually, Malaysians should be prompt in responding to be more quick to respond if incidents like flash floods happen and always be prepared. Given the unpredictable nature of climate and disasters, people should be predicted, so people should be more ready to mitigate and prepare for such events. In the future, we can expect an increase

in the number of people opting for insurance coverage as awareness about insurance grows through media channels.

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